

**15 Annex - Energy**

**70. STRATEGY FOR DEVELOPMENT OF SMALL HYDRO  
POWER PLANTS IN MONTENEGRO**

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*Republika Crna Gora*  
*Ministarstvo ekonomije*



*republic of Montenegro*

**Ministry of Economy**

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**STRATEGY FOR DEVELOPMENT  
OF SMALL HYDRO POWER PLANTS  
IN MONTENEGRO**

**Podgorica, March 2006**

70. STRATEGY FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN  
MONTENEGRO

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STRATEGY FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS  
IN MONTENEGRO

TERMS OF REFERENCE

**TERMS OF REFERENCE WITH THE CONTENTS LIST OF THE DOCUMENT  
TITLED »STRATEGY FOR DEVELOPMENT OF SMALL HYDRO POWER  
PLANTS IN MONTENEGRO«**

**MAIN STRATEGIC OBJECTIVES**

**0. LIST OF ABBREVIATIONS**

**1. INTRODUCTION**

Arguments for the need to prepare the Strategy for Development of Small Power Hydro Plants of the Republic of Montenegro by the year 2015 should be stated herein.

**2. AVAILABILITY, USABILITY AND ACCEPTABILITY OF  
WATERCOURSES' HYDRO POTENTIALS FOR CONSTRUCTION OF**

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### **SMALL HYDRO POWER PLANTS IN MONTENEGRO**

A brief overview of hydro potentials as per their types should be given herein, as well as an estimate of their value.

- 2.1. Available (theoretically) – gross energy potential
- 2.2. Technically – net usable potential
- 2.3. Financially acceptable potential
- 2.4. Environmentally acceptable potential
- 2.5. Socially acceptable potential
- 2.6. Realistically usable (practicable) potential

### **3. PREVIOUS STUDIES ON POTENTIAL FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

The present situation concerning the development and previous treatment of the issue should be stated herein.

- 3.1. The present status of small hydro power plants development
- 3.2. Previous activities on research of the potential
- 3.3. Treatment of small hydro power plants

### **4. AIM AND PROSPECTS FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

Legal and other obligations with regard to promotion of renewable resources, with prospects for development of small hydro power plants, from the viewpoint of both energy development and overall sustainable development.

- 4.1. Aim of small hydro power plants development
- 4.2. Prospects for development of small hydro power plants

### **5. OBSTACLES TO DEVELOPMENT OF PROJECTS OF SMALL HYDRO POWER PLANTS**

An overview of the existing barriers with regard to realisation of small hydro power plant projects should be given herein based on the analysis from the baseline documents.

### **6. SCHEDULE OF CONSTRUCTION OF NEW SMALL HYDRO POWER PLANTS IN MONTENEGRO**

A projection of possible development of small hydro power plants by the year 2015, in two scenarios, should be given herein as based on the available documentation and the conducted analysis.

### **ECONOMIC-FINANCIAL ANALYSIS AND FINANCIAL RESOURCES**

### **REQUIRED FOR CONSTRUCTION OF NEW SMALL HYDRO POWER PLANTS**

### **IN MONTENEGRO**

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In accordance with the set criteria and the methodology used by the authors of the baseline documents, an economic-financial analysis and a review of the financial resources required for realisation of the estimated schedule of construction of small hydro power plants should be given herein.

### **7. NATIONAL PROGRAMME FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS**

The programme's main activities on development and construction of small hydro power plants in Montenegro should be set forth, with a special emphasis put on multi-purpose utilisation of small watercourses, with a view to overall sustainable development.

### **8. LEGAL FRAMEWORK FOR DESIGNING AND CONSTRUCTION OF SMALL HYDRO POWER PLANTS**

Based on the analysis from the baseline documents, an overview of the prescribed procedures for realisation of small power plants construction projects should be presented herein.

9.1. Methodology for setting the purchase price of electric power from small hydro power plants

9.2. Connection of small hydro power plants to the electric power distribution grid

9.3. Concessions for construction of small hydro power plants

9.4. Legal procedure for designing and construction of small hydro power plants

### **10. ACTIVITIES AND MEASURES FOR REALISATION OF DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

The necessary activities and measures for removal of detected barriers, as well as possible stimulative measures with a view to faster construction of small hydro power plants, should be set forth herein.

10.1. Methodology for defining the realistically practicable hydro potential for small hydro power plants

10.2. Model for purchase of electric power from small hydro power plants

10.3. Modalities of public-private partnership in terms of realisation of small hydro power plants projects

10.4. Reinvesting the revenues from operation of small hydro power plants

10.5. Stimulative measures (developmental, economic-financial and legal ones) for construction of small hydro power plants

10.6. Incentives to domestic entrepreneurs and local communities

### **11. ORGANISATIONAL AND INSTITUTIONAL FRAMEWORK OF SMALL HYDRO POWER PLANTS DEVELOPMENT**

A proposal of the institutional framework for realisation of the prescribed measures for promotion and stimulation of utilisation of small watercourses should be given herein.



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### **12. ENVIRONMENTAL IMPACT OF CONSTRUCTION OF SMALL HYDRO POWER PLANTS**

An overview of the prescribed legal (both national and EU) requirements should be given herein, with a specific reference to the environmental impact of construction of small hydro power plants.

12.1. Legal obligations (national and EU legal regulations)

12.2. Construction of small hydro power plants from the aspect of environmental protection

12.3. Advantages and benefits of adoption of the Kyoto Protocol for Montenegro with regard to development of small hydro power plants

### **13. SYSTEM FOR MONITORING REALISATION OF THE STRATEGY FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS**

#### **THE PUBLIC & COMMUNICATING INFORMATION TO THE PUBLIC**

14.1. The public

14.2. Communicating information to the public

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#### **APPENDIX: ACTION PLAN**

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### MAIN STRATEGIC OBJECTIVES

1) **Hydro power potential of SHPPs:** The overall technical hydro power potential of SHPPs in the Republic of Montenegro (excluding the Tara, Čehotina and Ibar rivers) is calculated to approximately 800 -1000 GWh/year, while such potential as per the studies is assessed to 231 MW and 644 GWh/year, in 70 sites. Since there are no multi-annual waterflow measurements for most of the considered watercourses, the need has arisen for reassessment of the potential through innovation of the previously designed solutions as well as through researches undertaken on all the watercourses, in accordance with the determined schedule and established common methodology, on the basis of measurements conducted in a high-quality manner, in accordance with all the requirements of spatial planning, water management, environmental protection criteria, etc.

2) **Share of renewable energy resources in energy consumption:** By signing the Energy Community Treaty for South East Europe (ECSEE Treaty), the Republic of Montenegro has accepted, inter alia, to implement *Acquis Communautaire* in the areas of energy, environment, competition and renewables. In more detail, within the plan for implementation of the Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, the Republic of Montenegro should define a strategic aim desired to be achieved through utilisation of the renewables, according to realistic assessments. Taking into account the development of the entire energy sector in the Republic of Montenegro in accordance with the long-term National Energy Strategy (whose drafting is underway), it is assessed that the share of all renewables (not only SHPPs) in the years 2010/2015 can be achieved to the level of 3-5% of the total energy needs. It is calculated that the SHPPs generation could reach a share in the national electric power balance of approximately 2.5% in the year 2015.

3) **Realistic scope of new SHPPs by the year 2010/2015:** According to the Reference Scenario, construction of a certain number of SHPPs is envisaged in the period until 2010 with the total installed power of 10 MW, as well as construction of additional 20 MW in the appropriate number of sites in the period until 2015. In other words, in the period of 10 years, the installed capacities and production in SHPPs are envisaged to be increased 3 times in comparison with the present situation at the end of 2005. As per the Higher Scenario, construction of SHPPs is envisaged in the period until 2010 with the total installed power of 5 MW, as well as construction of additional 15 MW in the appropriate number of sites in the period until 2015. In other words, in the period of 10 years, the installed capacities and production in SHPPs are envisaged to be increased 4 times in comparison with the present situation.

4) **Share of the installed capacity and generation from SHPPs in the total capacity/generation:** The share of capacity in the year 2015 would amount to 3.3% (the Reference Scenario), i.e. 4.4% (the Higher Scenario), respectively, under the assumption that there will not be any construction of other generation capacities. The share of generation from all SHPPs in the total electric power generation (without valorisation of the Contract for Piva HPP) in the year 2015 would amount to 2.5% (the Reference Scenario), i.e. 4.2% (the Higher Scenario), respectively. If electric power import is also taken into account, the possible share of SHPPs' generation in meeting the needs for electric power in Montenegro in 2015 would vary in the range between 1.5 and 3%.

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5) **Problem of integration of SHPPs in the electric power system (EPS):** Due to small share of SHPPs in the overall generation in the electric power system of Montenegro, their dispersed nature will not create any difficulties in comparison with other fluctuations occurring in supply and delivery that the procedures for the system's plants management have to cope with on daily basis. New SHPPs with the calculated levels of power and generation, as specified above, can be integrated in the electric power system of Montenegro without occurrence of technical restrictions from the aspect of management of the system's plants, if all the standard conditions for their connection to the grid are properly met.

6) **Economic-financial analyses (EFA) for SHPPs (for the Reference and Higher scenarios, respectively):** For the assumed reference purchase price in the market of 3.0 EURcent/kWh, incremental cost amounts to 4.6 EURcent/kWh (i.e. the required incentive providing the minimum internal rate of return (IRR) of 8%). The price of generation of 7.6 EURcent/kWh is calculated as the average price (fixed) for a twenty-year period (techno-economic lifetime of the project).

7) **Impact of construction of SHPPs - illustration (the Reference Scenario):** As per EFA conditions mentioned under Item 6:

a. incentives required for construction of new SHPPs: 5 MW in the year 2010 amount to EUR 644 000 and EUR 2.576 mill. in 2015 respectively, for the total of 20 MW in new SHPPs;

b. increase in the selling price: 0.016 EURcent/kWh (the year 2010) and 0.061 EURcent/kWh (the year 2015),

c. expected cost increase for electric power: from 0.63 to 1.27 EUR/year (in the year 2010) and from 2.42 to 4.83 EUR/year (in the year 2015),

d. additional cost for new SHPPs due to increase of the total electric power cost for an average household: approximately 1.4 % (very small).

**Impact of construction of the SHPPs - illustration (the Higher Scenario):** As per EFA conditions mentioned under Item 6:

a. incentives required for construction of new SHPPs: 10 MW in the year 2010 amount to EUR 1.288 mill. and EUR 3.864 mill. in 2015 respectively, for the total of 30 MW in new SHPPs;

b. increase in the selling price: 0.032 EURcent/kWh (the year 2010) and 0.091 EURcent/kWh (the year 2015),

c. expected cost increase for electric power: from 1.26 to 2.53 EUR/year (in the year 2010) and from 3.60 to 7.21 EUR/year (in the year 2015),

d. additional cost for new SHPPs due to increase of the total electric power cost for an average household: approximately 2.0 % (very small).

Additional costs for construction of SHPPs distributed onto a large number of customers do not greatly affect the electric power costs to be borne by each end user.

8) **Legal framework:** The current legal framework that refers to preparation and construction of SHPPs includes regulations from the area of energy, spatial planning and civil engineering/construction, proprietary legal affairs, water management, private investments into the public sector, environmental protection and

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company law. Norms contained in the above mentioned regulations, subject to certain interventions of the legislator, provide for realistic grounds for implementation of SHPPs construction projects.

9) **Process of implementation of the prescribed procedures and the key actors:** The process of implementation of the prescribed procedures is divided into 5 stages. The key actors participating in the process itself are as follows: the investor, the Government of the Republic of Montenegro, the Ministry of Economy, the Ministry of Agriculture, Forestry and Water Management, the Water Administration, the Hydro-Meteorological Institute of Montenegro, the Regulatory Energy Agency, the Ministry of Environmental Protection and Physical Planning, the Electric Power Company of Montenegro (EPCG) Nikšić (network operator, supplier) and the authorised bodies of local administrations.

10) **Obstacles to development of SHPPs** are numerous: political, legal and administrative, organisational, financial and professional-technical.

11) **Involvement of the state in development of SHPPs:** Due to non-existence of any reliable data, investment of the state in development and research of energy potentials of renewables, thereby in SHPPs as well, is of general social and economic significance.

In more detail, the State should:

a) organise the system of necessary measurements and researches in the watercourses, as well as preparation of the study and preliminary project documentation as qualitative grounds for a potential investor to make a decision to build a SHPP in a certain location. This implies possibility to conclude a concession contract for investigations and preparation of baseline documents as per the defined criteria;

b) also provide for a possibility of an initiative to be started by the investor for execution of preparation and exploration works;

c) as a final aim of preparation-exploration activities, establish a registry of SHPPs at the state level – a geographical information system (GIS) (basic data on watercourses and systems for water supply, and general technical solutions for potential sites with all necessary characteristics, with spatial planning, environmental protection and protection of cultural heritage restrictions).

d) initiate the *National Energy Programme for Construction of SHPPs* which would organise the system for research of realistic, usable potentials, enable preparation of the Medium-Term Master Plan for Construction, encompass local plans for construction of such facilities, realise construction of the facilities, and also prepare construction of other facilities in the future, as well as gather the specialised staff in this area. The aim of the National Energy Programme is to create conditions for entrepreneurial activities and eliminate all obstacles to construction of SHPPs on the watercourses and sites that meet the criteria related to environmental protection, preservation of natural and cultural heritage, and comply with the necessary parameters of profitability and efficiency as per the set conditions.

e) initiate a pilot-programme for SHPPs to be financed by the state, or by investors interested in testing of the existing legal procedures and identification of additional obstacles which cannot be detected by project simulation methods.

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Out of about 70 sites identified so far, and among other possible sites for SHPPs in Montenegro, a certain number of initial pilot-projects should be selected. The methodology approach to be applied on these sites is described in this document.

12) **Engagement of local communities in development of SHPPs:** Local communities should be given greater importance, responsibilities and authority with respect to fulfilment of long term strategic national goals and directed towards cost-effective and profitable energy utilisation of huge hydro potentials of small watercourses in the Republic of Montenegro.

13) **Methodology for determination of realistically practicable potential of SHPPs:** The suggested approach includes 16 activities: (1) to define potential locations, i.e. sites, (2) to define in general the environmental acceptability of the sites, (3) to analyse the impacts of international obligations on border watercourses, (4) to detect conflicts with the present or potential users of the same space, (5) to establish measurements on the watercourses, (6) to make a registry for SHPPs – GIS for SHPPs (at the level of general technical solution), (7) to undertake basic analyses for projects profitability, (8) to incorporate the sites into the spatial plans and water management plans and programmes, (9) to undertake field visits – designing, (10) to incorporate spatial planning limitations, (11) to incorporate environmental limitations, (12) to incorporate limitations related to protection of cultural heritage, (13) to incorporate restrictions related to water availability, (14) to conduct the analysis of the previous feasibility study for the project, (15) to define realistically feasible projects, and (16) to prepare conceptual projects.

14) **Model for electric power purchase from SHPPs:** International experience shows that a system of guaranteed fixed prices or a system of fixed incentives (i.e. some of the *Feed-In Tariff* models) gives best results. The main features of this model are as follows:

- simplified administration, application and control of the system of incentives,
- creation of a more positive investment ambience.

The model of guaranteed fixed prices (incentives) is assessed to be suitable for application in Montenegro, and therefore it is recommended to be introduced due to its substantial contribution to encouragement of investments in renewables as the primary goal.

Therefore it is necessary to:

a) establish a stable purchase system, define the purchase price and conditions of purchase (competence of the Ministry of Economy) which will be specified in a PPA (*Power Purchase Agreement*),

b) introduce a system for purchase of electric power at the minimum guaranteed price (*Feed-in Tariffs*) which will be proposed by the Ministry of Economy and adopted by the Regulatory Energy Agency,

c) guarantee the stability of the purchase price and secure purchase for a pre-defined time period (for example, minimum 10 years, provided that it does not violate market principles, according to the assessment by the Regulatory Energy Agency),

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d) put electric power purchase under the competence of the supplier (within the structure of EPCG AD Nikšić),

e) warrant for investment security, which is often the element bearing more importance than the level of purchase price, regardless of the fact that the purchase security is governed by the Energy Law,

f) define methodology for determination of purchase price for electric power produced in SHPPs.

**15) Methodology for determination of purchase price for electric power from SHPPs:** Purchase price is the combination of the so called "basic price" (average production price) of electric power in the system and the additional incentive, in order to secure sufficiently high economic profitability for renewable energy projects, and thus attract the investors. Determination of the level of the incentive is based on evaluation of avoided costs for production of electric power from the plants that burn fossil fuels.

**16) Determination of purchase price for initial SHPPs pilot-projects:** Until all elements required for application of the proposed methodology from the preceding point are acquired, purchase prices of electric power for SHPPs can be determined as per the principle of "regulated profit", under the assumption that there are cash flows and acceptable rates or periods of return for typical projects – representatives of each technological group (e.g. internal rate of return of 8-10%, period of return 10 years). Definition of detailed implementation conditions and the manner of monitoring is under the competence of the Regulatory Energy Agency of the Republic of Montenegro.

**17) Problems related to connection of SHPPs to the distribution grid:** It is necessary to set forth technically feasible and economically acceptable measures for efficient connection of SHPPs to the grid. These measures include: (1) establishment of the limits of competence over the property and installed equipment in accordance with the ownership and proprietary fees, (2) setting of technical requirements for the equipment, (3) prescribing payments which have to be made by the investor in order to compensate for the costs incurred due to a new connection, (4) definition of responsibility for payment of connection costs, and (5) definition of mutual obligations between the investor and the distribution system operator.

**18) Other measures for connection of SHPPs to the grid:**

- The Provisional Distribution Code should define the financial funds required for connection and utilisation of the grid for SHPPs (< 10 MW). It is also necessary to develop a more detailed procedure for considering the requests for connection to the distribution grid.

- The Regulatory Energy Agency of the Republic of Montenegro should supplement the Regulations on Tariffs for Electric Power from the power plants having the capacity lesser than 10 MW, which should also regulate the issue of payment for connection.

- Standard connection conditions should define the financial funds for connection as per the principle of "shallow" investments.

- Non-standard connection conditions should allow for the third parties to invest into construction of necessary infrastructure in the grid.

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- The methodology for determination of connection fee should be prescribed and the connection fee should be set as for it to cover actual connection costs based on standard unit prices for the line, transformer and switching equipment.

- It is necessary to adjust the fees for utilisation of the system-related services of the electric power system in order to encourage construction of SHPPs.

19) **Charges for water utilisation and the royalty fee:** There are two types of charges envisaged for water utilisation in Montenegro for the purpose of electric power generation (the charge for water utilisation and the royalty fee). Such approach is not in consistency with the practice in EU member states, and therefore new legal regulations will propose simplified approach in determination of the level of the fees.

20) **Prescribed procedures for construction of SHPPs:** The Law on Private Sector Participation in Delivery of Public Services, and more specifically, the Decree passed under this Law (Decree on the Manner and Conditions for Award of Concession for Utilisation of Potable Water, Water for Agriculture, Industry, Public Utility Needs and Similar Purposes) have been successfully applied in the field of commercial water utilisation, while their application in the field of construction of new energy facilities is facing difficulties.

As procedures for adoption of new laws on waters and participation of private sector in delivering of public services are underway, there will be certain adjustments to this approach and simplification of procedures and transfer of authorisations to operative bodies, all with the aim to encourage construction and create simplified procedures.

21) **Advantages and benefits of adoption of the Kyoto Protocol for Montenegro (with regard to SHPPs):** The Federal Republic of Yugoslavia ratified the Framework Convention (UNFCCC) in 1997, and the State Union of Serbia and Montenegro officially became a member of the Convention in 2001, through a succession arrangement; however, the Kyoto Protocol has not been ratified so far, although the document does not imply any concrete obligations for the State Union of Serbia and Montenegro in terms of reduction of greenhouse gas emissions. By means of acceding to the Kyoto Protocol (no additional obligations attached), Serbia and Montenegro could achieve certain benefits.

Projects for construction of SHPPs certainly belong to the group of potential CDM projects due to negligible greenhouse gas emissions arising from such facilities.

Financing of CDM projects, apart from the usual financial resources, can also be provided from dedicated funds, such as from: the European Investment Bank (EIB), the World Bank (WB) and the German Development Bank (KfW).

Establishment of transparent legal and institutional framework has the crucial importance for realization of SHPPs projects within the CDM mechanisms, as a positive signal but also as a steady warrant to the potential investors, thus removing all possible obstacles in the process of construction of SHPPs.

22) **Organisation of the programme for development of SHPPs:** In accordance with the obligations and the activities of the Ministry competent for energy affairs that have been stipulated under the Energy Law, it is necessary to organise the Central Unit for SHPPs (abbr. CUSHPPs) with the task to conduct overall coordination of activities related to the programme of development of SHPPs in the Republic of Montenegro. The ultimate aim of formation and operation of the CUSHPPs is to establish

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a "one-stop-shop" agency, wherein the investor/entrepreneur can be provided with all the relevant information in one place and, through this CUSHPPs, acquire all relevant permits required for realization of a SHPPs project. In this way it will be possible to generate income to be used for financing a portion of costs for the operation of the CUSHPPs from off-budgetary resources.

Within the CUSHPPs' scope of work, programmes for exploration works at potential sites for SHPPs should be initiated through tenders, and organising of implementation of the pilot-projects for SHPPs should be set to; next, preparation of the Master Plan for construction should be initiated, as well as organisation of preparation of local plans. Additionally, CUSHPPs is in charge of provision of information, ensuring the transparency of work and monitoring with respect to realization of the National Programme and Strategy for Development of SHPPs.

**23) Investment incentives for construction of SHPPs:** For Montenegro, it is suggested (i) to establish an optimum system of investments encouragement through loans with favourable repayment conditions, and (ii) to provide state guarantees, e.g. as per the following models:

- subsidising a portion of interest – after an investor is granted a commercial bank loan, the portion of interest is subsidised, this portion being equal to the difference between the interest rate obtained by the interested investor and the interest rate which would make the project profitable and acceptable for the investor. Prior to this, the Government of the Republic of Montenegro and the Regulatory Energy Agency need to adopt general criteria for «profitability» of the SHPPs project (e.g. IRR, the return period of the investment, concession conditions, etc.),

- providing guarantees– a guarantee is issued to an investor who is taking a loan from a domestic and/or a foreign bank, thus reducing a risk of loan approval as well as loan costs borne by the investor.

**24) Model of public-private partnership:** A public-private partnership (PPP) implies cooperation between the public authorities and the private sector, with the aim to meet certain public needs in the broadest meaning of the term (financing, construction, rehabilitation, management, maintenance, delivery of a service). The public and private sectors join their respective resources and expert know-how in order to meet certain public needs through appropriate distribution of resources, risks and rewards. A PPP also implies that the private sector participates not only in realization of a project, but also in a decision making process. A PPP model is applicable for both the existing and new facilities. When applying a PPP model, attention should be paid to fulfilment of the basic conditions:

- to ensure market freedom and equal treatment for all participants in tender procedures as well as competition,
- to protect public interest and maximize the project value,
- to assess the most efficient type of the PPP model for each project.

**25) Selection of the best PPP model:** Under the Energy Law and the Law on Private Sector Participation in Delivery of Public Services, several modes of performance of public activities are provided for in relation to the contract type (lease contract, management contract, concession and the BOT contract). The convenient



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types of contracts for implementation of SHPPs projects are concession or combined concession/BOT.

26) **Institutional competence for granting concessions:** Competence to grant concession for water utilisation (and for generation of electric power) is vested in the Ministry of Agriculture, Forestry and Water Management. Since SHPPs constitute a specific mode of utilisation of watercourses which is closely connected with the energy sector, it is necessary that the Ministry of Economy (as the Ministry competent for energy), within the process of concession granting for SHPPs, undertake all preceding preparatory activities in order to create conditions for announcement of a tender, as well as to conduct the tender procedure itself.

27) **Approaches in concession granting:** The Law on Private Sector Participation in Delivery of Public Services stipulates that the concession is granted through a public tender. Some simplified procedures for concessions granting should be introduced as well – further to the request of an investor, in order to accelerate this procedure. In the implementation of SHPPs projects, two approaches should be available:

- free initiative of the investor,
- initiative from the state or local communities (to announce a tender).

Free initiative of an investor should be enabled in such a manner as that they be allowed to submit the request for granting of the concession for SHPPs in a certain location, as well as to initiate research and other works required for implementation of a SHPPs project. Such approach is consistent with the second EU Directive on Internal Market in Electricity (2003/54/EC).

28) **Reinvesting the revenues from operation of SHPPs:** Engagement of domestic companies and/or products in a certain percentage should be encouraged within tender documents, while adhering to European regulations on giving the first refusal rights to domestic business entities rather than to foreign-owned companies. Furthermore, tender documentation may also provide for joint development of SHPPs projects and accompanying activities and/or infrastructural facilities (e.g. tourism, catering, recreation, rehabilitation and development of local infrastructure, etc.), or bind the investors to certain investments for the development needs of a local community.

29) **Incentives to domestic entrepreneurs and local communities:** With respect to project implementation, it is necessary to provide for concrete stimulative measures as well, such as financial and tax facilities, state grants, advantageous loans, construction of ancillary infrastructure and services provided by the state, and the like. This is a matter of essential importance in case when the investor is a local community, which mostly has neither sufficient funds nor any guarantees enabling them to implement the project by themselves.

30) **Revitalisation of the existing SHPPs:** Since the existing small hydro power plants have been operating for a long while (some of them longer than 40 years), the ever increasing problems present in their operation with the growing tendency, as well as the age of the equipment, indicate that it cannot be expected from these plants to be highly operational, or to have high availability and operational safety. Therefore, adequate measures and activities have to be undertaken with the purpose to revitalise,

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modernise or reconstruct these facilities. This document accepted the standpoint that those measures would be included in the process of privatisation of these facilities.

31) **Action Plan:** On the basis of the previously elaborated activities (conclusions in Items 1 – 30), a preliminary Action Plan has been designed, with the aim to create the most favourable ambience for development of SHPPs projects in Montenegro. The implementation of the Action Plan will regulate in the shortest possible time the system for utilisation of potentials for SHPPs' in Montenegro on entrepreneurship basis, especially with regard to purchase (incentive prices, purchase period), bearers of obligations related to purchase, and mechanisms for raising funds for encouraging utilisation of SHPPs.

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### LIST OF ABBREVIATIONS

AD	Joint-Stock Company
AP	Action Plan
BOT	Build-Operate-Transfer
CDM	Clean Development Mechanism
CUSHPPs	Central Unit for Small Hydro Power Plants
EC	European Commission
ECSEE	Energy Community in South-East Europe
EPS	Electric Power System
EFA	Economic-Financial Analysis
EIB	European Investment Bank
EIHP	Energy Institute 'Hrvoje Požar'
EPCG	Electric Power Company of Montenegro
ET	Emission Trading
ETS	Emission Trading Scheme (EU)
EU	European Union
GEF	Global Environmental Facility
GIS	Geographic Information System
GWh	Giga( $10^9$ )-Watt-hour
HPP	Hydro Power Plant
IEA	International Energy Agency
JI	Joint Implementation
EMS	Environmental Management System
PPP	Public-Private Partnership
KfW	<i>(deut.) Kreditanstalt für Wiederaufbau</i>
kWh	kilo( $10^3$ )-Watt-hour
SHPP	Small Hydro Power Plant
MW	Mega( $10^6$ )-Watt
NES	National Energy Strategy (MNE)
NPV	Net Present Value
IRR	Internal Rate of Return
RES	Renewable Energy Sources

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PPA	Power Purchase Agreement
RMNE	Republic of Montenegro
S&MNE	(State Union) of Serbia and Montenegro
SDSHPPs	Strategy for Development of Small Hydro Power Plants (MNE)
TPP	Thermal Power Plant
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
WB	World Bank
WEC	World Energy Council

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### 1. INTRODUCTION

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The energy sector in Europe commenced the process of its transformation and new structural and organisational arrangements at the beginning of the last decade of the previous century, with a common goal of creating a free energy market and uniform norms for dealing at this market.

The Republic of Montenegro (RMNE), through adopting the Energy Law in 2003, has started the adjustment of its energy sector to the conditions of new requirements of the European Union (EU) in this field, as well as preparation for participation in the South-East Europe regional market of electric power, as a constituent part of the overall inclusion in Euro-Atlantic integration.

The Energy Law stipulates that the Government of the RMNE in the area of energy is to establish and implement the national energy policy and the national energy strategy, the long-term and the annual energy balances and the balance's implementation policy, ensure implementation of environmental protection measures, stimulate and facilitate investments in the energy sector, development of competition and participation of private sector in the energy industry, define the policy and the strategy for construction of new and/or rehabilitation of the existing energy facilities.

Through its ministry competent for the energy affairs (the Ministry of Economy), the Government does as follows: implements the policy for energy efficiency and preservation of energy resources, provides incentives and advice on energy efficiency and cost-effective use of energy, develops and promotes incentives for efficient use of renewable energy sources (RES), promotes greater use of RES in production in the domestic market, manages the funds allocated for saving and more efficient use of energy, promotes the use of new technologies with regard to energy as well as participation of private sector in the energy sector of Montenegro and privatisation of energy entities or segments owned by the state, along with promotion of utilisation of RES.

In the course of 2005, the Energy Policy of Montenegro was established in the spirit of sustainable energy development, which, based on: the Energy Law, the Agenda of Economic Reforms in Montenegro, the Athens Memorandum of Understanding, the Strategy of Development and Poverty Reduction of Montenegro, the general policy of the Government of Montenegro with respect to creation of conditions for joining EU, laws and documents that govern the environmental protection and spatial planning & development areas, and other relevant laws, in accordance with the documents of the European Commission, World Energy Council (WEC), International Energy Agency (IEA), and with the aim to ensure available, attainable and affordable energy, as well as to provide conditions for creation of an open energy market and fast inclusion in the regional energy markets, has the following objectives:

1. Secured, high-quality, reliable and diversified supply of energy with the aim to create a balance between the deliveries and the requirements as per all forms of energy,
2. Maintenance, revitalisation and modernisation of the existing infrastructure and construction of new infrastructure, for the needs of generation and utilisation of energy,



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3. Reduction of dependence on energy import, primarily by means of creating stable conditions for investments in research and construction of new energy facilities (especially at the already researched sites with unused hydro potential) and through investments in other energy infrastructure,
4. Creation of adequate legislative, institutional, financial and regulatory framework for encouraging participation of private sector and investments in all the aspects of energy infrastructure,
5. Creation of conditions for greater use of renewable energy sources, combined heat and power generation (CHP) and utilisation of fossil fuels based on clean technologies,
6. Establishment of competitive market for supply of energy in the areas where there is a possibility to do so (generation and supply) in accordance with the concept of regional energy market, along with regulation of monopolistic grid activities,
7. Provision of institutional and financial incentives for improvement of energy efficiency and reduction of energy intensity in all the sectors, from generation to consumption of energy,
8. Sustainable generation and utilisation of energy in relation with environmental protection, and international cooperation in this field, particularly with regard to reduction of greenhouse gas (GHG) emissions,
9. Provision of support to research, development and promotion of new, clean and efficient energy technologies and to pursuing energy policy based on expert and scientific grounds.

Harmonisation of the economic-technological development with preservation of the environment is an imperative which also arises from the "Declaration on the Ecological State of Montenegro" from 1991, by means of which the obligation has been undertaken to give special importance and priority to ecology and environmental protection in the future development of Montenegro. In these terms, utilisation of RES should be developed in accordance with the objectives of the environment preservation in the RMNE. In this respect, development of projects of utilisation of renewable energy sources and protection of the environment makes the basis for sustainable development of the country.

With the purpose to implement the established policy, preparation of strategic documents from this field was embarked on. Thus, the Strategy of Energy Efficiency (2005) was adopted, the drafting of the Energy Development Strategy of the RMNE for the period until 2025 is underway (NES), and the Strategy for Development of Small Hydro Power Plants is being prepared at the same time, which is actually the subject matter hereof.

The Energy Development Strategy of the RMNE needs also to be prepared due to the assumed international commitments with respect to environmental protection, as well as due to adjustment of the energy sector to the conditions for utilisation of energy in EU, since one of the strategic objectives of Montenegro is its future membership in EU.

During the second half of the year 2005, a study titled 'Preparation of the Strategy for Development of Small Hydro Power Plants in Montenegro' was prepared by the Energy

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Institute 'Hrvoje Požar' (Zagreb). On the basis of this Study a document was prepared to serve as the basis for the Strategy for Development of SHPPs, which was completed and adjusted in terms of both its content and form by the Task Force formed in the Ministry of Economy. The strategy for Development of SHPPs (SDSHPPs) will therefore become an integral part of the National Energy Strategy (NES), which has its energetic, economic, legislative, organisational and institutional dimensions. The solution proposed in this SDSHPPs have been adapted to the needs and specific features of the RMNE, along with taking into account the positive international experiences of the EU member states and some of the associated countries.

The chief purpose of this Strategy (SDSHPPs), i.e. of the long-term policy of development and construction of small hydro power plants in Montenegro, is to provide favourable conditions for development and construction of the facilities, enable energy (techno-economic) utilisation of hydro potentials of small watercourses via small hydro power plants in a planned and organised, cost-effective and profitable, long-term manner, as well as their multi-purpose utilisation with a view to faster overall development.

Through the Strategy for Development of SHPPs and the programme for its implementation, the following aspects are defined: possible and adequate schedule of construction of SHPPs in Montenegro, influence of the adopted schedule of construction of SHPPs on the energy balance of Montenegro, the estimated costs of construction/operation of new SHPPs, influence of construction of new SHPPs on the electric power price for end customers, construction of SHPPs as a contribution to fulfilment of (assumed and prospective) international commitments of the RMNE, legal procedures which must be followed during construction, impact of construction on the environment, organisational and institutional aspects accompanying such documents.

One of the measures which are an integral part of the assumed commitments for requirements of realisation of energy policy and domestic and international regulations and recommendations is Implementation of the Directive 2001/77/EC<sup>1</sup>(on the promotion of electricity produced from renewable energy sources in the internal electricity market) of the European Parliament and the Council; by signing the ECSEE Treaty (Energy Community in South-East Europe) on 25 October 2005, with its ratification planned to be done by the middle of 2006, the RMNE accepted, inter alia, the commitment to implement the *Acquis Communautaire* in the fields of energy, environment, competition and RES. In pursuance with the Treaty, the plan for implementation of the Directive 2001/77/EC should be prepared and submitted no later than the end of the first year following its effective date.

The Directive prescribes defining of the share of renewable energy sources (RES) in total electricity consumption. The main requirement of a country's concept of "sustainable development" is more considerable utilisation of RES, which are defined within a national energy strategy in a way as to determine the share of RES in the total energy needs of that country. In pursuance to this share, the size and significance of power plants that use RES and their influence on the electric power system (EPS) is

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<sup>1</sup> Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market.

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determined. Small hydro power plants (SHPPs) in the Republic of Montenegro are RES with outstandingly high level of development potential.

With a view to stimulation of greater use of SHPPs as RES, it is necessary to define concrete measures for increase of their share in the total energy generation. The first step towards this end is the *Strategy for Development of SHPPs in the RMNE* (SDSHPPs), along with the accompanying *Action Plan* (AP).

In addition to the above said, it is necessary to analyse the Kyoto Protocol in this document. With respect to international initiatives for protection of environment, the most distinguished one is the "United Nations Framework Convention on Climate Change"<sup>2</sup> (hereinafter referred to as "the Convention") along with the provisions of the "Kyoto Protocol" as an accompanying document to the Convention. Parties eligible to join the Convention are the United Nations member states. The State Union of Serbia and Montenegro (S&MNE) officially became a member of the Convention in 2001 through the succession arrangement, while the FRY had ratified the convention in 1997. The status of Montenegro, in terms of the Convention and the Kyoto Protocol, is defined by the status of S&MNE. S&MNE has not ratified the Kyoto Protocol so far, although no concrete commitments would stem therefrom for the state itself in terms of reduction of greenhouse gas emissions, because S&MNE is not included in the list of countries in the Annex B to the Protocol.

### **2. AVAILABILITY, USABILITY AND ACCEPTABILITY OF SMALL WATER COURSES' HYDRO POTENTIALS IN MONTENEGRO**

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Montenegro has available considerable hydro power potential of its watercourses, which has been utilised with only 17% of the total theoretical hydro potential. A part of these natural resources includes respective hydro potential of small watercourses, which offers sufficient possibilities for its utilisation through construction of small hydro power plants.

Utilisation of hydro potential for generation of electric power in the present-day conditions is a very important mode of obtaining energy. With respect to small hydro power plants it should be noted however that these are the types of facilities installed on smaller watercourses.

The chief parameter on the basis of which a small hydro power plant is defined in most countries is solely the installed capacity. Nowadays the term of small hydro power plant is fully established in the field of hydroenergetics and it refers to the hydro power plants with capacity up to 10 MW.

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<sup>2</sup> UNFCCC (*United Nations Framework Convention on Climate Change*).

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### **2.1 AVAILABLE (THEORETICAL) – GROSS ENERGY POTENTIAL**

Theoretically speaking, natural and gross energy potential usually have identical meaning and refer to the potential arising from the available natural resource considered, while available power and energy of that resource is defined as the total theoretical amount, irrespective of the manner in which energy utilisation of that resource is possible and regardless of energy losses arising from the aforesaid utilisation. Although the total potential is considered as the sum of certain levels of potentials, the same term is sometimes used to describe theoretical potential as well.

Based on the data from the strategic planning document in force that addresses hydro power potentials of Montenegro – *The Water Resources Development Master Plan of Montenegro* (WRDMPMN), Montenegro has available 9.846 GWh/year theoretical hydro potential on the main watercourses and their tributaries. There is a certain difference between various assessments of potential of the so called "small water powers ", i.e. the potential that may be utilised by means of small hydro power plants. In the previous planning documents, the gross hydro power potential of smaller watercourses was estimated to amount to 800 ÷ 1.000 GWh/year.

Due to insufficient hydrological research of small watercourses (tributaries), which essentially comprise the overall potential of main watercourses, at present it is not possible to separately show the overall hydro potentials as per each tributary, in their volume amounts.

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### **2.2 *TECHNICALLY – net USABLE POTENTIAL***

The next level of potential is the net potential, i.e. the technically usable potential. This potential refers to that part of the available gross potential which may be energetically used in a reliable manner by means of application of certain technical solutions. In some cases the amount of net potential is higher in level (preliminary studies on the possibilities of natural resources utilisation at the level of macro location), while the technically usable potential is lower in level (more detailed design studies at the level of a micro location).

The researched technically usable hydro power potential of small watercourses of Montenegro, which was elaborated mainly at the level of studies in the period between 1980 and 1986, apart from a small segment of documentation in which some locations were elaborated on a higher level, is estimated to amount to 643 GWh/year.

On the other hand, an expert estimate of technically usable potential was carried out in indirect manner for unresearched tributaries in the respective catchment areas of the Tara, Ćehotina, Ibar rivers and for a number of tributaries to the Lim river, amounting to 683 GWh/year. Based on such analysis, the total technically usable hydro power potential for construction of small hydro power plants on the said tributaries is estimated to amount to 1.326 GWh/year.

The technically usable potential still does not provide information on realistic possibilities for utilisation of a certain natural resource, since unconditional application of technological solutions for utilisation of certain natural resources to energy purposes is not possible nowadays. Therefore an additional level of potential is defined, but it cannot be unambiguously determined. Namely, due to a great number of criteria, three categories are defined in principle: financially acceptable, environmentally acceptable and socially acceptable potentials.

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### **2.3 *FINAncially acceptable potential***

Financially acceptable potential is determined by application of economic justifiability criteria.

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### **2.4 ENVIRONMENTALLY ACCEPTABLE POTENTIAL**

Environmentally acceptable potential is defined by the environmental protection criteria.

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### **2.5 SOCIALLY ACCEPTABLE POTENTIAL**

Socially acceptable potential is principally determined by the attitude of the public on acceptability of a certain energy technology for utilisation of natural resources.



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### **2.6 REALISTICALLY USABLE (PRACTICABLE) POTENTIAL**

In addition to the aforesaid criteria, there are other criteria which considerably reduce the potential, and these are determined by concrete spatial-planning restrictions, protection of cultural heritage, international and inter-state agreements and other limitations. Application of all the aforesaid criteria will result in the amount of realistically usable potential as the final level of potential for a certain resource.

Accordingly, when speaking of the possibilities for construction of small hydro power plants, it should be noted that the previous approach in which the potential of small hydro power plants was generally presented as the value of technically usable potential is not in compliance with contemporary perceptions, especially in consideration of highly developed environmental awareness of people and already adopted principles of sustainable development. Namely, several decades ago, when on one hand environmental science was not given sufficient importance within implementation of the largest number of construction/civil engineering projects, and on the other hand, opinions of local communities were not taken for consideration in substantial extent, a potential regarded as technically usable was principally accepted as realistically usable, taking into consideration, of course, economic profitability of a specific project. Nowadays, while planning construction and the construction process itself, investors are facing significantly greater number of limitations, which in a great number of cases limit the initially defined technically usable potential to some smaller levels, and in a certain number of cases completely disable any interventions in the area.

Taking into consideration everything said above, an emphasis should be put on sites with realistically practicable projects, while accepting all the limitations and conditions stemming from regulations, professional standards and public opinion - i.e. on the sites which possess realistically usable potential. According to the estimates given among professional circles, the realistically usable potential of small hydro power plants is approximately 400 GWh/year. This estimate has been given on the basis of evaluation of rather steadfast environmental and spatial limitations set on a range of small watercourses. This caution is necessary, since it deals with a very commonly encountered misapprehension in this part of the world that the solution to the electric power problems lies only in small rather than in large hydro power plants.

### **3. PREVIOUS STUDIES ON POTENTIAL FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

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### 3.1 The present SITUATION of small hydro power plants DEVELOPMENT

Table 1 shows basic data on the existing small hydro power plants, while Table 2 shows the installed capacity, net plant capacity, as well as the realised and planned generation in the existing small hydro power plants (SHPPs), hydro power plants (HPPs) and thermal power plants (TPPS) in Montenegro at the end of the year 2005.

**Table 1**

Nominal parameters/HPP	»Glava Zete«	»Slap Zete«	»Rijeka Mušovića«	»Savnik«	»Lijeva Rijeka«	»Podgor«	»Rijeka Crnojevića«
Generator voltage (kV)	6,3	3,15	3,15	0,4	0,4	0,4	0,4
Generator capacity (kVA)	2x3200	2x12000	3x650	2x100	110	465	650
Capacity factor	0,7	0,8	0,7	0,8	0,87	0,8	0,8
Transmission ratio of the transformer (kV/kV)	6,3/35	3,15/10 10/35	3,15/35	0,4/10	0,4/10	0,4/6 6/35	0,4/10
Transformer capacity (kVA)	2x4000	2x1000 1600	2x1000	400	100	400	630
Type of turbine	Kaplan vertical	Kaplan vertical	Pelton horizontal	Francis horizon.	Banki	Michell Ossber.	Michell Ossberger
Turbine capacity (kW)	2x2680	2x600	3x420	2x100	55	395	555
Flow (m <sup>3</sup> /sec)	14,5+14,5	13+13	0,35+ 0,35+ 0,35	0,5+0,5	0,22	0,9	3,0

**Table 2 Installed capacity of generation facilities and generation of electric power within the electric power system of Montenegro**

	Installed capacity		Net capacity plant		Average generation achieved		Realised in the year 2005		Plan for the year 2006	
	MW	%	MW	%	GWh	%	GWh	%	GWh	%
Existing SHPPs	9,0	1.0	9,0	1.1	21,4	0.9	22,9	0.8	21	0.8
HPPs	649,0	74.8	649,0	76.3	1 552,0	62.2	1 818	66.6	1 673	60.5
TPP	210,0	24.2	193,0	22.7	922,0	36.9	890	32.5	1 073	38.7
Total generation	868,0	100.0	851,0	100.0	2495,4	100.0	2 730,9	100.0	2 767	100.0
Total available*					2 786		3795,9		3 832	

\* The item designated as 'Total available' refers to the total available electric power in the electric power system of Montenegro considering the agreement on exchange of electric power generated at Piva HPP with the system of Serbia (1065 GWh).

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According to the provisions of the Energy Law, in Montenegro SHPPs are defined as HPPs with the installed capacity of up to 10 MW. The installed capacity of 7 (seven) existing SHPPs amounts to 8,92 MW with the achieved annual generation of 21,4 GWh. The total installed capacity of the Montenegrin electric power system amounts to 868 MW, most of which comes from two large HPPs (Perućica HPP and Piva HPP). The existing SHPPs' share in the capacity of the generation units (facilities) is at the level of only 1,1%, while the share of generation of SHPPs in the total annual generation of the EPS of Montenegro as per average achieved values is 0,9%. In connection to this, it should be borne in mind that Montenegro procures approximately 1/3 of its total electric power needs from other systems, hence the contribution of SHPPs to coverage of total consumption is even smaller. Two thirds of electric power are generated in large HPPs, while one third is generated in Pljevlja TPP.

The Electric Power Company of Montenegro (EPCG AD Nikšić) provides electric power to approximately 285000 customers. Generation of domestic SHPPs, HPPs and a TPP is not sufficient to meet the total electric power demand in Montenegro, therefore a considerable portion of the required electric power is imported from other EPSs. In 2005, the domestic power plants generated 2 730,9 GWh in total (without valorisation of Piva HPP), while the consumption coverage deficit was compensated by imported power – 1598 GWh. The production plan for 2006 amounts to 2 767 GWh, while the import plan for 2006 envisages the amount of 1 600 GWh.

Due to neglected construction of domestic generation facilities during the previous three decades and growth in consumption of electric power, dependence on import has been increasing every year. During the '90-ies there was a considerable decrease in consumption, along with the change in the structure and characteristics of consumption. In addition to a big drop in industrial consumption, this period was also characterised by accelerated growth of consumption at the level of distribution. Consumption of direct customers in 1989 reached 2 095 GWh, while in 1994 it dropped to only 505 GWh. The level of consumption of direct customers at the end of '90-ies was reached in 2005 (2 077 GWh), while for 2006 consumption has been planned at the level of 2 107 GWh.

Consumption at the level of distribution was doubled during the previous ten years. In 1985 it amounted to 1 127 GWh, while in 2005 it amounted to 2287 GWh, and for 2006 it has been planned at the level of 2 336 GWh. The deficit of electric power in 1985 amounted to 607,4 GWh, while in 2005 it amounted to 1 800 GWh (excluding valorisation of the contract for Piva HPP).

Due to constant increase in consumption, the volume of imported electric power is expected to increase in the course the forthcoming years, and to remain this way until a new larger-scale generation facility has been constructed in Montenegro. At the same time it is necessary to provide more funds for import of electric power due to increased needs and rise in the price of electric power in the free market, as expected in the future.

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### **3.2 Previous activities on research of the potential**

In the course of several previous years, increasingly intensive activities on research of SHPPs development potentials were carried out in Montenegro.

Due to its extensiveness and comprehensiveness, a document titled "Guidelines for Development and Construction of Small Hydro Power Plants in Montenegro" from 2001 stands out as the basic material, which incorporates assessment of the hydro power potential of SHPPs in Montenegro. Besides, this material elaborates on technical and legal issues and proposes a concept of planned approach to development and construction of SHPPs in Montenegro. In addition to the aforesaid document, a publication titled "Small Hydro Power Plants in Montenegro" (2003) was issued, in which technical and economic features of SHPPs in Montenegro are addressed. A considerable number of other papers was published in professional and scientific magazines and in proceedings from professional gatherings.

Thy hydro power potential of watercourses from the catchment area of main rivers of Montenegro was investigated for all the tributaries except for the respective catchment areas of the Tara, Ćehotina and Ibar rivers and some of the tributaries to the Lim river. The investigated hydro power potential of small watercourses of Montenegro was elaborated at the level of studies in the period between 1980 and 1986, except for "Otilovići" HPP (Conceptual Project and Tender Dossier from 2001), "Buča" HPP and "Vukovo Vrelo" HPP (Conceptual Project from 1984), "Šavnik-2" HPP (Conceptual Design from 1992), "Krupac" HPP and "Slano" HPP (General Project from 2002).

It is necessary to update the assessment of the hydro power potential given at the level of a study, on the basis of proper hydrological measurements performed in line with all the requirements and criteria pertaining to environmental protection.

Considering the assessed values of small watercourses' hydro potential, the quickest and most efficient manner in which Montenegro can fulfil the commitments stipulated by the EU Directives, the Energy Law and other documents on promotion and incentives to development of renewable energy sources is through implementation of projects on construction of small hydro power plants.

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### **3.3 *Treatment of small hydro power plants***

Development of electric power industry in the Republic of Montenegro in the previous period was mainly directed towards designing, planning and construction of a larger-scale energy facilities. This implies, when speaking of hydro power plants, facilities on main watercourses.

Previous investigation of small hydro power plants in Montenegro did not have an organised and planned approach and did not systematically evaluate energy potential of all small watercourses; also, this was within the competencies of both business entities on the respective territories of municipalities and the Electric Power Company of Montenegro as the investor.

Although construction of small hydro power plants was allowed in previous times, these facilities have not obtained an adequate position in the energy industry of Montenegro. Due to the lack of a long-term strategic, economic and energy interest of the state and its orientation established on a defined programme for development of construction of small hydro power plants based on cost-effective energy utilisation of small watercourses, in absence of comprehensive technical and legal regulations, non-existence of an organisational structure as well as of stimulating measures, adequate utilisation of these hydro potentials in Montenegro did not occur, which is evidenced by results achieved by now. Namely, none of the designed small hydro power plants has been realised so far.

## **4. THE OBJECTIVE AND PROSPECTS FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

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### **4.1 THE Objective of small hydro power plants development**

Promotion of renewable energy sources (RES) is a high priority of EU, which has been stated in several strategic documents, primarily because of its environmental characteristics, but also because of other benefits from their utilisation. In this respect, the most significant is the Directive already mentioned above, namely Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, with the aim to increase the share of RES in production of electric power. The Directive sets the target share of RES in production of electric power at the level of 22.1 %<sup>3</sup> in the year 2010, which is nearly doubled percentage in comparison with the situation in 1997 (13.9%). Its share in 2003 was at the level of 15.2%.

Definition of strategic goals desired to be achieved through utilisation of RES is the first step in determination of minimum share of RES and regulation of conditions for their utilisation. The designed (future) share of RES should be based on realistic estimates, in order that the energy entities could be obliged to achieve relevant goals through accomplishment of the set task. Goals ambitiously set, despite the principal support from the general public, do not lead to stable growth in utilisation of RES.

It is not possible to give a concrete answer to the question of realistically practicable share of RES in the total energy production in Montenegro before a concrete analysis is performed for all RES for which there is some considerable potential in Montenegro (hydro, solar, wind, biomass, etc.). In the meantime, the analysis of the expected share of RES in ten new EU member countries may serve as initial assessment of the expected level and aims of RES utilisation in Montenegro. It is estimated that the share of all RES (not only SHPPs) in the period from the year 2010 to 2015 may be achieved in the range between 3 and 5 % of the total energy demand.

On the basis of framework analyses it is estimated that generation from SHPPs in the national electric power balance of the RMNE may reach the share of approximately 2,5% in the year 2015. This goal is possible to achieve but is subject to urgent adoption of the necessary documents that define and enable development of SHPPs in RMNE.

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<sup>3</sup>Note: According to the definition from the Directive, the percentage is calculated by dividing the volume of electric power generated from the RES with the gross electric power consumption.

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### **4.2 Prospects for development of small hydro power plants**

Montenegro has exceptional possibilities for generation of electric power from small watercourses.

Abundance of small mountain watercourses, with high gradients, enables construction of a considerable number of small hydro power plants and offers the possibility to obtain »environmentally clean« electric power.

The principal characteristic of profuse hydro potential of small watercourses in Montenegro is its location in a demographically challenged and economically under-developed hilly-mountainous rural part of the country, with favourable conditions for construction of profitable small hydro power plants.

Besides, in this part of the country there is a large number of abandoned watermills (over 100 of them), which could be adapted and transformed into small hydro power plants by means of small-scale reconstruction and investments.

Correspondingly, developmental possibility and opportunity for this part of the country is seen in construction of small hydro power plants, which would not only contribute to increase in the volume of electricity produced, but also become, as producers of energy, an important element of the local policies and the chief driver of economic development through multiple activities: various ancillary plants, dairies, sawmills, wood processing plants, farms, fish ponds, stone processing plants, water bottling plants, tourism, catering, sports, recreation and so on.

This would enable better economic living standards for the people living in this area, through cost-effective and profitable energy utilisation of small watercourses by means of small hydro power plants, since nature has been very bountiful and benevolent to this area, giving it a great wealth of hydro potentials of its watercourses.

In order to be able to expect with optimism better future results regarding energy utilisation of small watercourses, the nationally policy of development and construction of small hydro power plants in Montenegro should be synchronised with local programmes for the overall development and construction of these facilities. In connection with this, local communities should be given higher significance, responsibilities and competencies with regard to realisation of strategic long-term national objectives and orientation towards cost-effective and profitable energy utilisation of abundant hydro potential of small watercourses in the Republic of Montenegro.

## **5. OBSTACLES TO DEVELOPMENT OF PROJECTS OF SMALL HYDRO POWER PLANTS**

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The analysis of the overall developmental issues and of SHPPs projects realisation indicates the existence of certain obstacles. These obstacles arise primarily from inaccuracy and deficiencies of certain laws and regulations, excessive regulation of certain areas, lack of financial resources and lack of relevant information and coordination among responsible parties.

Main obstacles to development and construction of SHPPs in Montenegro are divided in several groups:

- political,
- legal and administrative,

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- organisational,
- financial,
- professional and technical.

One of the aims of the Strategy for Development of Small Hydro Power Plants is to overcome the identified obstacles with a view to creating a more favourable ambience for realisation of the National Programme for Construction of Small Hydro Power Plants.

### 6. SCHEDULE OF CONSTRUCTION OF NEW SMALL HYDRO POWER PLANTS IN MONTENEGRO

According to the results from the baseline documents for preparation of the Strategy for Development of Small Hydro Power Plants in Montenegro, the total number of 70 possible sites was identified for their construction. The total installed capacity of SHPPs amounts to 231,72 MW, while the expected annual generation of electric power is 643 GWh. Utilisation of the maximum installed capacity is on the level of 31,7 % or 2 780 hours per year.

Below follows the analysis of two scenarios for construction of SHPPs in Montenegro – the Reference Scenario and the Higher Scenario. Tables 4 and 5 show the assumed schedule of construction of SHPPs, by the year 2015, for the Reference and Higher scenarios respectively. It should be noted that in these calculations no concrete sites for SHPPs were considered.

According to the Reference Scenario, in the period until 2010, construction of SHPPs is envisaged with the total installed capacity of 5 MW, as well as construction of additional 15 MW at an adequate number of sites in the period until 2015. In other words, within the period of 10 years the installed capacities and generation in SHPPs are planned to be increased 3 times in comparison to the situation at the end of 2005. As per the Higher scenario, in the period until 2010, construction of SHPPs is envisaged with the total installed capacity of 10 MW, as well as construction of additional 20 MW at an adequate number of sites in the period until 2015. In other words, within the period of 10 years the installed capacities and generation in SHPPs are planned to be increased 4 times in comparison to the present situation.

**Table 4 The Reference Scenario for construction of small hydro power plants in Montenegro until the year 2015**

Reference Scenario	2005	2010	2015
<b>Installed Capacity [MW]</b>			
The existing SHPPs	9	9	14
New SHPPs	0	5	15
Total SHPPs	9	14	29
<b>Envisaged annual production [GWh]</b>			
The existing SHPPs	21	21	35
New SHPPs	0	14	28
Total SHPPs	21	35	63

**Table 5 The Higher Scenario for construction of small hydro power plants in Montenegro until the year 2015**



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Higher Scenario	2005.	2010.	2015.
Installed Capacity [MW]			
The existing SHPPs	9	9	19
New SHPPs	0	10	20
Total SHPPs	9	19	39
Envisaged annual production [GWh]			
The existing SHPPs	21	21	49
New SHPPs	0	28	56
Total SHPPs	21	49	105

Despite the construction schedule defined as above, development of SHPPs has a limited influence on the total capacity of the generation facilities and electricity generation in Montenegro. The share of the installed capacity of all the SHPPs in the total installed capacity in the electric power system of Montenegro in the year 2015 will amount to 3.3% (the Reference Scenario), i.e. 4.4% (the Higher Scenario), under the assumption that there will not be any new construction of other generation capacities. In case the total generation capacities are increased, the share of the installed capacity of SHPPs will be correspondingly smaller. The share of generation of all SHPPs in the total generation in the electric power system of Montenegro (without valorisation of the Contract for Piva HPP) in the year 2015 will amount to 2.5% (the Reference Scenario), i.e. 4.2% (the Higher Scenario). If valorisation of the Contract for Piva HPP is taken into account, the share of SHPPs in the total generation will be smaller. In this case as well, the assumption that neither one new larger-scale electric power generation facility will be constructed in the period until 2015 is applied. In other words, if electric power import is also taken into account, the possible share of SHPPs' generation in meeting the demand for electric power in Montenegro would vary in the range between 1.5 and 3% in 2015, as per the envisaged electric power consumption as stated in the National Energy Strategy (NES).

Due to small share of SHPPs in the overall generation in the electric power system of Montenegro, their dispersed nature will not create any difficulties in comparison with other fluctuations occurring in supply and delivery that the procedures for the system's plants management have to cope with on daily basis. Their impact will be particularly small in comparison to the problem of meeting the demand and maintenance of safety of the system's operation in case of dropout of a large production unit. In other words, under the above said assumptions, new SHPPs with the calculated levels of capacity and generation as specified above, can be integrated in the electric power system of Montenegro without occurrence of technical restrictions from the aspect of management of operation of the system, if, of course, all the standard conditions for their connection to the grid are properly fulfilled.

The presented scenarios for SHPPs development schedule (the Reference Scenario and the Higher Scenario) show that, despite accelerated development and multiple increase of the installed capacity of SHPPs, the ultimate impact on the total capacity and generation of the electric power system of Montenegro is limited after all.

Since implementation of the estimated schedule cannot be commenced immediately, in the forthcoming period of 2 years - while the activities on adjustment of legal infrastructure are being carried out, as well as the procedure and investigations of watersources, which are underway (the programme is being realised with a donation

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from the Government of Norway), it is necessary to realise a certain number of small hydro power plant facilities as pilot programmes. Procedures, parameters, impacts and other relevant indicators that will enable proper defining of the schedule of construction in accordance with regulations and current standards, will be investigated separately for each project. These facilities will not be further analysed through these scenarios; instead, after the test research has been finished, their position will be defined and their share determined, the same as for those facilities which will be operating under the regular programme (scenario).

It was also assumed that the existing SHPPs will continue with their operation. The issues concerning renewal of the existing SHPPs are not discussed herein. It is obvious that these facilities (or at least the greatest number of them) will be privatised, and therefore renewal or rehabilitation of all the existing SHPPs will be defined through the process of their privatisation.

### **7. ECONOMIC-FINANCIAL ANALYSIS AND FINANCIAL RESOURCES REQUIRED FOR CONSTRUCTION OF NEW SMALL HYDRO POWER PLANTS IN MONTENEGRO**

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Sites at which new SHPPs are going to be constructed have not been precisely defined yet nor included in a comprehensive data base. In order to perform an economic-financial analysis of construction of small hydro power plants, several assumptions have been made (listed hereunder from a to n) for economic-financial analyses which are in accordance with the scope of investment, for four considered facilities: Otilovići HPP, Krupac HPP, Slano HPP and Šavnik 2 HPP, with the investments ranging between 800 and 2400 EUR/kW<sup>4</sup>:

- a) distribution of total investment: 40 % in structures/construction works and 60 % in equipment,
- b) project implementation period: two (2) years with the investment schedule envisaging 50% in the first year and 50% in the second year,
- c) project funding: through loans from financial institutions at the level of total (100%) investment,
- d) loan repayment period: 10 years,
- e) interest rate: 6% per year,
- f) the analysis has been carried out at the constant value of EUR for the overall period,
- g) techno-economic life of the project: 20 years,
- h) purchase price of electric power: 3.0 EURcent/kWh<sup>5</sup>,

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<sup>4</sup> It is important to note that there were available and usable data, sufficiently processed, with acceptable age, for only four of the above said sites.

<sup>5</sup> i.e. the market price or the price which the owner of a SHPP could get if they were selling electric power in a free market: the price without incentives (since the data on the level of production price or market price in SHPPs in Montenegro was not available, this amount has been assumed on the basis of establishing of the purchase price for renewable energy sources, e.g. in Croatia at the level of 0.033 EUR/kWh, namely for the purpose of preparation of by-laws for renewable energy sources in Croatia)

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- i) internal rate of return (IRR): 8%,
- j) net present value ratio (NPV): 1,
- k) index of profitability: 1,
- l) time for maximum capacity utilisation: 2 800 hours a year,
- m) average specific investment: 1 500 EUR/kW (equal for all 4 facilities),
- n) engagement of manpower at a facility during its operation: 1 man/MW.

The results of the economic-financial analysis obtained on the basis of values assumed as above are shown below – Table 6 (the Reference Scenario) and Table 7 (the Higher Scenario). The incremental cost refers to additional cost incurred due to construction of new small hydro power plants when compared to the situation prior to the said construction (i.e. the incremental cost refers to monetary incentives required for construction of new small hydro power plants with reference to the market price). For the assumed reference purchase price of 3.0 EURcent/kWh, the incremental cost is at the level of 4.6 EURcent/kWh (i.e. the production price from small hydro power plants deducted by the reference purchase price). The production price at the level of 7.6 EURcent/kWh has been calculated as the average price for the twenty-year period (the techno-economic life of the project).

**Table 6 Results of the analysis for the Reference Scenario**

Reference Scenario		2010	2015
Total installed capacity of new SHPPs	MW	5	20
Generation	GWh	14	56
Production price from SHPPs (IRR = 8%)	EURcent/kWh	7.6	7.6
Total cost	million EUR	1.064	4.256
Incremental cost (i.e. required incentives)	million EUR	0.644	2.576
Final demand for electricity*	GWh	3 969	4 244
Increase in the average selling price	EURcent/kWh	0.016	0.061

\*- estimate

**Table 7 Results of the analysis for the Higher Scenario**

Higher Scenario		2010	2015
Total installed capacity of new SHPPs	MW	10	30
Annual production	GWh	28	84
Production price from SHPPs (IRR = 8%)	EURcent/kWh	7.6	7.6
Total cost	million EUR	2.128	6.384
Incremental cost (i.e. required incentives)	million EUR	1.288	3.864
Final demand for electricity*	GWh	3 969	4 244
Increase in the average selling price	EURcent/kWh	0.032	0.091

\*- estimate

Note: The presented results of the economic-financial analysis should be taken provisionally, due to incomplete data on possible sites for SHPPs in RMNE. These

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results may serve as a reliable benchmark for making a decision on the schedule of construction of SHPPs in Montenegro, on setting the purchase price and impact of that price on the total costs.

According to the Reference Scenario, incentives for construction of 5 new MW in SHPPs in the year 2010 amount to 0.644 million EUR, i.e. 2.576 million EUR in the year 2015 for the total of 20 MW of installed capacity of new SHPPs. If the total amount of incentives is divided by the future expected electricity demand<sup>6</sup>, the result is the expected increase in average selling price per unit (kWh). In this case the increase equals 0.016 EURcent/kWh (the year 2010) and 0.061 EURcent/kWh (the year 2015). The average amount of the bill for consumed electric power for the category of households in Montenegro is at the level between 15 and 30 Euros, which, considering the assumed average selling price of 4.5 EURcent/kWh results in the consumption figure between 330 and 660 kWh/month, i.e. between 4 000 and 7 900 kWh/year. If we include in this calculation the increase due to construction of new SHPPs, we will obtain the expected increase in electric power cost in the range between 0.63 and 1.27 EUR/year (in the year 2010), i.e. from 2.42 to 4.83 EUR/year (in the year 2015). The additional cost for new SHPPs has a very small impact on increase of the total electric power cost for an average household – approximately 1.4%.

According to the Higher Scenario, incentives for construction of 10 new MW in SHPPs in the year 2010 amount to EUR 1.288 million, i.e. EUR 3.864 million in the year 2015 for the total of 30 MW in new SHPPs. Increase in the average selling price of electric power in this case amounts to 0.032 EURcent/kWh (year 2010) and 0.091 EURcent/kWh (year 2015). If we also include in the calculation of an average household's electric power bill in Montenegro the increase due to construction of new SHPPs, we will obtain the expected increase in electric power cost in the range between 1.26 and 2.53 EUR/year (in the year 2010), i.e. from 3.60 to 7.21 EUR/year (in the year 2015). The additional cost for new SHPPs has a very small impact on increase of the total electric power cost for an average household – approximately 2 %.

The additional cost of construction of SHPPs since distributed on a great number of customers does not largely influence the cost of electric power borne by an individual end user. Greater influence on increase of electric power bills in the future may be expected due to other reasons such as: increase of fuel price and increase of electricity price in the free market, abolishment of subventions, harmonisation of the tariff system with actual operating expenses, etc. On the other hand however, certain reductions in operating expenses may be expected (increase in operational efficiencies, decrease in technical and non-technical losses in the system).

It is important to note that construction of SHPPs (and most of the facilities that use RES) signifies increase of costs in comparison to options for generation of electric power from the so called conventional sources (coal and gas fired TPPs, large HPPs, etc.). One of the reasons for higher costs for RES is the fact that externalities are not included in the costs of conventional sources. RES have minimum negative impact on the environment if environmental protection rules are applied, therefore it is necessary to stimulate their development. Since one of the principal objectives of Montenegro is to

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<sup>6</sup> According to the forecasts for electricity demand from the NES.

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join EU, it is necessary to stimulate development of SHPPs and other RES through supporting the most cost-effective method of their construction.

Table 8 presents amounts of estimated financial resources required for construction of facilities, in accordance with the assumed schedule and selected scenarios.

Table 8

		2010	2015
<b>Reference Scenario</b>			
Total installed capacity of new SHPPs	MW	5	20
Total investments	€	7,500,000	30,000,000
<b>Higher Scenario</b>			
Total installed capacity of new SHPPs	MW	10	30
Total investments	€	15,000,000	45,000,000

Note: Amounts of financial resources required for construction of SHPPs facilities have been calculated by applying the input data for Table 7. It should be pointed out that these power plants are not the priority candidates for construction; however, the data about these power plants served to present a methodological approach for performance of an economic-financial analysis.

### 8. NATIONAL PROGRAMME FOR DEVELOPMENT OF SMALL HYDRO POWER PLANTS

The main objective of this Strategy, i.e. the long-term policy of development and construction of small hydro power plants in Montenegro, is to create favourable conditions for development and construction of facilities, and for a planned and organised, cost-effective and profitable, long-term energy (techno-economic) utilisation of small watercourses' hydro potential through small hydro power plants, as well as for their use for various purposes with a purpose to accelerate the overall development.

The basic programme activities of the policy of development and construction of small hydro power plants in Montenegro will include as follows:

- a. The National Energy Programme of Development and Construction of Small Hydro Power Plants
- b. The Master Plan for Construction of Small Hydro Power Plants
- c. The local – municipal energy concept of development and construction of small hydro power plants

These activities will define a long-term planned approach to research, designing, planning and construction of small hydro power plants in Montenegro.

- a. The National Energy Programme of Development and Construction of Small Hydro Power Plants

Any approach taken with respect to the National Programme of Development and Construction of Small Hydro Power Plants should reflect both national interest&conditions and needs&requirements of local communities, in accordance with the national objectives of the small hydro power plants development policy in the circumstances of liberalised and deregulated energy market. The programme includes the schedule of medium-term activities with regard to research, designing, planning and construction of SHPPs. The Programme presents precisely defined activities per sites and time periods in which the activities are to be carried out, which has to be preceded

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by exploration works, primarily hydrological and geological ones. In this respect, the planned hydrological measurements and observations (hydrological network of measuring stations - 15 locations), whose implementation is underway, ought to be expanded on the entire area, in accordance with financial and other possibilities. In connection with this, legal conditions should be created for an individual entrepreneurial initiative, while accompanied by assumption of risk, to be equally treated within the process of granting the right to perform research (explorations) in order to obtain a more realistic hydrological notion of all the small watercourses in Montenegro. Within the National Programme, the Master Plan for Construction (preparatory works, designing, construction) of SHPPs is to be prepared.

### b. The Master Plan for Construction of Small Hydro Power Plants

A natural and logical approach to research on possibilities for energy utilisation of small watercourses through small hydro power plants is creation of the Master Plan for Construction of Small Hydro Power Plants in Montenegro (MPSHPP).

The main task of the MPSHPP is to provide basic information on the possibilities to utilise energy potentials of small watercourses, on the basis of the available topographical, meteorological, hydrological, water management and geological characteristics, as well as field surveys.

Along with bringing to the spotlight the already designed solutions for small hydro power plants (70 sites), in the new circumstances (The Water Resources Development Master Plan of Montenegro, the Spatial Plan, the environment, hydrological data) the MPSHPP would also define new opportunities for construction of small hydro power plants. The possible sites would refer to:

1. new sites,
2. supplementing (upgrading) with small hydro power plants the existing water management and hydro power facilities: the existing dams, at a biological minimum, structures for regulation of riverbeds and retention of deposits, retention facilities for flood defence and other protective structures, water supply systems, irrigation systems, etc.),
3. transference of use of the existing facilities (watermills and so on) into SHPPs

Since Montenegro has available a great number of small watercourses, all of which have not been explored for their energy potential (the catchment areas of Tara, Ćehotina, Ibar and other tributaries) in terms of available, technical and realistically practicable potential, the Master Plan will include the whole area of Montenegro, and by means of a single methodology, systematic approach and effective processing, highlight those watercourses, parts of watercourses and sites suitable for energy (techno-economic) utilisation.

The MPSHPP would be composed of the Master Plans for Development of SHPPs for those local communities on whose territory the analysed hydro potentials of small watercourses are located.

Preparation of a complex Master Plan is a prerequisite for systematic and long-term planning of construction and creates a general framework for development of small hydro power plants in Montenegro.

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### c. The local – municipal energy concept of development and construction of small hydro power plants

It should be noted that renewable energy sources, which also include small watercourses, are as a rule of thumb local energy-generating products. The term "local energy industry" refers to all such sources, processes and energy flows which are close to end users as well as adapted to local sources, circumstances, possibilities and needs for energy services.

Local energy industry include facilities of »small energy industry« (small hydro and other plants), the entire distribution grid and the companies that operate these facilities. Furthermore, it includes the motivation and eagerness of the interested parties from that area to be involved in electric power business through small (hydro) power plants.

The local-municipal energy concept of development and construction of small hydro power plants is a concept of development of local community in the field of energy utilisation of small watercourses' hydro potential.

The local energy concept of development and construction of small hydro power plants is the basic planning document which, in pursuance with the guidelines from the National Energy Programme of Development and Construction of Small Hydro Power Plants and the energy policy of the Republic of Montenegro, defines the long-term plan and the policy of development of »small energy industry« in the local community based on cost-effective and profitable utilisation of local energy-generating products (small watercourses).

The development of national energy industry, and correspondingly the economic development as well, arises from development of local energy industry, since small hydro power plants (and other small power plants) contribute not only to increase of the quantity of generated electric power, but also to creation of an economic basis for integral development of municipalities.

Therefore each municipality should propose, within their local developmental strategic energy policy, the Energy Programme for Development and Construction of Small Hydro Power Plants on its territory, and thus become included in the National Energy Programme for Development and Construction of Small Hydro Power Plants in the country. This implies updating of spatial plans and earmarking the areas for energy utilisation of small watercourses' hydro potential.

Local plans consider realisation and implementation of a specific local concept which deals with energy utilisation of small watercourses through small hydro power plants in the municipality on whose territory they run, but it also deals with multipurpose utilisation of watercourses and supports the overall development.

Coordination of these activities will be accomplished through the Central Unit for Small Hydro Power Plants (CUSHPPs) and the competent local administration bodies.

## **9. LEGAL FRAMEWORK FOR DESIGNING AND CONSTRUCTION OF SMALL HYDRO POWER PLANTS**

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As pointed out above, adoption of the Energy Law and by-laws, as well as of other regulations and documents at the regional and international level, signified commencement of the process of deregulation and preparations for establishment of

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free electricity market and access of third parties to the grid. Some basic prerequisites for development of small hydro power plants in Montenegro are being created through these processes.



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### **9.1 Methodology for setting the purchase price of electric power from small hydro power PLANTS**

The grounds for determining the purchase price of electric power include the so called "basic price", i.e. the average production price of electric power in the system. Due to higher price of production from RES (for most technologies), an incentive should be added to the basic price in order to ensure sufficiently high economic profitability of RES projects and thus attract the investors.

According to the international practice, it is recommended to introduce the methodology for determining the level of incentives, which is based on valorisation of avoided costs of electric power production from power plants that burn fossil fuels, and comprises the following four steps:

- **Step 1** – to determine the so called production curve for SHPPs (RES in general),
- **Step 2** – to determine additional costs due to unavailability of certain SHPPs,
- **Step 3** – to determine the avoided external costs (externalities), which occur due to replacement of conventional energy sources with SHPPs (RES in general),
- **Step 4** – to determine the economically justifiable share of SHPPs (RES in general) by comparison to conventional power plants, to analyse costs and profit and set the level of tariffs.

The recommended methodology enables determination of realistic value of energy from RES for the electric power system which is in compliance with environmental protection requirements. The main disadvantage of this methodology is the requirement to be familiar with a certain number of input data which are not easily transferable to monetary values due to their nature and to which the final result is sensitive. Therefore this methodology is mainly used for determination of the minimum and economically justifiable share of production of electric power from RES.

Until the conditions are created for application of the above presented methodology for determination of the share of electric power from certain RES such as SHPPs and its purchase price, prices may be determined as per the principle of "**regulated profit**", with assumptions made on the cash flows and acceptable rate or period of return for typical projects as representatives of certain technological groups (e.g. internal rate of return assumed at 8-10%, period of return assumed at 10 years).

It is not recommended to establish the average selling price as the basis for formation of the purchase price of electric power from RES in the open electricity market, since all energy actors (producer, operator of transmission/distribution grid, supplier) have to get paid for their services from the price of kWh. Special fees are also financed from the price of kWh (e.g. for work of the regulator, market operator, etc.). This approach would not yield good results for Montenegro, having in mind the process of opening of the electricity market. Besides, the level of average selling price is usually not sufficient for producers from RES, i.e. for achievement of the expected profitability of the project, which is the chief prerequisite for investing in RES.

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### **9.2 Connection of small hydro power plants to the electric power distribution GRID**

With a view to preservation of security of operation of the electric power system, it is necessary to define technically justified and economically acceptable requirements to be set for connection of SHPPs of various make to the electricity grid. In order to secure efficient connection of a SHPP to the grid, it is necessary to do the following:

- establish i.e. define the limits of competence over property and equipment to be installed in order to perform the connection,
- set technical requirements for equipment with the purpose to preserve security of the system and the overall level of quality of service provided to customers, as well as with a view to possible needs to reinforce the distribution system due to the said connection,
- define payments that the investor has to effect with the aim to compensate for the costs incurred due to a new connection,
- define responsibility for payment of connection costs,
- set the line between payments due by the investor and costs financed by the operator of the distribution system and compensated by all the connected customers.

The detailed mandatory technical rules for connection to the grid are stated in the Provisional Distribution Code, and they refer to all kinds of small production units (<10 MW). Financial funds required for connection and utilisation of the grid are not prescribed for power plants whose capacity is less than 10 MW. Nevertheless, it is necessary to separately and individually define the specificities of certain types of dispersed production units in special documents on the subordinate legislation level (e.g. regulations or recommendations).

On the basis of the Provisional Distribution Code, the procedure of connection, following the submission of the application, may last no longer than 30 days for connection to the low-voltage grid or 60 days for connection to the medium-voltage grid.

Development and construction of SHPPs is facilitated by greater involvement of the Regulatory Energy Agency through supervision of the connection procedure, in order to avoid non-excusable delays in the process of issuing of approvals for execution of a connection, or to sanction any occurrences of such delays. With a view to this, penalty provisions should be legally defined, on the basis of which the non-exusability of delay would be assessed.

The Regulatory Energy Agency of the RMNE published the Regulations on Tariffs for Electric Power, which do not address determination of price of electric power from the power plants having the capacity lesser than 10 MW. Therefore it is necessary to do as follows:

- supplement the above said Regulations, or prepare new ones separately for power plants having the capacity lesser than 10 MW, which would also regulate the issue of payment for connection,

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- define the financial funds for connection as per the principle of “shallow” investments (ref. the Code), in case of standard conditions for connection of a SHPP to the grid,
- in case of non-standard connection conditions, third parties should be allowed to invest in construction of the necessary grid infrastructure, in cases when the distribution system operator is not able to approve the connection due to insufficient development of the grid,
- prescribe the methodology for determination of the connection fee and set the connection fee as for it to cover actual connection costs based on standard unit prices for the line, transformer and switching equipment,
- fees for use of the system (as well as fees for transmission, fees for auxiliary services, fees for disturbance of competitiveness, tariffs related to capacity, tariffs related to flow of power to a higher voltage level) should be adjusted in order to stimulate construction of SHPPs,
- income from connection fee should be earmarked for financing creation of technical conditions within the grid, and construction of connections themselves should be financed from the connection fee as well,
- connection fee should include drafting of the necessary investment-technical documentation, settlement of proprietary-legal relations over a public area, land use fees, securing of necessary permits for construction of a connection, execution of construction works with the required material and equipment, execution of electric assembly works with the required material and equipment, equipping of billing measuring sites with measuring equipment, the necessary testings and inclusion into the grid.

Cost for preparation of documentation on conditions for connection should make a constituent part of the connection fee, since costs of SHPPs connection to the grid are to be assessed on the basis of this study on connection.

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### **9.3 Charges for water utilisation and the royalty fee**

There are two types of charges provided for water utilisation in Montenegro for the purpose of electric power generation (the charge for water utilisation as provided for under the Water Law, and the royalty fee as provided for under the Law on Private Sector Participation in Delivery of Public Services). Such approach is not in consistency with the practice in EU member states, where, as a rule of thumb, only one type of charge is applied, which is administrative in nature and which does not have any significant economic influence in the SHPPs projects.

Existence of only one type of charge has been estimated as sufficient, which shall not significantly influence economic profitability of a project, and whose exact amount needs to be determined through simulations using a concrete example of a SHPP, with other input data being known (investment, production, etc.).

In this way Montenegro would have a system harmonised with systems of other European countries. Besides, it is recommended to consider the possibility for charging different amounts of the fee for run-of-the-river HPPs and storage HPPs, as well as for different capacities.

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### **9.4 Legal procedure for designing and construction of small hydro power plants**

The current legal framework which directly refers to preparation and construction of SHPPs includes regulations from the area of energy, spatial planning and civil engineering/construction, proprietary-legal affairs, water management, private investments in the public sector, environmental protection and company law. Norms contained in the above mentioned regulations, subject to certain interventions made by the legislator, provide for realistic grounds for implementation of SHPPs construction projects. The prescribed procedure should be simplified through concrete interventions for all SHPPs facilities, while for facilities whose installed capacity is lesser than 100 kW the said procedure should be minimised to the level of indispensable, while thereby not endangering the safety and reliability of the facilities. With respect to the above said, it is certainly necessary to take account of competencies of public institutions, with special emphasis put on requirements of a local community.

The entire prescribed procedure for construction has been divided in five stages (Figure 2):

**stage one** – includes documents and activities related to selection of a site, i.e. exploration works, designing (at the level of conceptual technical design), preparation of a pre-feasibility study, inclusion in spatial and urban development plans and inclusion in water management plans and programmes;

**stage two** – includes documents (Concession Study) and activities which are in connection with the process of awarding a concession/BOT contract;

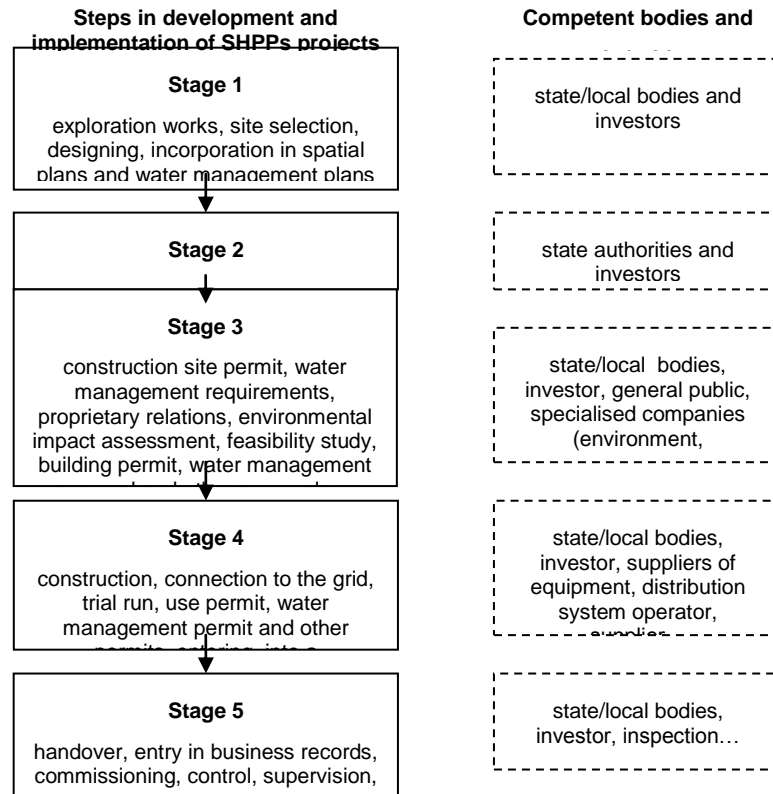
**stage three** – includes documents and activities related to preparation and obtaining of construction site permits, water management requirements, a building permit, a water management approval and other approvals and permits, along with settling proprietary-legal relations;

**stage four** – includes documents and activities related to construction, obtaining of a use permit, a water management permit, an activity licence and a concession licence or a privilege approval for BOT arrangement;

**stage five** – includes documents and activities related to handover of a SHPP and its registration in business records, operation, control and maintenance of a SHPP during the operational life of the plant.

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**Figure 2** Stages in the process of development and implementation of SHPPs projects in Montenegro



Key actors that participate in the process itself are as follows:

- Investor,
- Government of the Republic of Montenegro,
- Ministry of Economy,
- Ministry of Agriculture, Forestry and Water Management,
- Ministry of Environmental Protection and Physical Planning,
- Water Administration,
- Hydrometeorological Office of Montenegro,
- Local communities,
- Regulatory Energy Agency,
- EPCG AD Nikšić (grid operator, supplier, potential investor) and
- Authorised bodies of local administration.

Duration of the entire process of construction of SHPPs depends on exploration level of sites and the processing level through project and other documentation, as well as on

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duration of the legal procedure. The assessment of duration of the procedure includes the construction period as well, which is estimated to 1-2 years. When making such assessment, all bottlenecks and problems of procedural nature must be taken into account, and therefore for some parts of the procedure time limits cannot be precisely defined. Only realisation of pilot projects will reveal all drawbacks of the procedure and its duration, which will entail insisting on shortening of certain elements of the procedure.

### **10. ACTIVITIES AND MEASURES FOR REALISATION OF DEVELOPMENT OF SMALL HYDRO POWER PLANTS IN MONTENEGRO**

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### **10.1 Methodology for defining the realistically practicable hydro potential for small hydro power plants**

The existing baseline documents for development of SHPPs projects do not contain sufficient data for reliable defining of their potential in Montenegro, since on many watercourses no multi-annual hydrological measurements have been performed, neither the environmental properties of these sites have been researched. All this entails impossibility to define realistic technical solutions.

With the purpose to define conditions under which it is possible to build SHPPs, it is recommended to apply a methodological approach that will result in defining of a realistically practicable potential for SHPPs. In short, this approach includes the following 16 activities:

- 1) identify potential sites,
- 2) determine, in principle, the environmental acceptability of sites,
- 3) investigate the impact of international commitments with regard to border watercourses,
- 4) detect conflicts with the existing or potential users of the same area,
- 5) set up hydrological measurements on the watercourses,
- 6) create a registry of SHPPs – GIS for SHPPs (at the level of general technical design),
- 7) conduct basic analyses of projects' profitability,
- 8) incorporate the sites in spatial plans and water management plans and programmes,
- 9) perform field visits – designing,
- 10) incorporate spatial-planning limitations,
- 11) incorporate environmental limitations,
- 12) incorporate limitations with regard to protection of cultural heritage,
- 13) incorporate water availability limitations,
- 14) conduct the analysis of the projects' pre-feasibility study,
- 15) define realistically practicable projects,
- 16) prepare conceptual projects.

A Conceptual Project will be prepared for those sites which meet the criteria from the pre-feasibility study. The conceptual project is a prerequisite for all further activities related to preparations for construction of the facilities. Based on an environmental impact assessment, determination of spatial-planning limitations and proprietary-legal relations, construction site permit should be obtained and water management requirements defined, which is followed by the procedure for preparation of the Main Project, obtaining of a building permit, water management approval, and only then it is possible to commence the process of building a small hydro power plant. It must be noted that this procedure is in compliance with the law, however considerable problems occur with respect to obtaining a building permit, since for this type of structures the



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main project cannot be prepared in this stage. Therefore it is necessary to devise adequate better solutions in the law, in terms of issuing a building permit on the basis of the revised Conceptual Project.

Conditions valid only for a specified site are defined through this procedure for each site. The final result of the proposed methodology is a list of projects which incorporate all the explained requirements: environmental criteria have been met, as well as the criteria of economic profitability and general social acceptability. In other words, this means that realistically practicable and viable projects have been selected.

It is necessary to simplify the procedure of determining the possibility for construction of hydro power plants with the capacity up to 100 kW, while necessarily taking care of safety of the facilities, environmental protection and any discords with other facilities at the site.

A specific case is construction of SHPPs on water supply systems, where there is also some non-negligible potential for production of electric power. In such cases it is recommended to apply a simplified methodological approach in comparison with the approach for construction of SHPPs on the watercourses. In these cases it is necessary to do as follows:

- a) identify possible sites;
- b) analyse possibilities for installation of a power unit,
- c) create a registry of SHPPs – GIS for SHPPs at the level of general technical design,
- d) conduct basic analyses of profitability of the project,
- e) perform designing.

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### **10.2 Model for purchase of electric power from small hydro power PLANTS**

Renewable energy sources are still not competitive to fossil fuel sources if costs of environmental protection are not included in the production price of technologies utilising fossil fuels. Therefore it is necessary to introduce some form of stimulating mechanism which would help promote RES.

Two basic stimulating mechanisms for production of electric power from RES are as follows:

- I. The Quota Approach – The competitive body (most commonly it is the government) defines the quantity (quota) of production from RES, which must be realised in a year. The prices for individual types of RES are formed in the market. This model may be realised in two ways:
  - Tendering System,
  - Tradable Green Certificates
- II. Feed-In Approach – Producers that use RES are given a fixed guaranteed price or a fixed guaranteed incentive for a certain period of time. Additional cost is covered by electric power customers or tax payers.

In addition to these two approaches, there are other mechanisms, such as incentives to invest and tax reliefs. Besides, it is also important to mention introduction of environmental fees as one of the instruments for the so called internalisation of external costs.

Irrespective of whether the said incentives are given at the level of investment or for the final product (generated kWh), previous international experience shows that the system of guaranteed fixed prices or the system of fixed incentives (i.e. some of the Feed-In-Tariff models) produce best results. The model of fixed prices (incentives) is suitable for the systems with undeveloped electricity market. The main features of this model are as follows:

- simplified administration, application and control of the system of incentives,
- creation of positive investment ambience.

The model of fixed prices (incentives) is estimated as suitable to be applied in Montenegro, therefore introduction of this model is recommended, due to its substantial contribution to encouragement of investing in RES as a primary goal. Efficiency in provision of funds, as another primary goal, may be achieved through other models (e.g. green certificate trade and similar models), in which case however it is necessary to take into account the risk from introduction of such advanced and insufficiently tested models, as well as from preliminary activities required for their application.

In order to encourage the investors to invest in RES projects in Montenegro and to increase their share in the energy balance, it is necessary to increase the purchase price through the system of incentives to the level which covers additional production costs. The purchase price of electric power from SHPPs should be compared to minimum purchase price from the equivalent fossil fuels-fired power plant (the new unit of Pljevlja TPP), along with internalisation of external costs. Incentives could be provided from a special fee for development of RES which would be included in bills for electric power, or

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through increase of fee for use of the grid. In other words, encouraging development of RES also means increase of price /cost for end users of electric power.

Considering the aforesaid, it is necessary to do as follows:

- establish a stable system of purchase, define the purchase price and conditions of purchase (competence of the Ministry of Economy), which will be specified within a Power Purchase Agreement,
- introduce a system of purchase of electric power at the minimum guaranteed price (Feed-in Tariffs), which will be proposed by the Ministry of Economy and adopted by the Regulatory Energy Agency,
- guarantee the stability of the purchase price and secure purchase for a pre-defined period of time (e.g. minimum 10 years, provided that it does not violate market principles, according to the assessment by the Regulatory Energy Agency),
- put electric power purchase under the competence of the supplier (within the structure of EPCG AD Nikšić),
- warrant for purchase security, which is the basic prerequisite for creation of investment security and stable platform for planning of projects, even in circumstances of developed energy market, and even more so if energy market is not developed,
- warrant for investment security, which is often the element bearing more importance than the level of purchase price, regardless of the fact that the purchase security is governed by the Energy Law (legally standardised security of purchase is important but not crucial determinant for creation of conditions for RES, if purchase model is not established and necessary by-laws are not adopted),
- define methodology for determination of purchase price for electric power produced in SHPPs.

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### **10.3 MODALITIES OF PUBLIC-PRIVATE PARTNERSHIP in terms of realisation of small hydro power plants projects**

A public-private partnership (PPP) implies cooperation between the public authorities and the private sector, with the aim to meet certain public needs in the broadest meaning of the term (financing, construction, rehabilitation, management, maintenance, delivery of a service). The public and private sectors join their respective resources and expert know-how in order to meet certain public needs through appropriate distribution of resources, risks and rewards. A PPP also implies that the private sector participates not only in realisation of a project, but also in a decision making process. A PPP model is applicable for both the existing and new facilities. When applying a PPP model, attention should be paid to fulfilment of the basic conditions:

- to ensure market freedom and equal treatment for all participants in tender procedures as well as competition,
- to protect public interest and maximise the project value,
- to assess the most efficient type of the PPP model for each project:

The Energy Law provides for activities of the electric power sector to be performed as public services. The Law on Private Sector Participation in Delivery of Public Services provides for several modes of performance of public activities with respect to the contract type (lease contract, management contract, concession contract and the BOT contract).

The convenient types of contracts for implementation of SHPPs projects are concession or combined concession/BOT. A concession or a BOT contract is awarded for the period not longer than 30 years or for the period required for repayment of an investment. In the case of concession and in the case of the BOT model as well, the project developer is obliged to secure investment funds, i.e. the public sector is not responsible for investing and public sources of funds are not burdened (state budget, town budget, municipal budget, etc.), although public sources of funds might act as some type of incentive through various facilities and privileges (i.e. tax reliefs, import privileges, co-financing of interests on commercial loans, exemption from payment of various types of public fees, non-repayable funds for initiation of a project and exploration works, etc.). It is also necessary to define allocation of funds from royalty fees between the local community and the state.

Selection of the best PPP model depends on the type of project and the general attitude of the public towards PPP models. In the process of selection of an optimum PPP model for a certain project it is necessary to assess the needs, consider distribution of risk between the public and the private sector, decide on which parts of a project should be realised as per a PPP model, establish the approximate price and value of the project, as well as define elementary contractual relations between the contracting parties. The basic determinants that affect selection of a PPP model suitable for realisation of SHPPs projects are as follows:

- Lack of public resources for financing this kind of projects; certain possibilities for co-financing might arise after establishment of the "Environmental Protection Fund" or a similar fund which would raise the resources from fees paid by polluters. The main goal of the public sector is to attract private investors,

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- The public sector is not ready to assume a great risk associated with SHPPs projects. Since each PPP model (excluding the model of full privatisation) allocates certain risk on the side of the public sector as well, the state has to assume some risk, while endeavouring that a situation entailing risk does not arise in practice, with the purpose to protect public funds. In this concrete case for SHPPs, this refers to, for example, guarantees for payment of the premium for the generated electric power. If a SHPP is realised as a BOT project, this obligation of the state has already been defined under the Law on Private Sector Participation in Delivery of Public Services,
- there has to be a concession for utilisation of water resources,
- the concession is awarded exclusively by means of a public announcement,
- it is necessary to enable a more liberal approach to construction of SHPPs, i.e. to relinquish the initial initiative to investors,
- all electric power services are public services, and therefore the manners in which the public sector may participate in them are defined by the Law on Private Sector Participation in Delivery of Public Services,
- it is necessary to implement as soon as possible a certain number of SHPPs projects, in order to establish a clear and well-tried procedure. With respect to this, there are no conditions for any significant modifications of the current legal framework, except in the missing part (e.g. costs of connection to the grid (connection fee), purchase price for electric power, competencies and simplification with regard to award of concession for SHPPs, etc.),
- insufficient number of expert personnel with experience in implementation of PPP models (concession and BOT model in the first place, as well as preparation of tender dossiers, setting the criteria for selection of a successful bidder, issues of ownership over facilities during a concession period or a BOT agreement period and after its expiry),
- impact of complexity of a model on possibility for participation of domestic entrepreneurs, investors and local communities in realisation of SHPPs projects. After analysing spatial disposition of small watercourses in Montenegro it can be concluded that a great number of possible sites for SHPPs is located in rural areas. Small hydro power plants might become protagonists of development of the area in which they are located, and this is actually a priority interest of these areas. It is necessary to envisage special treatment for facilities having capacity lesser than 100 kW in these areas (financial and tax facilities, non-repayable state funds (state grants), advantageous loans, construction of ancillary infrastructure and services provided by the state, concession facilities and the like). Attracting foreign investors is a positive thing to do, but it needs to be ensured that income from SHPPs is reinvested in Montenegro.

Affairs and competencies concerning award of concession for water utilisation are under competence of the Ministry of Agriculture, Forestry and Water Management. Since SHPPs constitute a specific mode of utilisation of watercourses which is closely connected with the energy sector, it is necessary that the Ministry of Economy (as the ministry competent for energy), within the process of concession granting for SHPPs,

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undertake all preceding preparatory activities in order to create conditions for announcement of a tender, as well as to conduct the tender procedure itself.

The Law on Private Sector Participation in Delivery of Public Services stipulates that the concession is granted through a public tender. In order to accelerate this procedure, some simplified procedures for concessions granting should be introduced as well – further to the request of an investor. Two approaches should be available for implementation of SHPPs projects:

- free initiative of the investor,
- initiative from the state or local communities (to announce a tender).

Free initiative of an investor should be enabled in such a manner as that they be allowed to submit the request for granting of the concession for SHPPs in a certain location, as well as to initiate research and other works required for implementation of a SHPP project. Such approach is consistent with the second EU Internal Market in Electricity Directive (2003/54/EC).

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### **10.4 *Reinvesting the revenues from operation of small hydro power plants***

Reinvesting the revenues from operation of SHPPs in the economy of Montenegro is a problem broader by far than the issue of strategy for development of SHPPs projects, and it refers to the overall legal and economic system of the state. If this system is efficient and if it offers opportunities for further investments, there will be investing as well. According to the law, a foreign investor has free use of the earned profit and is allowed to carry it out of the country. It is the matter of fact that Montenegro does not have any considerable industries which could sell their products required for construction of SHPPs (generators, turbines, etc.), however it is possible for domestic companies to participate in the process of construction, production and acquisition of construction equipment, acquisition of IT equipment, production and acquisition of some smaller mechanical parts of the plant, etc. Domestic companies are interested in such dealings, but in principle an investor in a SHPP is unrestricted in making a decision on selection of a supplier of products or services required for construction of a SHPP.

Engagement of domestic companies and/or products in a certain percentage should be encouraged within tender documents, while adhering to European regulations on giving the first refusal rights to domestic business entities rather than to foreign-owned companies. Furthermore, tender documentation may also provide for joint development of SHPPs projects and accompanying activities and/or infrastructural facilities (e.g. tourism, catering, recreation, rehabilitation and development of local infrastructure, etc.), or bind the investors to certain investments for the development needs of a local community.

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### **10.5 Stimulating measures (developmental, economic-financial and legal ones) for construction of small hydro power plants**

One of the main obstacles that investors in SHPPs are facing is the problem with finding an advantageous financing source. Since SHPPs generate substantial net benefits for the society if strict environmental standards are complied with, it is in the interest of the state to encourage investments in such projects.

Encouragement of SHPPs projects in the construction phase is done in the following manners:

- **developmental measures** would imply investments by the state and by local communities in development and exploration of hydro potentials (measurements, exploration and drafting of study-level and preliminary design documents),
- **state investment subventions** which would provide for a portion or for the entire funds needed for realisation of SHPPs projects. Subventions may be given in the following forms:
  - direct subventions from the budget
  - state guarantees
  - tax reliefs or exemptions
  - direct state investments of capital.
- **loans with favourable repayment conditions** (“soft“ loans) – this scheme may be very useful (both for an investor and the legislator) in such a way as to be able to check in the process of loan approval whether a proposed project is sustainable from environmental, technical and economic aspects. Favourable conditions may refer to lower interest rates, less demanding insurance mechanisms, longer loan repayment grace period, and so on.
- **allowance for tax on consumed energy** – this allowance is applied in a way that the electric power company effects payments to producers of electric power from SHPPs of an amount equivalent to the amount of the tax on consumed energy. This makes energy from conventional sources relatively costlier, thus stimulating production of electric power from SHPPs.
- **water fees and royalty fees** should be set in a way as for them to be acceptable for investors, while in demographically disadvantaged areas these should be adjusted to the need of improved development of those areas.

It is proposed to create in Montenegro an optimum system for stimulation of investments, based on loans with favourable repayment condition and state guarantees. Application of other methods is more complex and they give poorer results.

The programme of giving advantageous loans and state guarantees may be realised through CUSHPPs. In pursuance with its competencies and obligations, the CUSHPPs could appraise the quality of a project in a most competent manner. Following a positive appraisal of the project, a favourable funding source should be found:

- **subsidising a portion of interest** – after an investor is granted a commercial bank loan, the portion of interest is subsidised by the state, this portion being equal to the difference between the interest rate obtained by the interested



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investor and the interest rate which would make the project profitable and acceptable for the investor. Prior to this, the Government of the Republic of Montenegro and the Regulatory Energy Agency need to adopt criteria for “profitability“. The CUSHPPs has the role to connect interested investors with domestic and foreign financial institutions interested in financing SHPPs projects, and these include: development funds, international financial institutions and local community bodies,

- **providing guarantees** – a guarantee is issued to an investor who is taking a loan from a domestic and/or a foreign bank. It is assumed herein that the CUSHPPs will study in detail each application for co-financing and promote only those which are based on economically viable assumptions. Thereby a risk of loan approval as well as loan costs borne by an investor are reduced.
- **purchase price** of the generated electric power from small hydro power plants should be acceptable for an investor. The model of guaranteed fixed prices (incentives) is assessed to be most suitable for application in Montenegro, and therefore it is recommended to be introduced due to substantial contribution to encouragement of investments in renewables as the primary goal. It is also required to adjust the fees for use of system-related services of the electric power system in order to encourage construction of SHPPs.
- **legal measures** – simplification of legislation is envisaged for construction of small hydro power plants, with the purpose to shorten the time schedule of necessary activities in connection with realisation of projects of the above mentioned facilities. In this respect it is necessary to form a CUSHPPs, which would act as main support for development and realisation of small hydro power plants projects.

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### **10.6 Incentives to domestic entrepreneurs and local communities**

Specific problems are related to encouraging small, domestic private investors and/or local communities to invest in SHPPs. In this segment, SHPPs projects should be promoted in appropriate manner in the first place, while entrepreneurs and local communities should be familiarised with possibilities for developments of SHPPs. Since the procedure of development and construction of SHPPs requires specific know-how from diverse fields (electric power industry, water management, environmental protection, law, finances, etc.), it is necessary for the competent state authorities to provide expert assistance (one of the important activities of the proposed CUSHPPs).

At the level of realisation of a project, it is necessary to provide for concrete incentive measures as well, such as, for example, financial and tax facilities, state grants, advantageous loans, construction of ancillary infrastructure and services provided by the state, and the like. This is a matter of essential importance in case when the investor is a local community, which mostly has neither sufficient funds nor any guarantees enabling them to implement the project by themselves.

## **11. ORGANISATIONAL AND INSTITUTIONAL FRAMEWORK OF SMALL HYDRO POWER PLANTS DEVELOPMENT**

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The issues related to the overall process of SHPPs construction are very complex and determined by a number of various laws and regulations. Certain parts of this process are under competencies of different state authorities, while some of them necessitate further elaboration and clarification. Considering the allocation of the overall process and competencies among several bodies of state and local administration, the need arises to encompass and direct projects of SHPPs construction in an integral procedure.

The current legal framework recognises the need for stronger and faster development of projects of production from RES, but it is necessary to integrate and simplify the said procedures, with a view to attract interested investors and entrepreneurs. The practice of European countries indicates that in order to integrate this kind of processes it is usually necessary to establish a special body (a centre, a division, an agency or another adequate organisational form) with a carefully defined role, objectives, tasks, activities, organisation and funding method.

The position of such a body with respect to other stakeholders in the process must be clearly defined, so that the new structure would indeed be efficient and in order that it does not create a bottleneck in the process nor duplicate the existing activities. The basic role of such a body is coordination of activities, promotion and attracting of interested entrepreneurs and investors. In addition to organisational structure, special attention should be paid to development of human and information resources, where selection of suitable personnel and their additional specialisation/training is an especially critical point.

Considering the possibilities for development of SHPPs and their significance for Montenegro, it is necessary to establish, as a first step in initiating the national energy programme for construction of SHPPs, a dedicated body for encouragement of the overall process of SHPPs projects development in the form of a Central Unit for SHPPs of Montenegro (CUSHPPs). Moreover, it is possible to consider the topical issues from somewhat broader perspective, taking into account other RES. The potential of RES in Montenegro is also considerable, and therefore, as soon as within this first step, the need to establish a dedicated body in charge of RES might be considered, which would

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be closely connected or integrated with the Central Unit for Energy Efficiency of Montenegro (CUEE), *in a way as for it to become a joint body for renewable energy sources and energy efficiency.*

The role and the objectives of the CUSHPPs arise from the Energy Law provisions, which define the role of the ministry in charge of energy with respect to SHPPs (i.e. generally with respect to RES). The CUSHPPs would function as the national centre for SHPPs ("*one-stop-shop*" or "*fast track*") by means of:

- coordination of activities concerning realisation of SHPPs projects through cooperation with the competent state authorities and the competent local administration bodies, educational institutions, financial institutions, associations for environmental protection and other bodies and organisations,
- building the capacities of local administration units, natural persons and legal entities for realisation of SHPPs projects,
- promotion of SHPPs projects, information and education of target groups, with the emphasis put on the need to protect the environment and on sustainable development,
- international cooperation, exchange of know-how, participation in work of international associations for SHPPs and other similar associations (for environmental protection, for RES, etc.).

During its first several years, the work of the CUSHPPs should be directed towards:

- simplification of procedures for realisation of projects,
- realisation of pilot-projects of construction of new SHPPs,
- development of the information system,
- organisation of measurements and collection of hydrometeorological baseline documents and other explorations required for realisation of future SHPPs projects,
- organisation of collection of geological baseline documents,
- promotion of SHPPs projects and pooling and specialisation of personnel,
- coordination in preparation of the National Programme for Development and Construction of SHPPs, the Master Plan of Construction of SHPPs and the local plans.

As the ultimate goal of establishment and operation of the CUSHPPs, it is recommended to create a "*one-stop-shop*" agency where an investor/entrepreneur will be able to get all relevant information and to obtain, through the CUSHPPs, the necessary permits for realisation of a SHPP project. In this way revenues will be earned for financing of a portion of costs for operation of the CUSHPPs from off-budget resources. The role of the CUSHPPs is to coordinate the activities required for realisation of projects, education and promotion of projects, through cooperation with all the stakeholders in the process of realisation of a project.

As part of the CUSHPPs' work, programmes of exploration works on possible sites for SHPPs should be initiated on the basis of tenders, and organisation of realisation of a

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certain number of projects for construction of new SHPPs, as a pilot programme, should be undertaken. The hydrological risk (insecurity of production at the annual level) cannot be avoided, but its level and impact on business of SHPPs can be anticipated. Therefore it is necessary to have available reliable measurements of hydrometeorological parameters and other features of the site which is earmarked as a possible location for construction, and without these data there cannot be any construction. Collection of such data should be organised through cooperation of the CUSHPPs with the competent institutions and interested parties. In addition to this method, it is necessary to enable private initiative of the interested parties, both for exploration and construction of small hydro power plants.

### **12. ENVIRONMENTAL IMPACT OF CONSTRUCTION OF SMALL HYDRO POWER PLANTS**

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Environmental problems put energy industry in the foreground after it had been established that 60-70% of pollution arises from energy industry. Production and consumption of electric power are among main causes of global, regional and local pollution. Therefore development and reform of the energy sector in Montenegro must be in compliance with requirements of environmental protection. This primarily implies increase of share of renewable energy sources in energy production, which in the first place refers to production of electric power from hydro power plants.

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### **12.1 Legal obligations (national and EU legislation)**

The Law on Environment is the basic legal act which forms the basis of the so called environmental rights.

Environmental protection is based on the following principles: preservation of natural values, biological diversity, reduction of risk, environmental impact assessments, alternative solutions, substitution of harmful substances, reuse and recycling, polluter pays, payment for use of natural resources, mandatory insurance, public nature of data on environmental situation and notification.

The government prescribes types of projects for which it is necessary to prepare an environmental impact assessment, as well as the content and method of its preparation, selection of a site, manners for evaluation and verification, participation of the public and other issues significant for preparation of an environmental impact assessment (Decree on Environmental Impact Assessment). This Decree provides that the investor is obliged to prepare environmental impact assessment study for hydro power plants and accompanying facilities and plants.

It should be pointed out that new laws have been passed as well, as a measure for harmonisation of the legal infrastructure with EU legislation, which will have to be taken into special account with respect to realisation of these projects.

The Law on Strategic Environmental Impact Assessment, the Law on Environmental Impact Assessment and the Law on Integrated Prevention and Control of Pollution of the Environment were published in the Official Gazette of the RMNE 80/05. They came in force, while they will be applied as of the 1 January 2008. The Law on Waste Management was published in the same gazette, which also came in force, while it will be applied as of the 1 November 2008. All of the aforesaid four legal acts have been harmonised with EU legislation and they are very important for construction and operation of energy generating facilities.

### **EU legislation**

With respect to EU legislation that refers to environmental protection and which largely affects development of the electric power system with regard to selection of primary energy-generating products and technologies for generation of energy, four groups of legal acts may be distinguished, as follows:

- Legal acts which define position of the EU member countries with respect to provisions of the UN Framework Convention on Climate Change (UNFCCC) and the accompanying Kyoto Protocol,
- The Geneva Convention on Long Range Trans-Boundary Air Pollution (LRTAP), with accompanying protocols,
- The Large Combustion Plant Directive (LCPD),
- Water Framework Directive (WFD).

### **Commitments in the field of environmental protection in pursuance with the provisions of the Energy Community South East Europe Treaty**

Montenegro is involved (as a separate entity) in creation of the Energy Community of South East Europe. The whole process is under the auspices of European Union. The idea of the Treaty is to connect the states of South East Europe in terms of energy, in a

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way as to achieve opening of energy markets, in accordance with the model defined by EU directives on establishment of a common market of electric power and gas, through implementation of system-related reforms in energy sectors of individual countries. Besides, the Treaty provides for adoption of EU legislation (*Acquis Communautaire*) in several areas, including environmental protection.

In addition to the above said, the Treaty further states the need to acknowledge the importance of the Kyoto Protocol for the member states, as well as the importance of the rules from the Directive 96/61/EC, which refers to integrated prevention of pollution and its control. The Treaty also obliges the member states that construction and operation of new production capacities must be in compliance with the EU legislation with respect to environmental protection, as well as defining of subject matter of legislation that refers to environmental protection.

The signing parties to the Treaty are obliged to apply the provisions of the Directive 85/337/EEC on assessment of environmental impact of some public and private projects, as well as its modifications as defined by the Directives 97/11/EC and 2003/35/EC.

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### **12.2 Construction of small hydro power plants from the aspect of environmental protection**

Small hydro power plants are an important component of the system of utilisation and management of water resources, due to many good features of these plants. Their relation towards the environment is especially important, since they easily fit in the environment.

A small hydro power plant is a plant which has to fit to a maximum degree in the environment with respect to its operational mode, its shape and size of its constituent elements; also, it has to be subordinated to other infrastructure facilities and to other users of space and water, which goes in favour of the tendency of its small environmental impact.

Advantages of small hydro power plants are as follows: their operation does not pollute air, they prevent flood hazard because they enable regulation of watercourses, they can be used for water supply and irrigation. Most often they are located away from settlements, and therefore the level of noise present in the power house, if up-to-date technological solutions in design and making are used, is below the allowed and recommended levels. Another positive thing is that their design can be completely fitted in the landscape, and thus adverse visual effects are minimised. In case that a reservoir is planned for the power plant, it can be used for water economy purposes (fish ponds) and/or sports/recreational purposes, and it cannot considerably endanger geological and pedological features of the land on which it is located thanks to its size, as opposed to large hydro power facilities. Small hydro power plants do not affect the change of climate characteristics of the area, due to the size of a reservoir, as is the case with large hydro power plants.

Small hydro power plants do not pose a risk from induction of seismic events (they have no influence in accidents), because the height of their respective dams and their respective storage capacities are small in comparison with dams of large hydro power plants (which might act as an initial seismic point).

Nonetheless, despite everything said above, and despite the fact that they use a renewable resource, small hydro power plants may have a slight negative environmental impact in case of improper management of water resources.

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### **12.3 Advantages and benefits of adoption of the Kyoto protocol for Montenegro with regard to development of small hydro power plants**

The problem of climate changes due to increased concentration of greenhouse gases is considered as the greatest global threat to the environment in the 21<sup>st</sup> century due to increase in average global air temperature. Therefore the United Nations member states adopted in 1992 the "Framework Convention on Climate Change" (UNFCCC), under which the countries that, in the past, contributed in the greatest extent to increase of greenhouse gases concentration undertook the commitment to stop its increase. These activities were expanded in 1997 by adoption of the Kyoto Protocol, which precisely states the commitments regarding reduction of greenhouse gas emissions for the developed countries and countries with their economy in transition (countries from the Annex 1). The Protocol became effective on the 16 February 2005, after it became ratified by Russia.

The Federal Republic of Yugoslavia ratified the Framework Convention (UNFCCC) in 1997, and the State Union of Serbia and Montenegro officially became a member of the Convention in 2001, through a succession arrangement. On the other hand, the Kyoto Protocol has not been ratified so far by the State Union of Serbia and Montenegro (S&MNE), although the document does not imply any concrete obligations for S&MNE in terms of reduction of greenhouse gas emissions. Similarly, S&MNE has not prepared its "First National Report on Climate Changes" so far (which S&MNE is obliged to do in pursuance with the UNFCCC), although it has available expert and financial assistance from the UN for that purpose. Namely, the UNFCCC provides for the so called financial mechanism for support to projects directed towards mitigation of climate changes and their consequences. The said mechanism is managed by the Global Environmental Facility through independent financing or co-financing of projects amounting to over US\$ 250 million a year.

Accession to the Kyoto Protocol does not imply any additional obligations for the states which are not enlisted in the Annex 1, and S&MNE might have some benefits from its accession. This is certainly a decision to be made at the level of the State Union of Serbia and Montenegro, since the right of accession is granted only to the UN member countries.

Preparations for drafting of the "First National Report on Climate Changes" are underway, for which it is possible to request all the necessary financial and expert assistance within the financial mechanism as defined in the Convention, i.e. through the Global Environmental Facility.

Adoption of the Kyoto Protocol is also a prerequisite for development of integration processes which are underway or which are the subject matter of long-term plans. This primarily refers to the process of approximation to the EU, since accession to the Kyoto Protocol is one of the conditions that EU sets for each candidate. Another integration process in which Montenegro is individually involved is formation of the Energy Community of Southeast Europe (ECSEE), whose member countries undertake to "endeavour to accede to the Kyoto Protocol". There is a certain dilemma in this respect, since currently Montenegro (although an independent signing party to the ECSEE Treaty as of the 25 October 2005) cannot accede to the Protocol independently, without Serbia.

Within the Kyoto Protocol the so called flexible mechanisms have also been defined, whose aim is to minimise costs for reduction of emissions on the global level. Each



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country enlisted in the Annex 1, beside its own allotted emission quota, may additionally acquire emission licences by means of flexible mechanisms. There are three such mechanisms: Joint Implementation (JI), the Clean Development Mechanism (CDM) and Emission Trading (ET). By means of the JI mechanism, emission licences may be acquired through realisation of projects that reduce emissions in other countries as under Annex 1. As for the CDM, the countries enlisted in Annex 1 realise such projects in developing countries, while within the ET mechanism the countries enlisted in Annex 1 are allowed to trade amongst themselves with emission quota units.

The European Union, as a part of its endeavours to reduce greenhouse gas emissions, initiated in 2005 the EU Emission Trading Scheme (EU ETS), which is the world's biggest system for trading in carbon dioxide emissions at the level of companies. Within the ETS, companies also have the possibility to use emission credits arising from the flexible mechanisms of the Kyoto Protocol (JI and CDM projects) in the aim of meeting their needs within the scheme. This creates a specific incentive for investment in projects for reduction of emissions in other states, especially in developing countries. In this respect, CDM projects are of greatest interest for the countries like S&MNE, which do not have defined emission limits.

Projects of construction of SHPPs certainly do belong to the group of potential CDM projects, due to negligible greenhouse gas emissions from such facilities. Such kind of reduction of emissions derives additional attractiveness from the fact that the price of emission licences in the European market has increased to over 20 EUR/tCO<sub>2</sub>.

After creation of initial prerequisites for realisation of CDM projects, it will be necessary, with a view to implementation of the clean development mechanisms on projects of construction of SHPPs, to identify and elaborate the most promising projects in line with the methodology of the Executive Board for CDM. This is a necessary precondition for the investor to obtain certified emission units, for which it is necessary to obtain approval from the Executive Board. Also, procedures and methodology for appraisal of smaller-scale projects (capacity up to 15 MW ) are simplified, which includes practically all SHPPs projects in Montenegro for which there are some project documents.

### 13. SYSTEM FOR MONITORING REALISATION OF THE STRATEGY FOR SMALL HYDRO POWER PLANTS DEVELOPMENT

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**1. Monitoring** of realisation of the Strategy will be organised by the CUSHPPs and the ministry competent for energy affairs, while the findings on realisation of the programme for development of SHPPs will be presented to the Government of the Republic of Montenegro and to other competent bodies and institutions included in this process through regular reporting activities, both periodical and annual.

#### 2. Presentation of programmes or projects to target groups

Target group	Means of communication
The Government	Direct contact, presentations of results of reports
Banks and potential investors	Direct contact
Local administration	Direct contact, contact through competent bodies of state administration, the media

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EPCG (electric power company)	Direct contact, professional magazines, the media
Population	The media, informative lectures and tribunes

### **3. Negotiation amongst stakeholders**

Negotiation will be performed through a range of activities with a view to inform the public, mitigate the resistance and create a broad concordance with activities of the energy sector. If the public is involved from the very beginning, requests may be taken into account on time, as early as in the planning stage, when modifications are more easily implemented, instead of later, when even rather small modifications may cause considerable costs. Even when the public does not fully agree with the final decision, it is more probable that they would understand the reasons for making such a decision and not oppose it.

## **14. THE PUBLIC & COMMUNICATING INFORMATION TO THE PUBLIC**

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### **14.1 THE PUBLIC**

In developed countries of the European Union, participation of the public in a process of making decisions important for the energy sector is understood. This document popularises such behaviour in the energy sector in Montenegro.

The necessary data and information should be disclosed in a mode compatible to mass media, in order that the public gets accurate and reliable, clear and comprehensible information. Such messages should contain the information on:

- energy policy and its objectives regarding issues of common interest for Montenegro, and in this particular case especially regarding development and construction of small hydro power plants;
- appraisal of the current situation and goals and prospects for construction of small hydro power plants;
- National energy programmes and their influence on the energy sector and on the environment, the Master Plan for Construction of SHPPs and local plans;

Participation of the public contributes to increased familiarity with consequences of effects on the environment caused by activities of the energy sector. Involvement of the public in the decision making process frequently necessitates preparation of detailed assessment of the energy sector's environmental impact. Such analyses might reveal inefficiencies in generation, transmission, distribution or consumption of energy. Precisely this activity, which leads to cost-effective management of energy, may be of special importance in complex economic conditions that govern the energy sector.

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### **14.2 COMMUNICATING INFORMATION TO THE PUBLIC**

Communication of information will be organised within the activities of the CUSHPPs. The citizens and other interested parties will be informed in this way about implementation of energy programmes, situation in the energy sector in their region and about all significant issues in connection with construction of small hydro power plants. This will be done by:

- representatives of state authorities and institutions in charge of these issues,
- companies which perform public activities concerning energy (EPCG),
- professional, scientific public and public information media,
- experts from non-governmental organisations,
- experts from companies dealing with environmental protection.

The Strategy for Development of Small Hydro Power Plants is a document whose realisation will be monitored and analysed on regular basis and in accordance with the established criteria, while corrections thereof will be performed when a need arises in order to achieve the set objectives. Instead of final considerations, the main strategic objectives are given in the text preceding the Strategy document itself.

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## 15. REFERENCES

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**APPENDIX: ACTION PLAN**

On the basis of the activities envisaged in the SHPPs Strategy, an Action Plan has been prepared, with the aim to create the most favourable ambience for development of SHPPs projects in Montenegro. The implementation of the Action Plan will regulate in the shortest possible time the system for utilisation of potentials for SHPPs' in Montenegro on entrepreneurship basis, especially with regard to purchase (incentive prices, purchase period, bearers of obligations related to purchase), as well as mechanisms for raising funds for encouraging utilisation of SHPPs.

The activities are ordered according to the priorities. The column "Time Period" states the estimated period in which a certain activity needs to be completed, while calculating the time from an arbitrarily selected initial time-point.

**Action Plan for establishing a national programme for development of small hydro power plants projects in Montenegro**

<b>Time period</b>	<b>Activity</b>	<b>Competent authorities</b>
-	- To identify the current situation	-
3 months	<ul style="list-style-type: none"> <li>- To propose and adopt the strategy for development of SHPPs</li> <li>- To make a decision on the strategic objective of the policy of utilisation of renewable energy sources for production of electric power in the forthcoming 10-year period.</li> <li>- It would be realistic to set the target at 3-5% (excluding large HPPs).</li> <li>- Within the set target, it is necessary to define the Reference Scenario and the Higher Scenario of SHPPs development.</li> <li>- To initiate a national energy programme for construction of small hydro power plants (exploration, pilot programmes, the Master Plan for Construction of SHPPs, local plans)</li> </ul>	Government of the RMNE
6 months	<ul style="list-style-type: none"> <li>- To prepare an implementation programme based on the strategy for development of SHPPs.</li> <li>- To establish the CUSHPPs as a central state authority for coordination of development programmes.</li> <li>- To complete the initiated exploration works at 15 selected sites. To create conditions for exploration of other sites in accordance with the schedule that will be adjusted to available resources. Selection of sites should be made in pursuance with the procedure described above. Exploration works in this stage should be organised by means of tenders or on the basis of a private initiative or an initiative of a local community. The Schedule should set up the process of continuous exploration of sites for small hydro power plants.</li> </ul>	Government of the RMNE Ministry of Economy
6 to 9 months	<ul style="list-style-type: none"> <li>- Through the process of adoption of a new Law on Private Sector Participation in Delivery of Public Services for realisation of SHPPs projects, the number of competent authorities in the evaluation procedure should be decreased, the right of an investor to initiate the concession award procedure should be established – award of a concession at one's request.</li> <li>- The procedure for award of concessions, competencies and terms and conditions for a concession contract should be harmonised with provisions of the new laws (the Law on Private Sector Participation in Delivery of Public Services and the Water Law), and if needed, secondary legislation acts should be adopted, which would enable high quality, fast decision-making with respect to construction of small hydro power plants in the segment arising from the aforesaid laws.</li> <li>- To allow for an investor to perform all the necessary preparatory activities at their own initiative (exploration works, measurements, drafting of a concession study) and to initiate a concession award process.</li> </ul>	Government of the RMNE Ministry of Economy Ministry of Agriculture, Forestry and Water Management
1 – 1.5 years	<ul style="list-style-type: none"> <li>- To draft and adopt secondary legislation acts and other legal acts as provided for under the Energy Law, within the defined scope of competencies.</li> <li>- To adopt a legal act containing the criteria for issuing an authorisation for construction of new and reconstruction of the existing energy generation</li> </ul>	Ministry of Economy Regulatory Energy Agency

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	<p>capacities.</p> <ul style="list-style-type: none"> <li>- To adopt a legal act which will define simplified criteria for the procedure of issuing authorisations for construction of SHPPs.</li> <li>- To adopt a legal act which will define simplified criteria for the procedure of issuing activity licences for producers of electric power in SHPPs.</li> <li>-To adopt a legal act which will define the methodology for determination of purchase price for electric power from small hydro power plants and the level of the purchase price (the system of fixed prices and incentives).</li> <li>- To adopt a legal act which will define the methodology for determination of fee for connection of small hydro power plants to the distribution grid.</li> <li>- To adopt a legal act which will define the roles of individual energy stakeholders in purchase of electric power from small hydro power plants (physical handover, purchase, financing sources, incentives award conditions).</li> <li>- To adopt a legal act which will define incentives for investments in small hydro power plants.</li> </ul>	
2 years	<ul style="list-style-type: none"> <li>- To complete realisation of the initiative for ratification of the Kyoto Protocol in cooperation with Serbia (1 year).</li> <li>- To prepare the First National Report on Climate Changes (1.5 years).</li> <li>- To select several sites for small hydro power plants and elaborate them in pursuance with the methodology of the Convention (UNFCCC) for CDM projects (within the framework of realisation of pilot programmes).</li> <li>- To establish cooperation with financial institutions and partners in the field of implementation of CDM projects.</li> </ul>	<p>Government of the RMNE Competent ministries</p>
2.5 to 3 years	<ul style="list-style-type: none"> <li>- To set to construction of a certain number of small hydro power plants (pilot projects – new small hydro power plants).</li> </ul>	<p>Government of the RMNE Ministry of Economy</p>
continuously	<ul style="list-style-type: none"> <li>- To monitor realisation and, as may be required, define additional measures.</li> <li>- To continuously conduct exploration and data collection, in order to provide input parameters for realisation of the methodology for determination of the minimum share of renewable energy sources in power production and the level of purchase price for renewable energy sources.</li> <li>- To define and implement realistically practicable policy in the area of renewable energy sources, based on actual data.</li> </ul>	<p>Government of the RMNE Competent institutions</p>