High potential sites' selection

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Intro

Within the HYPOSO project, Studio Frosio is the leader partner of the work package number 5, "Case studies". The objective of WP5 is the elaboration of comprehensive business case studies (containing pre-feasibility, ecological, economic and political studies) for three selected sites for each target country. In this work package, four main tasks will be performed:

- T5.1 – Selection of three high potential hydropower sites (3 per target country);
- T5.2 – Pre-feasibility study for each case study;
- T5.3 – Environmental and socio-economic impact assessments of the case studies;
- T5.4 – Business case studies.

1. Overview

The selection of the three high potential hydropower sites per target country is based on a first pre-selection of 10 high potential sites per target country: stakeholders from target countries and European and local project partners worked together with the aim to collect all the available data concerning at least 10 high potential sites per target country. Based on this pre-selection, the identification and final selection of the three high potential sites will be executed. These sites will be considered as case studies for carrying out the pre-feasibility studies, the environmental and socio-economic impact assessment and business case studies.
A series of criteria like economic attractiveness, regional electricity demand, ecological impact, availability of grid connection but also expectations of the community and others will be applied for the final selection. A focus will be laid on the active involvement of the public: the identification of the community with the project will ensure the long-lasting functionality and avoid opposition.
Domestic and European stakeholders will meet to present and discuss and select the really best locations for case studies. Subsequently the stakeholders will evaluate independently and individually the catalogue of features and criteria to create a consensus decision. In this regard, one webinar or workshop per target country, will be organised.

1.1 Selection procedure

The final selection of the three high potential hydropower sites will be performed following different steps:

1. Development of a selection strategy;
2. Application of the selection strategy based on the available data collected for the pre-selected 10 high potential sites (per target country);
3. Definition of a ranking of the pre-selected 10 high potential sites;
4. Additional criteria to take into consideration for the final selection;
5. Organisation of workshops for European and domestic stakeholder and project partners;
6. Final identification of the three high potential hydropower sites per target country.

2. Selection strategy

Studio Frosio has developed a method, based on a numerical approach, aimed to the selection of 3 sites (among the 10 mentioned above) which will be considered as case studies. Thanks to its quantitative approach, this method has led to the definition of a ranking of the sites which gives an indication about those sites which are most suitable in order to perform the other activities foreseen within the work package 5, i.e. the pre-feasibility studies (T5.2), the environmental and socio-economic impact assessment (T5.3) and the business analysis (T5.4).

The approach is based on a series of main criteria and sub criteria coming from the experience of Studio Frosio in pre-feasibility studies carried out in Africa and in Latin America. This method has been presented and discussed among the project partners before its implementation. It is standard and independent from the available data collected by the local partner.

2.1 Main criteria and sub-criteria

The analysis starts from the definition of 12 main criteria:

1. Plant location;
2. Hydrologic assessment;
3. Topographic data;
4. Engineering information level;
5. Plant characteristics;
6. Project cost evaluation;
7. Incomes evaluation;
8. Environmental assessment;
9. Financial analysis;
10. Authorization procedure state and perspectives;
11. Social relevance of the energy production;
12. Multipurpose use of the water or/and of the plant infrastructures.

Each main criterion has been analysed through the evaluation of different sub criteria.

1	**Plant location**
1.1	Already existing plant
1.2	Catchment area identification [km^2]
1.3	River identification
1.4	Intake coordinates
1.5	Powerhouse coordinates
1.6	Existing access road to the main plant parts
1.7	Access road to the main plant parts to be built
1.8	Quite difficult access facilities to the main part of the plant
1.9	Uncultivated land owned by the State
1.10	Land owned by local communities
1.11	Land owned by private people
1.12	Distance of the available main construction material
1.13	Users' number identification ONLY IN CASE OF STAND-ALONE SYSTEM
1.13’	Easy connection to the national grid ONLY IN CASE OF CENTRAL GRID CONNECTED SYSTEM

Table 1. List of sub-criteria concerning the main criterion PLANT LOCATION

2	Hydrological assessment
2.0	Plant flow rate from international databases
2.1	Assessment based on flow rate record
2.1.1	Location of the available gauge station
2.1.1.1	*At the intake structures*
2.1.1.2	*On the river to be exploited*
2.1.1.3	*On a river close to the one to be exploited*
2.1.2	Measures rate of the flow rate
2.1.2.1	*Daily*
2.1.2.2	*Weekly (or decades)*
2.1.2.3	*Monthly*
2.2	Assessment based on the rainfall and catchment area
2.2.1	Location of the available rainfall data
2.2.1.1	*Catchment area of the river to be exploited*
2.2.1.2	*Catchment area of a river close to the one to be exploited*
2.2.2	Measures rate of rainfall data
2.2.2.1	*Daily*
2.2.2.2	*Weekly (or decades)*
2.2.2.3	*Monthly*

Table 2. List of sub-criteria concerning the main criterion HYDROLOGICAL ASSESSMENT

The evaluation of the sub criteria in the yellow rows comes from the evaluation of the characteristics written below.

3	Topographic data
3.1	Site specific survey
3.1.1	Total station detailed survey
3.1.2	Total station survey
3.1.3	GPS survey
3.2	Maps available
3.2.1	Large scale maps 1:1.000 or less
3.2.2	Large scale maps 1:10.000 or less
3.2.3	Large scale maps 1:25.000 or less
3.2.4	Large scale maps 1:50.000 or less
3.2.5	Large scale maps >1:50.000
3.2.6	Sketch map only

Table 3. List of sub-criteria concerning the main criterion TOPOGRAPHIC DATA

The evaluation of the sub criteria in the yellow rows comes from the evaluation of the characteristics written below.

4	Engineering information level
4.1	Pre-feasibility study
4.2	Feasibility study
4.3	Detailed design

Table 4. List of sub-criteria concerning the main criterion ENGINEERING INFORMATION LEVEL

5	Plant characteristics
5.1	Run of river
5.2	Storage
5.3	Installed capacity < 100
5.4	100 ≤ Installed capacity < 1.000
5.5	1,000 ≤ Installed capacity < 10,000
5.6	10,000 ≤ Installed capacity
5.7	Max flow rate
5.8	Average flow rate
5.9	Gross head
5.10	Net head
5.11	Expected annual energy production
5.12	Capacity gradient
5.13	Stand-alone functioning ONLY IN CASE OF CENTRAL GRID CONNECTED SYSTEM

Table 5. List of sub-criteria concerning the main criterion PLANT CHARACTERISTICS

6	Project cost evaluation
6.1	Detailed quantities estimation
6.2	Costs from preliminary offers of possible suppliers
6.3	Costs from similar projects in the country
6.4	Parametric evaluation of the construction costs
6.5	O&M costs detailed evaluation
6.6	O&M costs parametric evaluation
6.7	Possible incentives/contribution on the construction costs of rural lines
6.8	Possible incentive/contribution for investment in rural area

Table 6. List of sub-criteria concerning the main criterion PROJECT COST EVALUATION

7	**Incomes evaluation** - Price of the energy delivered to insulated grids ONLY IN CASE OF STAND-ALONE SYSTEM
7.1.1	Survey on the users' amount and typical energy consume
7.1.2	Users' willing-to-pay analysis
7.1.3	Mandatory tariffs from the legislation rules
7.1.4	Not justified value

Table 7. List of sub-criteria concerning the main criterion INCOMES EVALUATION for stand-alone systems

7	**Incomes evaluation** ONLY IN CASE OF CENTRAL GRID CONNECTED SYSTEM
7.1	Plant supplying energy to an insulate grid and to the national grid
7.1.1	Price of the energy delivered to insulated grids
7.1.1.1	*Survey on the users' amount and typical energy consume*
7.1.1.2	*Users' willing-to-pay analysis*
7.1.1.3	*Mandatory tariffs from the legislation rules*
7.1.1.4	*Not justified value*
7.1.1.4	Price of the energy delivered to the national grid
7.1.1.5	*Purchase obligation by law*
7.1.1.6	*Purchase tariff by law*
7.1.1.7	*Signed contract with the energy authority/public utility*
7.1.1.8	*Not justified value*
7.2	Plant supplying energy supplying energy to the national grid only
7.2.1	Price of the energy delivered to the national grid
7.2.1.1	*Purchase obligation by law*
7.2.1.2	*Purchase tariff by law*
7.2.1.3	*Signed contract with the energy authority/public utility*
7.2.1.4	*Not justified value*

Table 8. List of sub-criteria concerning the main criterion INCOMES EVALUATION for central grid connected systems

The evaluation of the sub criteria in the yellow rows comes from the evaluation of the characteristics written below.

8	**Environmental assessment**
8.1	General overview
8.1.1	Normal environmental requirement
8.1.2	Strong environmental requirement (sensitive environmental area)
8.1.3	Reserved flow evaluation
8.1.4	Sediment transport evaluation
8.2	Preliminary assessment
8.2.1	Preliminary water quality survey
8.2.1.1	*Direct on the river to be exploited*
8.2.1.2	*Literature data on the river to be exploited*
8.2.1.3	*Literature data on similar rivers*
8.2.2	Measures rate of water quality parameters
8.2.2.1	*Six months*
8.2.2.2	*One year or more*
8.3	Analysis of impacts during the construction
8.3.1	Transport impacts
8.3.2	Noise impacts
8.3.3	Pollution impacts
8.3.4	Positive impact on the economy at regional/country level
8.4	Analysis of impacts during the plant operating life
8.4.1	Impact on the water quality
8.4.2	Transport impacts
8.4.3	Noise impacts
8.4.4	Possible pollution impacts
8.4.5	Social impact at village/region/country level
8.4.6	Positive impact on the economy at regional/country level
8.4.7	Avoided climate change gas emission
8.4.8	Other positive environmental issues

Table 9. List of sub-criteria concerning the main criterion ENVIRONMENTAL ASSESSMENT

The evaluation of the sub criteria in the yellow rows comes from the evaluation of the characteristics written below.

9	Financial analysis
9.1	Incentives on produced energy
9.2	Financial support for the investors

Table 10. List of sub-criteria concerning the main criterion FINANCIAL ANALYSIS

10	Authorisation procedure state and perspectives
10.1	Signed agreement with landowners and/or local communities
10.2	Water licence already issued
10.3	Preliminary positive evaluation by local communities
10.4	Preliminary positive evaluation by the relevant authorities

Table 11. List of sub-criteria concerning the main criterion FINANCIAL ANALYSIS

11	Social relevance of the energy production
11.1	Energy delivered to rural area not connected to the national grid
11.2	Support to existing weak rural grid
11.3	Local communities involved into the plant ownership
11.4	Local investors

Table 12. List of sub-criteria concerning the main criterion SOCIAL RELEVANCE OF THE ENERGY PRODUCTION

12	Multipurpose use of the water or/and of the plant infrastructures
12.1	Additional irrigation/fish breeding facilities
12.2	Road or other plant infrastructures multipurpose use
12.3	Plant sharing a potable water supply grid

Table 13. List of sub-criteria concerning the main criterion MULTIPURPOSE USE OF THE WATER OR/AND OF THE PLANT INFRASTRUCTURES

2.2 Evaluation of the series of criteria

Each sub criterion has been evaluated by means of three parameters:

1. a maximum rank expressed by a percentage. It is fixed and standard. It has been set according to the importance of the sub criterion: higher its importance, higher its weight (and, as consequence, its percentage);
2. the availability or the possibility to obtain the required data or the presence of the situation described by the criterion;
3. the actual rank expressed by a percentage. It can be 0 if there isn't the required data set or, vice versa, it can be equal to the maximum rank assigned to the sub criterion.

The final rank associated to the main criterion is given by the sum of the actual ranks of each sub criterion.

The evaluation of each main criterion comes from the determination of three parameters:

1. an absolute weight expressed by a number. It is fixed and standard for all sites. It has been set according to the importance of the criterion: higher the importance of the criterion, higher its weight (and, as consequence, the number);
2. a rank coming from the evaluation of each single sub criterion. It represents the final rank associated to the main criterion, given by the sum of the actual ranks of each sub criterion;
3. the score associated to each main criterion, as the product between the previous two parameters.

Finally, the whole site is characterized by a number, the total score, as the weighted average of the scores of each main criterion.

2.3 Application of the method

A first application of the method has been performed in combination with the first progress meeting of the HYPOSO project at the end of March 2020 in order to present and share the method among all the project partners. At that time, the application of the method was based on the preliminary information collected by the local partners

concerning the pre-selected 10 high potential sites per target country with the aim just to show the method and its advantages to all the project partners. Once the method was discussed and agreed by all the project partners, it has been applied on the basis of more accurate information concerning the pre-selected sites collected by the local partners.
According to the changes in the project time schedule due to the Covid19 pandemic, the selection of the three high potential sites has been split into two part: at the moment, the HYPOSO project partners are focusing their efforts on the selection of three African high potential sites and at a later time, they will be focused on the selection of the three high potential sites for each Latin American country.
In the following tables, it has been reported the application of the described method to a real site in Uganda (1. Isuule Hydro Power).

The resulting evaluation of the sub criteria concerning the first main criterion "PLANT LOCATION" is shown in *Table 14*.

1	Plant location	Max rank	Y/N	Actual rank
1.1	Already existing plant	50%		0%
1.2	Catchment area identification [km^2]	20%		0%
1.3	River identification	2%	X	2%
1.4	Intake coordinates	2%	X	2%
1.5	Powerhouse coordinates	2%	X	2%
1.6	Existing access road to the main plant parts	5%	X	5%
1.7	Access road to the main plant parts to be built	2%	X	2%
1.8	Quite difficult access facilities to the main part of the plant	0%		0%
1.9	Uncultivated land owned by the State	5%		0%
1.10	Land owned by local communities	10%		0%
1.11	Land owned by private people	5%	X	5%
1.12	Distance of the available main construction material	4%		0%
1.13	Users' number identification	5%		0%
	FINAL RANK 1			**18%**

Table 14. Evaluation of the sub-criteria concerning the main criterion PLANT LOCATION

The total score of the whole site 1. Isuule Hydro Power comes from the evaluation of each main criterion, as shown in *Table 15*.

ID	MAIN CRITERIA	Weight	Rank	Score
1	Plant location	10	18%	1,80
2	Hydrological assessment	13	85%	11,05
3	Topographic data	13	100%	13,00
4	Engineering information level	6	100%	6,00
5	Plant characteristics	6	40%	2,40
6	Project cost evaluation	6	40%	2,40
7	Incomes evaluation	10	0%	0,00
8	Environmental assessment	10	15%	1,50
9	Financial analysis	3	0%	0,00
10	Authorisation procedure state and perspectives	13	0%	0,00
11	Social relevance of the energy production	5	70%	3,50
12	Multipurpose use of the water or/and of the plant infrastructures	5	20%	1,00
	TOTAL SCORE OF THE WHOLE SITE	**100**		**42,65**

Table 15. Evaluation of the 12 main criteria

3. Resulting rankings

Thanks to the quantitative approach of the method, its application has led to the definition of a ranking of the sites, from that site characterized by the highest score to that site characterized by the lowest score. It has allowed to prioritize the sites according to the total score based on the available data and to give an indication about the best sites to consider as case studies.
For each African country, the final ranking is presented below.

- Cameroon:

	SITE NAME		8. Mougue upstream - Lolodo		3. Falaise - Dschang		4. Fossong Wentcheng - Dschang		5. Bantoum - Fokoué		1. Djechi upstream - Bafang		11. Tsinkop-Dschang	
ID	**Main criteria**	***Weight***	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**
1	*Plant location*	***10***	21%	2,10	15%	1,50	20%	2,00	35%	3,50	25%	2,50	85%	8,50
2	*Hydrological assessment*	***13***	85%	11,05	35%	4,55	70%	9,10	70%	9,10	35%	4,55	10%	1,30
3	*Topographic data*	***13***	0%	0,00	70%	9,10	70%	9,10	70%	9,10	70%	9,10	70%	9,10
4	*Engineering information level*	***6***	30%	1,80	60%	3,60	0%	0,00	0%	0,00	0%	0,00	0%	0,00
5	*Plant characteristics*	***6***	40%	2,40	45%	2,70	65%	3,90	45%	2,70	45%	2,70	60%	3,60
6	*Project cost evaluation*	***6***	10%	0,60	10%	0,60	10%	0,60	10%	0,60	10%	0,60	10%	0,60
7	*Incomes evaluation*	***10***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
8	*Environmental assessment*	***10***	10%	1,00	10%	1,00	10%	1,00	10%	1,00	10%	1,00	10%	1,00
9	*Financial analysis*	***3***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
10	*Authorisation procedure state and perspectives*	***13***	20%	2,60	30%	3,90	20%	2,60	20%	2,60	20%	2,60	20%	2,60
11	*Social relevance of the energy production*	***5***	30%	1,50	30%	1,50	30%	1,50	30%	1,50	30%	1,50	30%	1,50
12	*Multipurpose use of the water or/and of the plant infrastructures*	***5***	80%	4,00	80%	4,00	20%	1,00	0%	0,00	80%	4,00	0%	0,00
	TOTAL SCORE	***100***		**32,95**		**32,45**		**30,80**		**30,10**		**28,55**		**28,20**
	Ranking position		**1**		**2**		**3**		**4**		**5**		**6**	

	SITE NAME		7. Mougue dowstream-Lolodorf		6. Manjo		2. Djechi downstream - Bafang		9. Maron – Foumban		10. Bongone – Bongone	
ID	**Main criteria**	***Weight***	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**
1	*Plant location*	***10***	20%	2,00	25%	2,50	25%	2,50	25%	2,50	16%	1,60
2	*Hydrological assessment*	***13***	90%	11,70	35%	4,55	35%	4,55	60%	7,80	10%	1,30
3	*Topographic data*	***13***	30%	3,90	70%	9,10	70%	9,10	50%	6,50	2%	0,26
4	*Engineering information level*	***6***	0%	0,00	30%	1,80	0%	0,00	30%	1,80	0%	0,00
5	*Plant characteristics*	***6***	40%	2,40	40%	2,40	45%	2,70	40%	2,40	70%	4,20
6	*Project cost evaluation*	***6***	10%	0,60	10%	0,60	10%	0,60	10%	0,60	10%	0,60
7	*Incomes evaluation*	***10***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
8	*Environmental assessment*	***10***	10%	1,00	10%	1,00	10%	1,00	10%	1,00	10%	1,00
9	*Financial analysis*	***3***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
10	*Authorisation procedure state and perspectives*	***13***	20%	2,60	20%	2,60	20%	2,60	0%	0,00	0%	0,00
11	*Social relevance of the energy production*	***5***	30%	1,50	30%	1,50	30%	1,50	20%	1,00	70%	3,50
12	*Multipurpose use of the water or/and of the plant infrastructures*	***5***	20%	1,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
	TOTAL SCORE	***100***		**26,70**		**26,05**		**24,55**		**23,60**		**12,46**
	Ranking position		**7**		**8**		**9**		**10**		**11**	

- Uganda:

	SITE NAME		1. Isuule Hydro Power		3. Sebwe Hydro Power		5. Lamwo HPP		6. Kabat		7. Chema		4. Kibaale HPP	
ID	**Main criteria**	***Weight***	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**
1	*Plant location*	***10***	18%	1,80	16%	1,60	11%	1,10	15%	1,50	17%	1,70	16%	1,60
2	*Hydrological assessment*	***13***	85%	11,05	70%	9,10	75%	9,75	85%	11,05	85%	11,05	75%	9,75
3	*Topographic data*	***13***	100%	13,00	70%	9,10	70%	9,10	100%	13,00	100%	13,00	70%	9,10
4	*Engineering information level*	***6***	100%	6,00	100%	6,00	30%	1,80	30%	1,80	30%	1,80	30%	1,80
5	*Plant characteristics*	***6***	40%	2,40	55%	3,30	55%	3,30	35%	2,10	35%	2,10	65%	3,90
6	*Project cost evaluation*	***6***	40%	2,40	40%	2,40	10%	0,60	10%	0,60	10%	0,60	10%	0,60
7	*Incomes evaluation*	***10***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
8	*Environmental assessment*	***10***	15%	1,50	15%	1,50	10%	1,00	10%	1,00	10%	1,00	15%	1,50
9	*Financial analysis*	***3***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
10	*Authorisation procedure state and perspectives*	***13***	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00	0%	0,00
11	*Social relevance of the energy production*	***5***	70%	3,50	70%	3,50	70%	3,50	20%	1,00	20%	1,00	70%	3,50
12	*Multipurpose use of the water or/and of the plant infrastructures*	***5***	20%	1,00	0%	0,00	80%	4,00	0%	0,00	0%	0,00	0%	0,00
	TOTAL SCORE	***100***		**42,65**		**36,50**		**34,15**		**32,25**		**32,25**		**31,75**
	Ranking position		**1**		**2**		**3**		**4**		**4**		**6**	

	SITE NAME		9. Bumasata/ Bumwalukani		10. Lwakhakha		2. Sisiyi Falls/Simu		8. Unknown	
ID	**Main criteria**	***Weight***	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**
1	*Plant location*	***10***	26%	2,60	21%	2,10	25%	2,50	5%	0,50
2	*Hydrological assessment*	***13***	10%	1,30	10%	1,30	50%	6,50	10%	1,30
3	*Topographic data*	***13***	70%	9,10	50%	6,50	70%	9,10	50%	6,50
4	*Engineering information level*	***6***	30%	1,80	30%	1,80	0%	0,00	0%	0,00
5	*Plant characteristics*	***6***	35%	2,10	35%	2,10	45%	2,70	25%	1,50
6	*Project cost evaluation*	***6***	0%	0,00	10%	0,60	10%	0,60	0%	0,00
7	*Incomes evaluation*	***10***	0%	0,00	0%	0,00	0%	0,00	0%	0,00
8	*Environmental assessment*	***10***	10%	1,00	0%	0,00	10%	1,00	0%	0,00
9	*Financial analysis*	***3***	0%	0,00	0%	0,00	0%	0,00	0%	0,00
10	*Authorisation procedure state and perspectives*	***13***	50%	6,50	50%	6,50	20%	2,60	0%	0,00
11	*Social relevance of the energy production*	***5***	30%	1,50	20%	1,00	30%	1,50	0%	0,00
12	*Multipurpose use of the water or/and of the plant infrastructures*	***5***	80%	4,00	80%	4,00	0%	0,00	0%	0,00
	TOTAL SCORE	***100***		**29,90**		**25,90**		**17,80**		**9,80**
	Ranking position		**7**		**8**		**9**		**10**	

4. Additional criteria

In order to get the most suitable selection of the sites, in terms of compliance with the HYPOSO objectives and in terms of saving time and money, additional criteria must be taken into consideration for the final selection.

4.1 Time for the sites visit

The visits of the selected sites are planned in combination with the on-site activities foreseen within the work packages WP4, 5 and 6. Since the capacity building courses (WP4) will take 8 days (6 days lecture + 2 days site visits), and the workshop on the framework conditions for hydropower (WP6) will take 1 day directly after the capacity building courses, the sites visits will be performed starting from the 10th day of on-site activities. The need to perform the sites visits after the training courses and the workshop on the framework conditions comes from the fact that among the participants to the training courses and to the workshop, there will probably be someone who should guide STUDIO FROSIO during the sites visits. For this reason, all these events planned during the on-site activities should not overlap. In order to save time and the project budget, the selected sites should be close to the location where the training courses and the workshop will be held (as far as possible).

4.2 Expectations of the local community

In order to comply with what the Grant Agreement states, among the series of criteria to take into account for the final selection of the sites, also the expectations of the local community are an unavoidable requirement. For this reason, a focus will be laid on the active involvement of the public: the stakeholders will evaluate the catalogue of features and criteria to create a consensus decision. The identification of the community with the project will ensure the long-lasting functionality and avoid opposition.

4.3 Variety of schemes

Another requirement for the best sites' selection set out in the Grant Agreement is that the selected locations should differ as good as possible in head and flow (high/low head, installed capacity range) and in type (weir type, diversion type, grid connected/stand-alone). In the tables below, the main characteristics of each African site are presented.

- Cameroon:

SITE NAME	*8. Mougue upstream - Lolodo*	*3. Falaise - Dschang*	*4. Fossong Wentcheng - Dschang*	5. Bantoum - Fokoué	1. Djechi upstream - Bafang	11. Tsinkop-Dschang
SF rank	1	2	3	4	5	6
Typology	ROR with diversion	ROR with diversion	ROR/storage with diversion	ROR with diversion	ROR with diversion	ROR with diversion
Gross head	4,5	460	490	238	40	50
Rated discharge (m^3/s)	8	0,4	0,6	0,25	4	0,3
Capacity [MW]	0,288	1,472	2,352	0,476	1,28	0,12
Grid connected	Central grid	Central grid	Central grid	Central grid	Central grid	Central grid
Other relevant information	Hydrology studies available, city council sustaining the project, access ok (untarred road), supported by the politicians	Hydrology and topography studies available, city council sustaining the project, easy access downstream with tared road, limited access upstream	Ongoing data acquisition on hydrology, city council sustaining the project, access upstream (15 km from the tared road), close to three other hydro projects in the vicinity (around 6 km)	Supported by city council, about 22 km of untarred road	Topography available, easy access with tared road, 30 kV network less than 1 km	Relatively easy site with dam, powerhouse, forebay already in place

SITE NAME	*7. Mougue dowstream-Lolodorf*	*6. Manjo*	*2. Djechi downstream - Bafang*	*9. Maron – Foumban*	*10. Bongone – Bongone*
SF rank	7	8	9	10	11
Typology	ROR with diversion	ROR with diversion	ROR with diversion	ROR with diversion	ROR/storage with diversion
Gross head	15	25	120	50	145
Rated discharge (m^3/s)	8	22	4	2	15
Capacity [MW]	0,96	4,4	3,84	0,8	17,4
Grid connected	Central grid	Central grid	Central grid	Central grid	Central/off-grid
Other relevant information	Hydrology studies available, city council sustaining the project, limited access (few km), supported by the politicians	Topography available, access easy, 30 kV network less than 2 km, supported by the ministry, feasibility studies available, funded by UNIDO	Topography available, access a bit difficult with around 5 km untarred road, 30 kV network less than 6 km, supported by the ministry, feasibility studies available, funded by UNIDO	Untarred access road, supported by the utility, 30 kV less than 5 km, about 7km of untarred road	Expected by the mining industries

- Uganda:

SITE NAME	*1. Isuule Hydro Power*	*3. Sebwe Hydro Power*	*5. Lamwo HPP*	*6. Kabat*	*7. Chema*	*4. Kibaale HPP*
SF rank	1	2	3	4	4	6
Typology	ROR	ROR	ROR with diversion	ROR	ROR	ROR with diversion
Gross head	189	250	390	272	200	45
Rated discharge (m^3/s)	0,3	0,5	0,8	1,21	1,9	7
Capacity [MW]	0,42	0,8	3	2,25	3,21	2
Grid connected	Off grid/isolated grid	Off grid/isolated grid	Off grid/isolated grid	Central grid	Central grid	Central grid
Other relevant information	The scheme has been undergoing initial prefeasibility studies. The site is a potential one with minimum average flows of 0.3 m3/s and can be developed for mini grid. The main electricity grid is also 6km away and can thus be connected to evacuate the access generated energy.	The site is a potential one with minimum average flows of 1m3/s and can be developed for mini grid. The main electricity grid is also 8km away and can thus be connected to evacuate the access generated energy.	No comments	The information is as a result of prefeasibility where Hydrology was as a result of spot measurement and the location is based the topography of the site	The information is as a result of prefeasibility where Hydrology was as a result of spot measurement and the location is based the topography of the site	No comments

SITE NAME	*9. Bumasata/ Bumwalukani*	*10. Lawakhakha*	*2. Sisiyi Falls/Simu*	*8. Unknown*
SF rank	7	8	9	10
Typology	ROR	ROR	ROR with diversion	Unknown
Gross head	Unknown	Unknown	244	62
Rated discharge (m^3/s)	Unknown	Unknown	1.086	8
Capacity [MW]	7	2,5	7,5	4,4
Grid connected	Central grid	Central grid	Central grid	Unknown
Other relevant information	Worth exploring as a potential prospect for future development	Worth exploring as a potential prospect for future development	No comments	No comments

4.4 Other

Despite the resulting rankings obtained by means of the application of the method described above are only an indication, it would be appreciable if the 3 final selected sites remain among the 5/6 first positions of the respective rankings.

5. Webinars in Cameroon and in Uganda

In order to comply with what the Grant Agreement states and therefore, to focus on the active involvement of the public, per target country one webinar or workshop will be organised within the high potential site selection procedure. Domestic stakeholders and project partners will meet to select the really best locations.
At the moment, the webinars in Cameroon and in Uganda have already been held by means of Microsoft Teams. Studio Frosio (SF), as leader partner of the work package number 5, organized them inviting local stakeholders, local project partners and European project partners.
They have been performed according to the following structure:

1. Detailed presentation of the numerical approach used by Studio Frosio;
2. Explanation of the resulting ranking;
3. Presentation of additional criteria to take into consideration for the final selection;
4. Time for questions about method and results;
5. Discussion among the participants.

5.1 Webinar in Cameroon

The webinar in Cameroon was held on Monday, 21 September 2020 from 11:00 to 13:00 (WAT - West African Time) - from 12:00 to 14:00 (CET – Central European Time). Among the Cameroon stakeholders which attended the webinar, there were members of Ministry of Energy of Cameroon, members of ARSEL (Regulatory Board), members of SHW (la societe solarhydrowatt sarl) and members of EDC (Electricity Development corporation). Besides them, some European project partners joined the webinar. After a presentation performed by Studio Frosio concerning the numerical method, its application, the resulting ranking and the additional criteria to take into account for the final selection, a proactive discussion took place. Collected all the needed information and the suggestion of the participants, now the local stakeholders with the contribution of Studio Frosio are going to evaluate the catalogue of features and criteria to create a consensus decision concerning the three high potential sites.
The final selection is planned at the latest on Monday 5 October.

Fig. 1 - Pictures taken during the webinar in Cameroon

5.2 Webinar in Uganda

The webinar in Uganda was held on Wednesday, 23 September 2020 from 11:00 to 13:00 (EAT – East African Time) - from 10:00 to 12:00 (CET – Central European Time). Among the Uganda stakeholders which attended the webinar, there were members of HPAU (Hydro Power Association of Uganda), members of the Uganda Development Bank, members of Ministry of Energy and Mineral Development and several engineer experts. Besides them, some European project partners joined the webinar. After a presentation performed by Studio Frosio concerning the numerical method, its application, the resulting ranking and the additional criteria to take into account for the final selection, a proactive discussion took place. Collected all the needed information and the suggestion of the participants, now the local stakeholders with the contribution of Studio Frosio are going to evaluate the catalogue of features and criteria to create a consensus decision concerning the three high potential sites.
The final selection is planned at the latest on Monday 5 October.

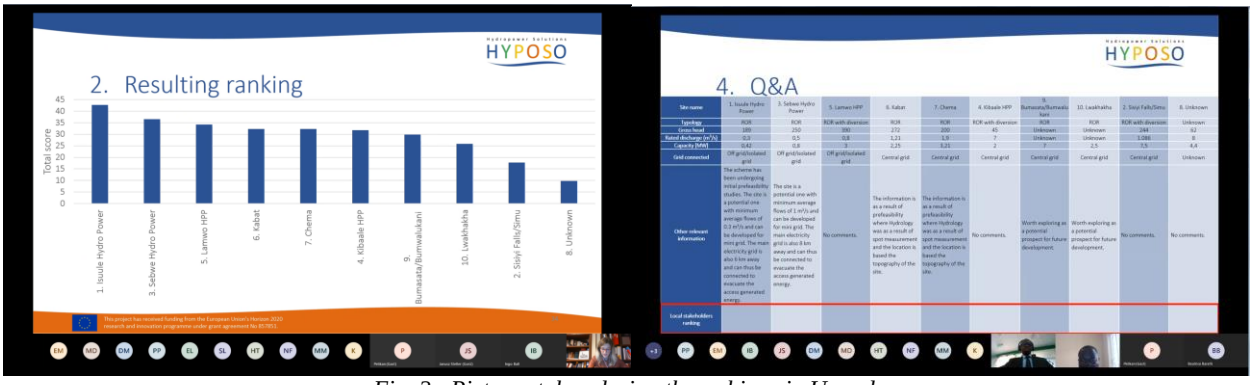

Fig. 2 - Pictures taken during the webinar in Uganda

6. Next steps

In the next days, Studio Frosio will support the local stakeholders and project partner in order to get a consensus decision about the three high potential selected sites (three for each African country). Trusting of getting the final sites selection in the following days, we will present the final results during the conference.
These sites will be considered as case studies for the elaboration of pre-feasibility studies, environmental and socio-economic impact assessment and business case studies.
In the meanwhile, Studio Frosio, together with other project partner, will be involved in the training courses foreseen within the work package no. 4.

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