Grant Contract	**BGENERGY-1.001-0001 "Feasibility study of the use of hydroenergy potential of existing water supply systems and increasing the potential of existing small hydroelectric power plants in water supply systems"**
Financed by	Renewable Energy, Energy Efficiency and Energy Security Program, financed under the Financial Mechanism of the European Economic Area 2014-2021
Beneficiary name	Sustainable Energy Development Agency (SEDA)
Donor project partner	Norwegian Water Resources and Energy Directorate (NVE), Norway
ACTIVITY 2	**Review of the pre-investment studies /PIS/ by water supply and sewerage companies, available with the MRDPW [Ministry of Regional Development and Public Works]**
Name of the document	**Results of the review of the pre-investment studies by water supply and sewerage companies, available with the MRDPW**
Date:	**14 July 2020**
Date of last revision:	**14 August 2020**

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I. Description of the activities

The activity includes a review of the pre-investment studies by water supply and sewerage (WSS) companies, available with the Ministry of Regional Development and Public Works (MRDPW) and analysis of the information contained therein. For implementing the activity, contacts were established and two meetings were held with representatives of MRDPW at the ministry offices.

Due to the large volume of information, the review of the feasibility studies was carried out at the MRDPW offices. In addition, the MRDPW presented maps with data about the water supply and sewerage infrastructure of 10 WSS companies.

II. List of PIS subject of review

Regional pre-investment studies (RPIS) have been carried out for separate territories serviced by the following WSS operators:

1. WSS EAD, Burgas
2. WSS OOD, Varna
3. WSS EOOD, Vidin
4. WSS OOD, Vratsa
5. WSS EOOD, Dobrich
6. WSS OOD, Kardzhali
7. WSS OOD, Pernik
8. WSS EOOD, Plovdiv
9. WSS OOD, Ruse
10. WSS OOD, Silistra
11. WSS OOD, Sliven
12. WSS EOOD, Stara Zagora
13. WSS OOD, Shumen
14. WSS EOOD, Yambol.

III. Available and missing or incomplete data

The major objective of the pre-investment studies is to define integrated WSS projects for achieving compliance with the national and European laws in the field of drinking water, waste water discharge and treatment, as well as enhance the efficiency of the systems and facilities. Collection and analysis of data, including analysis of the general regional WSS plans for the separate territories serviced

by the WSS operators included in the respective lot, and of the available information on the level of project readiness by agglomerations. Specifying measures for achieving compliance with the European and Bulgarian laws in the field of drinking water, discharge and treatment of wastewater, climate change etc. Development of comprehensive investment initiative projects for WSS infrastructure and adjacent facilities.

The water supply systems and facilities are described and information provided about the length, dimensions and type of the pipelines, as well as the material they are made of. Information is presented about the existing reservoirs in the water systems. The pump stations and their water sources are described. The information about the regulation of the water catchment, highest and lowest water level, intake in rivers and intake in the water catchment basins is incomplete. There is no available information about the connectivity of the water pipes and the water reservoirs, nor of the existing small HPPs in water supply systems. There are available maps with data about the WSS infrastructure, but the information contained therein is insufficient to make a realistic assessment of the potential for construction of small hydro power plants.

As the research is only focused on improving the supply of drinking water and the discharge and treatment of waste water, it may not be a basis and does not contain the data required for assessment of the hydroenergy potential of the existing water supply systems.

Maps with data about the WSS infrastructure are included in the following pre-investment studies:

1. WSS EAD, Burgas
2. WSS OOD, Varna
3. WSS OOD, Vratsa
4. WSS OOD, Kardzhali
5. WSS OOD, Pernik
6. WSS EOOD, Plovdiv
7. WSS OOD, Ruse
8. WSS OOD, Sliven
9. WSS EOOD, Stara Zagora
10. WSS OOD, Shumen

Based on the information from the maps of WSS infrastructure, the following conclusions can be drawn:

1. The water sources in the separate territory of Water Supply and Sewerage OOD, city of Ruse, are predominantly underground. Water is extracted by pumping. In this case, it is inappropriate to use the supply water pipes for the construction of hydro power units.
2. There is potential for construction of hydro power units in the areas serviced by: WSS EAD Burgas, WSS OOD Vratsa, WSS OOD Kardzhali, WSS EOOD Plovdiv, WSS OOD Sliven, WSS EOOD Stara Zagora.

For the remaining areas no conclusion can be drawn based on data from the pre-investment studies only.

Appendix 1 includes some basic sample data from the regional pre-investment study for the territory served by the regional WSS company (anonymized).

IV. Check-list of defined parameters and data to be subject of subsequent activity

After the review and analysis of the documents, it has been found impossible to determine the real possibility for utilisation of the hydroenergy potential of the WSS infrastructure.

For the purposes of project BGENERGY-1.001-0001 "Feasibility study of the use of hydroenergy potential of existing water supply systems and increasing the potential of existing small hydroelectric power plants in water supply systems", it is necessary to identify the possibilities for construction of hydro power plants in the existing water supply infrastructure. In this respect, the WSS companies have to be asked for information on the following parameters, by a questionnaire:

- Regulated and non-regulated lakes in the water catchment
- Intake in the reservoir
- Intake in the water catchment area in km^2
- Annual flow to intake, m^3/s and/or $l/s/km^2$
- Other reservoirs upstream the intake:
- Name, HRW, LRW, volume and water catchment area km^2
- Type of pipe and pressure
- Dimensions of pipe in millimetres (mm)
- Area of cross section and length of canal (if applicable), m^2 and m
- Length of pipe from the intake to the pressure reduction valve or to the pond, m
- Normal water surface in pond, above sea level - msl

The questionnaire (Appendix 2) is coordinated with the Norwegian Water Resources and Energy Directorate that has supplemented it with information requested in a similar research campaign conducted in Norway. The questionnaire has been sent to 44 WSS companies - state, municipal and of mixed (state and municipal) ownership. The feedback from them shall be used to identify and specify the companies having the biggest potential, and additional data shall be collected from them, including by site measurements.

Appendix 1: Basic sample data from the RPIS about a territory services by a provincial WSS company

Note: As the pre-investment studies are not public documents, the data in the appendices are anonymized

Table 1: List of the existing reservoirs within a single water system covered by a provincial WSS company

Reservoir	Elevation (m)	Volume, V (m^3)
Pressure reservoir 4,000 m^3	391.68	4,000
Pressure reservoir 13,000 m^3	407.00	13,000
Pressure reservoir 50 m^3	480	50
Pressure reservoir 6,200 m^3	401.40	6,200
Pressure reservoir 20 m^3	-	20
Pressure reservoir 50 m^3	-	50
Pressure reservoir 4,400 m^3	453.97	4,400
Pressure reservoir 1500 m^3	455.55	1,500
Pressure reservoir 5 m^3	488.40	5
Pressure reservoir 15 m^3	-	15
Pressure reservoir 50 m^3	-	50
Pressure reservoir 3,000 m^3	280	3,000
Pressure reservoir 320 m^3	407.00	320
Pressure reservoir 160 m^3	-	160
Pressure reservoir 150 m^3	236.00	150
Pressure reservoir 500 m^3	249.53	500
Pressure reservoir 120 m^3	215.00	120
Pressure reservoir 260 m^3	210.00	260
Pressure reservoir 500 m^3	198.10	500
Pressure reservoir 200 m^3	198.10	200
Compensating reservoir 70 m^3	126.98	70
Pressure reservoir 100 m^3	237.50	100
Pressure reservoir 25 m^3	197.95	25
Pressure reservoir 750 m^3	415.58	750
Pressure reservoir 180 m^3	391.68	180
Compensating reservoir 80 m^3	345.30	80
Compensating reservoir 10 m^3	-	10
Pressure reservoir 120 m^3	341.9	120
Pressure reservoir 500 m^3	-	500
Pressure reservoir 60 m^3	234.70	60
Pressure reservoir 1,000 m^3	284.75	1,000
Pressure reservoir 25 m^3	284.75	25
Pressure reservoir 140 m^3	-	140
Pressure reservoir 500 m^3	240.3	500
Pressure reservoir 500 m^3	313.6	500
Pressure reservoir 1,500 m^3	250	1,500
Pressure reservoir 180 m^3	312.00	180
Pressure reservoir 180 m^3	386.00	180
Total		40,420

Table 2: Water sources within the range of a separate territory of a provincial WSS company

Capacity of water sources	Captures	Tube wells	Shaft wells	Ranney wells	Drainage gallery
l/s	number	number	number	number	number
1,351.10	116	47	40	4	1

Table 3: Summarized list of water sources within a separate territory of a provincial WSS company

Springs	Number	117
	Flow rate [l/s]	790.1
Wells	Number	91
	Flow rate [l/s]	561.0
Total sources	**Number**	**208**
	Flow rate [l/s]	**1,351.1**

Table 4: Total length of the main water pipes by materials, diameters and length (summarized data about a single water system covered by a provincial WSS company)

Material	Diameter [mm]		Length	
	from	*to*	*[km]*	*[%]*
Total asbestos-cement	50	550	130.3	58%
Total steel	50	1,000	48.8	22%
Total pig iron	150	200	1.4	1%
Total polyethylene	63	355	43.0	19%

Table 5: List of the water sources within a single water system covered by a provincial WSS company

Type	Flow rate **(l/s)**
Reservoir	715
Captured karst springs	10
Captured karst springs	20
Ground water mainly from wells with river infiltration	2

Type	Flow rate (l/s)
Ground water mainly from wells with river infiltration	2
Captured spring	0.43
Captured spring	0.17
Captured spring	10.31
Captured spring	0.6
Captured spring	0.3
Captured spring	1
Captured spring	4.55

Main water source - reservoir; immediately downstream the dam, the pump station is built which brings water from the intake tower. The water volumes (Q=1,870 l/s) are driven to the treatment plant for drinking water.

The gravity water main from the hydro unit is built with two external water supply branches:

• The first water supply branch – waterway made of asbestos cement with a diameter of 546 mm (184 l/s)

• The second water supply branch – waterway made of steel with a diameter of 920 mm (732 l/s)

Appendix 2: Questionnaire to the owners of WSS companies

Project BGENERGY-1.001-0001 "Feasibility study of the use of hydroenergy potential of existing water supply systems and increasing the potential of existing small hydroelectric power plants in water supply systems
Financed under Renewable Energy, Energy Efficiency and Energy Security Program, within the Financial Mechanism of the European Economic Area 2014-2021.

QUESTIONNAIRE
to the owners of WSS companies

A: Location, owner details		
Province, municipality	*Name*	
WSS Company	*Name*	*Address, phone, e-mail*
Representative/s of the management of the WSS company	*Name*	*Phone, e-mail*
Location	*Map*	
Settlements covered by the WSS service	*Names*	*Map (if available)*
Number of customers		
Type of ownership		
B: Details of the water catchment area		

Regulated and non-regulated lakes in the water catchment	*Map (if available)*
Intake in the reservoir	*Information about the highest regulated water level (HRW) and the lowest regulated water level (LRW) in the reservoir and the available volume*
Intake in the rivers	*The intake in the rivers has to include information about the outflow of water comparative to the maximum, average and minimum inflow in the river*
Intake in the water catchment area in km^2	
Annual flow to intake, m^3/s and/or $l/s/km^2$	
Other reservoirs upstream the intake: Name, HRW, LRW, volume and water catchment area km^2	
Potential to increase the capacity of existing reservoirs	
New reservoir opportunities	
Comments on the waterways between the reservoirs and (if any) the tunnels, piles, canals, etc. *Details required about length (m) and cross section (m^2)*	
C. Technical information in case the waterway (pipe) from the main water intake outlet ends in a pond with daily regulation	
Type of pipe (wood, iron, pig iron, plastic reinforced with glass fibres, other) and pressure	
Dimensions of pipe in millimetres (mm)	

Area of cross section and length of canal (if applicable), m^2 and m	
Length of pipe from the intake to the pressure reduction valve or to the pond, m	
Normal water surface in pond, above sea level - msl	
D: Technical information in case the waterway (pipe) from the main water intake outlet does not end in a pond with daily regulation	
Type of pipe (wood, iron, pig iron, plastic reinforced with glass fibres, other) and pressure	
Dimensions of pipe in millimetres (mm)	
Area of cross section and length of canal (if applicable), m^2 and m	
Length of pipe from the intake to the pressure reduction valve and the water treatment plant, m	
E: Additional information	
Current water consumption rate m^3/s, m^3/24 hours and/or m^3/year	
Closed down water supply systems Are the existing structures useful for hydroelectric plants?	
Plans for extension of the water supply systems	

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Translated under Contract РД 05-02-26/03.07.2020. The Bulgarian text of the report is approved by Ivaylo Aleksiev, Executive Director of SEDA – beneficiary of the BGENERGY-1.001-0001 Project