

# Draft Environment and Social Impact Assessment

Project Number: 55205-001  
29 April 2022

## Lao PDR: Monsoon Wind Power Project Part 22: Appendix H

Prepared by Impact Energy Asia Development Limited (IEAD) for the Asian Development Bank.

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# Monsoon Wind Power Project, Sekong and Attapeu Provinces, Lao PDR

Environmental and Social Impact  
Assessment

29 April 2022

Project No.: 0598121

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## **APPENDIX H      SOCIO-ECONOMIC HOUSEHOLD DATABASE**

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
1	ING02	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
2	ING09	Triang	daksang	Xiengluang	dakchueng	sekong	10/11/2021
3	ING09	Triang	Sieang A	Xiengluang	Dakchueng	Sekong	12/11/2021
4	ING08	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
5	ING04	Triang	Daktreub	Xiengluang	dakchueng	Sekong	18/11/2021
6	ING12	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2021
7	ING07	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
8	ING07	Triang	Tongmueang	Xiengluang	Dakchueng	Sekong	10/12/2021
9	ING09	Triang	Dakdor	Dakduem	Dakchueng	sekong	13/11/2021
10	ING09	Triang	Dakden	Dakduem	Dakchueng	sekong	11/11/2021
11	ING09	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
12	ING14	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
13	ING14	other	Dakchueng	Aekkalard	Dakchueng	Sekong	11/24/2021
14	ING12	Triang	Tongsxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
15	ING11	Triang	Dampum	-	Dakcheung	Sekong	17/11/2021
16	ING15	Triang	Dalern	Aekkalard	Dakchueng	Sekong	13/11/2021
17	ING09	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
18	ING09	Katu	Dakkung	Namdae	Dakchueng	Sekong	14/11/2021
19	ING09	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
20	ING07	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	20/11/2021
21	ING13	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
22	ING14	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	11/17/2021
23	ING12	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021
24	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
25	ING13	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
26	ING13	Triang	Dak Yok	Nam Xou	Xay Xay	Attapue	12/5/2021
27	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
28	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
29	ING13	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
30	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
31	ING12	Triang	Dak Xied	Namzou	Xan Xay	Attapue	12/6/2021
32	ING07	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
33	ING11	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	10/11/2021
34	ING14	Triang	Daksieng A	Xiengluang	Dakchueng	Sekong	12/11/2021
35	ING06	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
36	ING07	Triang	Daktreub	Xiengluang	dakchueng	Sekong	18/11/2021
37	ING04	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6\11\2022
38	ING08	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
39	ING13	Triang	Tongmueang	Xiengluang	Dakchueng	Sekong	11/10/2021
40	ING13	Triang	Dakdor	Dakduem	Dakchueng	sekong	11/11/2021
41	ING07	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
42	ING09	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
43	ING14	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
44	ING07	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	11/24/2021
45	ING05	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
46	ING06	Triang	Dakpum		Dakchueng	Sekong	17/11/2021
47	ING15	Triang	Dalern	Aekkalard	Dakchueng	Sekong	13/11/2021
48	ING12	Triang	Plao	Namdae	Dakchueng	Sekong	14/11/2021
49	ING12	Triang	Dakkung	Namdae	Dakchueng	Sekong	14/11/2021
50	ING15	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
51	ING12	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
52	ING13	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
53	ING14	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	11/17/2021
54	ING12	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021
55	ING13	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
56	ING13	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
57	ING12	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
58	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
59	ING07	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
60	ING12	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
61	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
62	ING12	Triang	Dak Xied	Namzou	Xan Xay	Attapue	12/6/2021
63	ING02	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
64	ING11	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	10/11/2021
65	ING12	Triang	Daksieng A	Xiengluang	Dakchueng	Sekong	12/11/2021
66	ING13	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
67	ING15	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
68	ING10	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2021
69	ING03	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
70	ING03	Triang	Tongmueng	Xiengluang	Dakchueng	Sekong	10/11/2021
71	ING13	Triang	Dakdor	Dakduem	Dakchueng	sekong	11/11/2021
72	ING07	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
73	ING09	Yae	Dakrun		Dakchueng	Sekong	13/11/2021
74	ING14	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
75	ING09	Triang	Dakchueng	Aekkalard	Dakchueng	sekong	15/11/2021
76	ING01	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
77	ING10	Triang	Dakpum		Dakchueng	Sekong	17/11/2021
78	ING15	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
79	ING13	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
80	ING06	Katu	Dakkung	Namdae	Dakchueng	Sekong	14/11/2021
81	ING15	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
82	ING14	Yae	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
83	ING13	Triang	Dakmuan	Xekhaman	Dakchueg	Sekong	18/11/2021
84	ING07	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	17/11/2021
85	ING07	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021
86	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
87	ING07	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
88	ING07	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
89	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
90	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
91	ING03	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
92	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
93	ING12	Triang	Dak Xied	Namzou	Xan Xay	Attapue	12/6/2021
94	ING07	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
95	ING08	Triang	Dakcheng	Xiengluang	Dakchueng	Sekong	10/11/2021
96	ING13	Triang	Dakzieng A	Xiengluang	Dakchung	Sekong	12/11/2021
97	ING09	Triang	Xieng Luang	Xieng Luang	dakchueng	sekong	10/11/2021
98	ING15	Triang	Daktreub	Xeingluang	Dakchueng	Sekong	18/11/2021
99	ING06	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2021
100	ING12	Triang	dakdern	Xiengluang	dakchueng	Sekong	22/11/2021
101	ING06	Triang	Trongmueang	Xiengluang	Dakchueng	Sekong	10/11/2021
102	ING02	Triang	Dakdor	Dakduem	Dakchueng	sekong	11/11/2021
103	ING07	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
104	ING09	Triang	Dakrun		Dakchueng	Sekong	20/11/2021
105	ING03	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
106	ING09	Triang	Dakchueng	Aekkalard	Dakchueng	sekong	20/11/2021
107	ING04	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
108	ING15	Triang	Dakpum	-	Dakchueng	Sekong	17/11/2021
109	ING11	Triang	Daklern	Aekkalard	Dakcheung	Sekong	13/11/2021
110	ING15	Triang	Plao	Namdae	Dakchueng	Sekong	14/141/2021
111	ING15	Triang	Dakkung	Namdae	Dakchueng	Sekong	14/11/2021
112	ING11	Triang	Dakchom	Namdae	Dakcheung	Sekong	16/11/2021
113	ING12	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	28/11/2021
114	ING13	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
115	ING09	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	17/11/2021
116	ING03	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021



HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
117	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
118	ING12	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
119	ING13	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
120	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
121	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
122	ING07	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
123	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
124	ING12	Triang	Dak Xied	Namzou	Xan Xay	Attapue	12/6/2021
125	ING09	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
126	ING15	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	10/12/2021
127	ING06	Triang	Daksieng A	Xiengluang	Dakchueng	Sekong	12/11/2021
128	ING07	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/13/2021
129	ING01	Triang	Daktreub	Xeingluang	Dakchueng	Sekong	18/11/2021
130	ING08	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2021
131	ING08	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
132	ING12	Triang	TrongMueang	Xiengluang	Dakchueng	Sekong	10/11/2021
133	ING15	Triang	DakDor	Dakduem	Dakchueng	Sekong	12/11/2021
134	ING03	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
135	ING07	Triang	Dakrun		Dakchueng	Sekong	11/23/2021
136	ING14	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/22/2021
137	ING11	Triang	Dakcheung	Aekkalard	Dakcheung	Sekong	20/11/2021
138	ING07	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
139	ING13	Triang	Dak pum				11/17/2021
140	ING06	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
141	ING11	Katu	Plao	Namdae	Dakchueng	Sekong	18/11/2021
142	ING13	Katu	Dakkung	Namdae	Dakchung	sokong	14/11/2021
143	ING11	Triang	Dakchom	Namdae	Dakcheung	Sekong	16/11/2021
144	ING15	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
145	ING13	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
146	ING09	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	17/11/2021
147	ING07	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021
148	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
149	ING12	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
150	ING13	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
151	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
152	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
153	ING13	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
154	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
155	ING12	Triang	Dak Xied	Namzou	Xan Xay	Attapue	12/6/2021
156	ING15	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
157	ING05	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	11/10/2021
158	ING15	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
159	ING11	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2021
160	ING04	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2001
161	ING10	Triang	Dakaor	Xiengluang	Dakchueng	Sekong	22/11/21
162	ING07	Triang	Tongmueang	Xiengluang	Dakchueng	Sekong	10/11/2021
163	ING15	Triang	DakDor	Dakduem	Dakchueng	Sekong	12/11/2021
164	ING03	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
165	ING12	Triang	Dakrun	dakluem	Dakchueng	Sekong	11/13/2021
166	ING14	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/22/2021
167	ING11	Triang	Dakcheung	Aekkalard	Dakcheung	Sekong	20/11/2021
168	ING02	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
169	ING06	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
170	ING06	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
171	ING11	Triang	Dakchom	Namdae	Dakcheung	Sekong	16/11/2021
172	ING13	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
173	ING12	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
174	ING12	Triang	Daktaorknoy	Xekhaman	Dakchueng	Sekong	17/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
175	ING03	Triang	Dakdom	Xekhaman	Dakchueng	Sekong	16/11/2021
176	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
177	ING13	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
178	ING07	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
179	ING13	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
180	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
181	ING03	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
182	ING13	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
183	ING12	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
184	ING10	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	10/11/2021
185	ING13	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
186	ING11	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2022
187	ING12	Triang	Dakyang	XeingLuang	Dakchueng	Sekong	6/11/2021
188	ING05	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
189	ING14	Triang	Tongmueng	Xiengluang	Dakchueng	Sekong	10/11/2021
190	ING15	Triang	DakDor	DakDuem	Dakchueng	Sekong	11/11/2021
191	ING12	Triang	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
192	ING12	Triang	Daklun	dakluem	Dakchueng	Sekong	11/13/2021
193	ING03	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/24/2021
194	ING02	Triang	Dakcheung	Aekkalard	Dakcheung	Sekong	20/11/2021
195	ING07	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
196	ING10	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
197	ING10	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
198	ING06	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
199	ING13	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	20/11/201
200	ING12	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
201	ING07	Triang	Dak Nong	Namxou	Xan Xay	Attapue	12/6/2021
202	ING13	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
203	ING03	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
204	ING12	other	Dak Xuem	Namzou	Xan Xay	Attapue	12/7/2021
205	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
206	ING13	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
207	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
208	ING08	Triang	Dak Tiem	Xieng Luang	Dakcheung	Sekong	8/11/2021
209	ING04	Triang	Dakxeng	Xiengluang	Dakchueng	Sekong	11/10/2021
210	ING10	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021
211	ING11	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2022
212	ING08	Triang	Dakyarng	Dakyarng	Dakchueng	Sekong	18/11/2021
213	ING13	Triang	Dak Yen	Xiengluang	Darkjeang	Sekong	11/6/2021
214	ING04	Triang	DakDor	DakDuem	Dakchueng	Sekong	11/11/2021
215	ING12	other	Dakden	Dakduem	Dakchueng	Sekong	11/11/2021
216	ING13	Triang	Dakrun		Dakchueng	Sekong	11/13/2021
217	ING03	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/24/2021
218	ING04	Katu	Dakcheung	Aekkalard	Dakcheung	Sekong	20/11/2021
219	ING09	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
220	ING10	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
221	ING10	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
222	ING10	Triang	dakchom	Namdae	Dakchueng	Sekong	16/11/2021
223	ING11	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	22/11/2021
224	ING12	Triang	Dakmuan	Xekhaman	Dakchueg	Sekong	18/11/2021
225	ING12	Triang	Dak Samor	Namxou	Xan Xay	Attapue	12/5/2021
226	ING12	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
227	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
228	ING13	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
229	ING12	Triang	Dak Padoo	Dak Ben	Xan Xay	Attapue	12/8/2021
230	ING12	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
231	ING11	Triang	Xieng Luang	Xieng Luang	Dakchueng	Sekong	10/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
232	ING02	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2021
233	ING07	Triang	Dakking		Dakjueng	Sekong	18/11/2021
234	ING13	Triang	Dakvaiy	Xiengluang	Dakchueng	Sekong	11/6/2021
235	ING11	Triang	Dakdor	Dakduem	Dakcheung	Sekong	12/11/2021
236	ING12	Triang	Dakden	Dakduem	dakchueng	sekong	11/11/2021
237	ING07	Triang	Dakrun		Dakchueng	Sekong	11/13/2021
238	ING07	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/24/2021
239	ING05	Yae	Dakcheung	Aekkalard	Dakcheung	Sekong	20/11/021
240	ING09	Triang	Tongxieng	Aekkalard	dakchueng	sekong	15/11/2021
241	ING10	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
242	ING07	Triang	Plao	Namdae	Dakchueng	Sekong	14/11/2021
243	ING10	Triang	dakchom	Namdae	Dakchueng	Sekong	16/11/2021
244	ING11	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
245	ING12	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
246	ING12	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
247	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
248	ING03	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
249	ING07	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
250	ING12	Triang	Xieng Luang	Xieng Luang	Dakchueng	sekong	10/11/2021
251	ING11	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2021
252	ING06	Triang	Dakbrang	Dakyang	Dakchueng	Sekong	11/18/2021
253	ING15	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	6\11\2021
254	ING11	Triang	Dakdor	Dakduem	Dakcheung	Sekong	12/11/2021
255	ING09	Triang	Dakden	Dakduem	Dakchueng	sekong	11/11/2021
256	ING05	Yae	Dakrun		Dakchueng	Sekong	11/13/2021
257	ING07	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/23/2021
258	ING06	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021
259	ING13	Triang	Tongxieng	Aekkalard	Dakchung	sokong	15/11/2021
260	ING08	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
261	ING02	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
262	ING08	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
263	ING10	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
264	ING10	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
265	ING13	Triang	Dak Yok	Nam Xou	Xan Xay	Attapue	12/5/2021
266	ING13	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
267	ING13	Triang	Dak Dor	NamZou	Xan Xay	Attapue	12/7/2021
268	ING08	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
269	ING06	Triang	Daktreub	Xiengluang	Dakcheung	Sekong	18/11/2021
270	ING09	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	6\11\2021
271	ING06	Triang	Dakdor	Dakduem	Dakchueng	Sekong	12/11/2021
272	ING11	Yae	Dakrun		Dakchueng	Sekong	14/11/2021
273	ING07	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
274	ING06	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021
275	ING13	Triang	Tongxieng	Aekkalard	Dakchung	sokong	15/11/2021
276	ING08	Triang	Daklern	Aekkalard	Dakchueng	Sekong	13/11/2021
277	ING08	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
278	ING08	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
279	ING08	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
280	ING10	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
281	ING03	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
282	ING10	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
283	ING06	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
284	ING04	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
285	ING06	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
286	ING05	Triang	Dakrun				11/13/2021
287	ING08	Triang	Dakbrong	Aekkalard	Dakchueng	Sekong	21/11/2021
288	ING06	Yae	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
289	ING13	Triang	Tongxieng	Aekkalard	Dakchung	sokong	15/11/2021
290	ING02	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/13/2021
291	ING08	Katu	Plao	Namdae	Dakchueng	Sekong	14/11/2021
292	ING06	Triang	Dakchom	Namdae	Dakchueng	Sekong	16/11/2021
293	ING06	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
294	ING10	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
295	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
296	ING13	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
297	ING06	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
298	ING10	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
299	ING06	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
300	ING07	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
301	ING08	Triang	Dakbrong	Aekkalard	Dakchueng	Sekong	21/11/2021
302	ING10	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/21
303	ING13	Triang	Tongxieng	Aekkalard	Dakchung	sokong	17/11/2021
304	ING04	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/13/2021
305	ING03	Katu	Plao	Namdae	Dakchueng	Sekong	11/14/2021
306	ING14	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
307	ING07	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
308	ING14	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
309	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
310	ING03	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
311	ING04	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
312	ING14	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	6\11\2021
313	ING10	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
314	ING07	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
315	ING08	Triang	Dakbrong	Aekkalard	Dakchueng	Sekong	22/11/2021
316	ING10	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/21

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
317	ING15	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
318	ING02	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/13/2021
319	ING14	Katu	Plao	Namdae	Dakchueng	Sekong	11/14/2021
320	ING14	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
321	ING07	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
322	ING14	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
323	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
324	ING03	Triang	Dak Tiem	Xieng Luang	Dak Cheung	Sekong	8/11/2021
325	ING07	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	17/11/2021
326	ING14	Triang	Dak Yen	Xiengluang	Dakchueng	Sekong	11/6/2021
327	ING10	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
328	ING07	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
329	ING15	Triang	Dakbong	Aekkalard	dakchueng	Sekong	21/11/2021
330	ING15	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/21
331	ING11	Triang	Tongxieng	Aekkalard	Dakcheung	Sekong	16/11/2021
332	ING02	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/15/2021
333	ING14	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
334	ING15	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
335	ING14	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
336	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
337	ING04	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
338	ING07	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
339	ING02	Triang	Dak Yen	Xiengluang	dakchueng	sekong	11/6/2021
340	ING10	Triang	Dakdor	Dakduem	Dakchueng	Sekong	12/11/2021
341	ING11	Katu	Dakrun		Dakchueng	Sekong	20/11/2021
342	ING11	Triang	Dakbrong	Aekkalard	Dakchueng	Sekong	21/11/2021
343	ING08	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021
344	ING11	Triang	Tongxieng	Aekkalard	Dakcheung	Sekong	15/11/2021



HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
345	ING02	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/17/2021
346	ING02	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
347	ING02	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
348	ING14	Triang	Dakmuan	Xekhaman	Dakchung	Sekong	18/11/2021
349	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
350	ING15	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
351	ING02	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
352	ING15	Triang	DakAor	Xiengluang	Dakchueng	Sekong	22/11/2021
353	ING07	Triang	Dakdor	Dakduem	Dakchueng	Sekong	12/11/2021
354		Yae	Dakrun	Dakluem	Dakchueng	Sekong	13/11/2021
355	ING13	Katu	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
356	ING08	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021
357	ING06	Triang	Tongsieng	Aekkalard	Dakchueng	Sekong	17/11/2021
358	ING11	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/13/2021
359	ING04	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
360	ING14	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
361	ING14	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
362	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	12/8/2021
363	ING09	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
364	ING01	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
365	ING07	Triang	Dakdor	Dakduem	Dakchueng	Sekong	12/11/2021
366	ING12	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
367	ING10	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
368	ING08	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/2021
369	ING06	Triang	Tongsieng	Aekkalard	Dakchueng	Sekong	15/11/2021
370	ING11	Triang	Daklern	Aekkalard	Dakchueng	Sekong	11/13/2021
371	ING05	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
372	ING14	Katu	Ngonedone	Aekkalard	Dakchueng	Sekong	20/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
373	ING03	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
374	ING12	Triang	Nam Ngon Neua	Nam Ngon	Xan Xay	Attapue	8/12/2021
375	ING13	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
376	ING10	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	23/11/21
377	ING07	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
378	ING13	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
379	ING10	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
380	ING10	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/21
381	ING06	Triang	Tongsieng	Aekkalard	Dakchueng	Sekong	15/11/2021
382	ING13	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
383	ING13	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	19/11/2021
384	ING03	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
385	ING03	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
386	ING08	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
387	ING04	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
388	ING13	Triang	Dakrun		Dakchueng	Sekong	13/11/2021
389	ING09	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/22/2021
390	ING01	Triang	Dakchueng	Aekkalard	Dakchueng	Sekong	20/11/21
391	ING10	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
392	ING13	Triang	Dakchom	Namdae	Dakchueng	Sekong	11/16/2021
393	ING14	Triang	Ngonedone	Aekkalard	Dakchueng	Sekong	20/11/2021
394	ING03	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
395	ING11	Triang	Daktiem	Daktiem	Dakchueng	Sekong	8/11/2021
396	ING08	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
397	ING08	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
398	ING14	Triang	Dakrun	Dakrun	Dakchueng	Sekong	11/13/2021
399	ING09	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/22/2021
400	ING07	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	22/11/2021
401	ING10	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
402	ING15	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
403	ING08	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	23/11/2021
404	ING08	Triang	Dakdor	Dakduem	Dakchueng	Sekong	12/11/2021
405	ING14	Triang	Dakrun	Dakrun	Dakchueng	Sekong	11/13/2021
406	ING12	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
407	ING08	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
408	ING09	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
409	ING06	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
410	ING14	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
411	ING14	Yae	Dakrun	Dakduem	Dakchueng	Sekong	11/13/2021
412	ING01	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
413	ING08	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	15/11/2021
414	ING09	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
415	ING06	Triang	Daktreub	Xiengluang	Dakchueng	Sekong	18/11/2021
416	ING14	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
417	ING13	Triang	Dakrun		Dakchueng	Sekong	23/11/2021
418	ING13	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
419	ING08	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	17/11/2021
420	ING09	Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
421	ING14	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/22/2021
422	ING13	Triang	Dakrun				11/23/2021
423	ING09	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
424	ING14	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
425	ING09	1. Laos	Dakmuan	Xekhaman	Dakchueng	Sekong	18/11/2021
426	ING07	Triang	Dakdor	Dakdor	Dakchueng	Sekong	12/11/2021
427	ING06	Triang	Dakdor	Dakduem	Dakchueng	Sekong	11/11/2021
428	ING09	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
429	ING14	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
430	ING05	2. Triang	Dakmuan	Xekhaman	Dakchueng	Sekong	11/18/2021
431	ING15		Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021

HH No.	Enumerator Code	Ethnic origin	Village	Sub-District	District	Province	Date (DD/MM/YYYY)
432	ING03	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
433	ING04	Triang	Dakbong	Aekkalard	Dakchueng	sekong	21/11/2021
434	ING03	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/15/2021
435	ING07	other	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
436	ING14	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/23/2021
437	ING13	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
438	ING14	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	11/23/2021
439	ING06	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
440	ING10	Triang	Tongxieng	Aekkalard	Dakchueng	Sekong	17/11/2021
441	ING02	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
442	ING05	Katu	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
443	ING13	other	Dakbong	Aekkalard	Dakchueng	Sekong	11/24/2021
444	ING06	Yae	Dakbong	Aekkalard	Dakchueng	Sekong	11/21/2021
445	ING01	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021
446	ING09	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	22/11/2021
447	ING04	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	22/11/2021
448	ING06	Triang	Dakbong	Aekkalard	Dakchueng	Sekong	21/11/2021

## **APPENDIX I      STAKEHOLDER ENGAGEMENT (LOCAL EIA)**

## Summary of Past Engagement Activities for the Project

**Table 1: Engagement with Affected Communities during EIA**

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
<b>2<sup>nd</sup> Consultation for EIA Preparation, 7-23 September 2020 (18 villages)</b>							
1	9 September 2020	Ban Dak Tiem, Dakcheung District				<p>Disseminate the information about the project to the village peoples by giving the explanations on the change of locations, boundaries of the project, benefits and potential impacts of the project.</p> <p>Provides the opportunity to participants from all parties to ask questions and give comments.</p> <p>Interviews were conducted to collection data on viewpoint, socio-economic data, data on population, ethnic groups, living style, land use and forest data that are related to the livelihoods of the people and other social data in the villages.</p>	<ul style="list-style-type: none"> <li>■ Provide funding assistance for improving clean water system to the village.</li> <li>■ Provide funding assistance for building the village administration office.</li> <li>■ Provide promotion fund to create vocation for the people in the village, such as: recruit village labor force to work with the project.</li> <li>■ Help to improve access road to the village and the road within the village.</li> <li>■ Request the project to provide a new transformer to the village, because the existing transformer is out of use.</li> </ul>
2	10 September 2020	Ban Dak Seng, Dakcheung District				As above	In general, the village Administration Authority and the people agree with the project which will come to undertake development in the vicinity area of the village. As the village is not affected from the installation of wind turbine towers and the construction of road in this village area, it has no request to the project.
3	12 September 2020	Ban Dak Yang, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Help to build dispensary (health center), gravity-fed water system, toilets for the village.</li> <li>■ Help to provide water pipes or build and install irrigation system to supply water for rice cultivation for the village in order to increase rice production and achieve rice sufficiency for consumption in the village.</li> <li>■ Help to provide fund for improving road from Ban Dak Yang to Ban Dak King to allow travel on vehicle more convenient.</li> <li>■ Help to build school for the village.</li> </ul>
4	12 September 2020	Ban Sieng Ar, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Help to clear the access road to Ban Xieng Mai and to Ban Sieng Ar and road within the village to each production area of the people according to the suitability of the village area.</li> <li>■ Help to provide fund for sufficient supply of gravity-fed water system and toilets to the poor people or to each family in the village.</li> <li>■ Help to build bridge crossing Houay Air stream to facilitate the travel in the village.</li> <li>■ Help to build a permanent primary school for the village to assist inclusive education in the village.</li> <li>■ Help to build a dispensary to provide facilities to the village in case of sickness or emergency in the village area.</li> <li>■ After the construction of the project, the village shall be able to use the electricity widely.</li> </ul>
5	14 September 2020	Ban Dak Treb, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ If the land (crop cultivation land, paddy field land, construction land, etc.) of the village people is affected, the project must give reasonable compensation.</li> <li>■ Request to undertake the village settlement planning along the sides of Road 16A.</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>Help for vocation allocation, provide fund for animal raising to each family in the village.</li> <li>Help to provide fund for building the village administration office (size:10 x 20 m), expand the electricity network, build large irrigation system-scale, build complete secondary school and sport field, build dispensary, provide toilet seats and fruit- roofing sheets and tree saplings to the village.</li> <li>Help to provide fund for building bridge crossing Houay Ang stream at 3 points.</li> <li>Provide fund for buying 5 motorcycles and full set of community radio with 4 loud speakers for the village.</li> <li>When the project is launched, request to adopt the policy to recruit village labour force to work with the project.</li> </ul>
6	14 September 2020	Ban Dak Dern (Dak Yand), Dakcheung District				As above	<ul style="list-style-type: none"> <li>If the land (crop cultivation land, paddy field land, construction land, etc.) of the village people is affected, the project must give reasonable compensation.</li> <li>Help to provide fund for the construction and improvement of road within the village and road to the agricultural areas, and help the clearing of areas for lowland paddy cultivation to the people in order to decrease the slash-and-burn cultivation practice in the village.</li> <li>Provide fund for building the village administration office, 2 complete secondary schools and build water closets and provide toilet seats, teaching &amp; learning equipment to all schools in the village.</li> <li>Provide rice to poor families in the village.</li> </ul>
7	15 September 2020	Ban Xieng Luang, Dakcheung District				As above	<ul style="list-style-type: none"> <li>Help the clearing of additional areas for lowland paddy cultivation for the people within the village.</li> <li>Help the area clearing for road and livelihood place for the people in the village.</li> <li>In case of occurrence of land impact, request to avoid the impact on paddy field land, crops cultivation land and construction land of the people in the village.</li> <li>Avoid selecting the wind turbine tower site which is located near the village area.</li> <li>In case the project is required to clear the paddy field land and coffee plantation land of the people, the project must give reasonable compensation.</li> <li>Request to provide assistance to poor families in the village.</li> <li>If the project is constructed, request the project to pay financial obligation to the village at the rate of 1 million Kip per 1 tower which shall be considered as the funding assistance to the village land which is affected by the project.</li> </ul>
8	16 September 2020	Ban Dak Dor, Dakcheung District				As above	<ul style="list-style-type: none"> <li>Request for help to build irrigation to supply water to the rice field for the village.</li> <li>Request for help to improve the road within the village and the school area.</li> <li>Request for help to build the village administration office.</li> </ul>
9	16 September 2020	Ban Dak Yoin				As above	<ul style="list-style-type: none"> <li>Before carrying out any activity during the pre construction phase, the project shall contact or coordinate with the village first.</li> <li>In case there is any area of the village which is affected, it is requested that compensation for damage shall be made for each household including for the collective forest area of the village based on the laws and regulations and on the suitability of the compensation.</li> <li>Request for help to make new village area planning.</li> <li>Request for help to provide fund for building new school.</li> <li>Request for help to clear the area for rice field area and build the water channel to supply water to rice field conveniently.</li> <li>Request for help to build gravity-fed water system with clean water for the village.</li> <li>Request for help to provide fund for the construction of fish pond and fish breed to make the collective fish pond of the village.</li> <li>Request for help to provide medicines for general and collective use in the village</li> </ul>
10	16 September 2020	Ban Dak Run, Dakcheung District				As above	<ul style="list-style-type: none"> <li>Provide fund for building school (size: 32 m x 28 m with 4 classrooms), including the supply of educational equipment, tables and chairs for students.</li> <li>Request for help to build the village administration office (size: 8 m x 7 m), including the furniture which are necessary for use at the office.</li> <li>If there is the construction of towers in the village area, request to give the priority of hiring to the workforce of the village.</li> </ul>
11	19 September 2020	Ban Dak Kang, Dakcheung District				As above	<ul style="list-style-type: none"> <li>Request for help to improve the road within the village, including the production area of the village (with the length of about 9 km).</li> <li>Request for help to provide taps of gravity- fed water system for the whole village.</li> <li>Request for help to make new rice field area planning to the people in the village.</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>■ Request for help to build water closets and provide the toilet seats for the village.</li> <li>■ Request for help to improve the canal or to build the irrigation system and install the pipe to drain and supply water for rice cultivation better than before.</li> <li>■ Request for help to improve and make village area planning to allow it to become orderly.</li> <li>■ Request for help to provide rice to poor families in the village.</li> </ul>
12	9 September 2020	Ban Dak Dor, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ Request to give reasonable compensation for the land area affected by the project based on actual situation.</li> <li>■ The village have worried about the impact on natural livestock raising.</li> <li>■ Request to make village area planning to allow it to become more orderly.</li> <li>■ Before commencing the construction, the project must perform the ceremony of offerings in accordance with the tradition and belief of the people in the villages</li> <li>■ Request to build the village administration office and improve the access road to the village to allow convenient travel; and build the bridge crossing Houay Ang stream.</li> <li>■ Request the project to help to pay the obligation to the village for using as budget for village Fund and provide 1 motorcycle for serving the work of the village administration office.</li> <li>■ Request the project to hire the people in the village to work as workers in the project and help to reduce the problem of unemployment</li> </ul>
13	9 September 2020	Ban Dak Xied, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ The Village Administrative Authority has agreed with the project which will come to assist in the development of the village.</li> <li>■ Request the project to give reasonable compensation to project affected persons, including for collective land of the village based on actual situation.</li> <li>■ Provide assistance to poor people; help to provide job to the people in the village.</li> </ul>
14	10 September 2020	Ban Dak Samor, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ Request for help to provide fund for road improvement and make the planning of village area to allow it to become orderly.</li> <li>■ Request to build 1 village administration office and the gravity-fed water system for the whole village.</li> <li>■ Help to provide loud speaker system and telephone signal network for the village.</li> <li>■ Help to provide livestock to the people in the village.</li> </ul>
15	10 September 2020	Ban Dak Nong, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ Help to provide gravity-fed water system to the village and toilet seats and build water closets to the village widely.</li> <li>■ Request for help to build a village administration office, dispensary and make the plan of the village area to make it orderly.</li> <li>■ Request for help to build bridges across each stream in the village.</li> <li>■ Request for help to provide 1 motorcycle for serving the administrative work of the village.</li> <li>■ Request for help to clear land for production purpose for the village.</li> </ul>
16	10 September 2020	Ban Dak Nhok, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ The village has generally agreed with the project which will come as the village also want the project to come to develop and help the village.</li> <li>■ Request for help to provide fund for building road, telephone signal network for the village, gravity-fed water system, toilet seats, assistance to poor families in the village and make village plan to allow the village to become orderly.</li> <li>■ Request the project to recruit the workforce or workers from the village to work with the project.</li> </ul>
17	11 September 2020	Ban Nam Ngone Neua, Sanxay District				As above	<ul style="list-style-type: none"> <li>■ The village has agreed with the establishment of the project.</li> <li>■ In case the people's land and the village collective land are affected, compensation for project affected persons must be fully carried out before starting the project construction work.</li> <li>■ Request the company to pay monthly tax to the village at the rate of 2,500,000 kip per month.</li> <li>■ Request for help to build the village administration office and provide office equipment in full.</li> <li>■ Request for help to improve the road within the village and surrounding the village area.</li> <li>■ Request for help to provide food and vehicle for collective use of the village.</li> <li>■ Request for help to bore artesian wells and build electric network for the areas which have no network or have insufficient network in the village</li> <li>■ Request for help to build school and provide full set of educational equipment.</li> <li>■ In case the project comes to contact for the actual construction, the project shall first communicate and contact with the Administration Authority.</li> </ul>



No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
18	12 September 2020	Ban Dak Padoo Mai , Sanxay District				As above	<ul style="list-style-type: none"> <li>■ This village has agreed with the establishment of the project.</li> <li>■ Before starting the construction work, the project shall coordinate with the village. In case in the future, the selection of land for using in the project construction affects the production land of the people, the project must find the solution or give reasonable compensation before starting the implementation of the project.</li> <li>■ Request the project to build the village administration office, kindergarten, primary school and complete secondary school, water closets and toilets, gravity-fed water system, village meeting hall, accommodation place for voluntary teachers and 1 motorcycle for using as collective asset of the village.</li> <li>■ Request for help to make the plan of rice field area and other agricultural production areas for the people in the village.</li> <li>■ Request for help to improve the village surrounding road to allow it to be used in both seasons and make new plan of the village to ensure orderliness in the village.</li> </ul>
<b>1<sup>st</sup> Consultation for EIA Preparation, 12-21 November 2014 (16 villages)</b>							
1	2014	16 villages (as listed below for 2014)				Socio-economic data collection	
2	12 November 2014	Ban Prao, Dakcheung District				Disseminate Project related information and consultation at village level	<ul style="list-style-type: none"> <li>■ Request the project developer to avoid the installation of the wind turbine towers on the village cemetery or graveyard. Any tower planned to be located on this place shall not be allowed to be installed because it is a sacred and respected place of the village.</li> </ul>
3	12 November 2014	Ban Dak Rem, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ When the project comes to conduct the survey in each time, it shall take along someone from the village for helping to avoid the prohibited places.</li> </ul>
4	13 November 2014	Ban Dak Dor, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Request to improve the infrastructure system and public facilities, such as: improve the access road to the village and to the production areas, provide clean water, gravity-fed water system, build village administration office, and help to connect the electricity to the village.</li> </ul>
5	14 November 2014	Ban Dak Yoin, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Promote vocation for the people; adopt the policy to recruit village labour force to work with the project.</li> </ul>
6	15 November 2014	Ban Dak Treb, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Help to build the dispensary (health center) or to establish village medical boxes; provide the fund for building toilets for the people.</li> </ul>
7	15 November 2014	Ban Xieng Luang, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Build schools; provide scholarships for poor children in the villages.</li> </ul>
8	16 November 2014	Ban Dak Yang, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Promote animal raising, particularly cattle, buffaloes, pigs, goats, ducks, chickens and others; provide training on the prevention of animal diseases in the villages.</li> </ul>
9	16 November 2014	Ban Sieng Mai, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Give reasonable and fair compensation for loss to the project affected persons.</li> </ul>
10	17 November 2014	Ban Dak Vaiy, Dakcheung District				As above	<ul style="list-style-type: none"> <li>■ Have the policy to assist poor families that have no labour force to undertake the production.</li> </ul>
11	17 November 2014	Ban Dak Tiem, Dakcheung District				As above	
12	18 November 2014	Ban Dak Seng, Dakcheung District				As above	
13	18 November 2014	Ban Dak Run, Dakcheung District				As above	
14	20 November 2014	Dan Dak Dor, Sanxay District				As above	

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
15	20 November 2014	Ban Dak Yok, Sanxay District				As above	
16	21 November 2014	Ban Dak Samor, Sanxay District				As above	
17	21 November 2014	Ban Dak Sied, Sanxay District				As above	

**Table 2: Engagement with Other Interested Stakeholders during EIA and ESIA Preparation**

No.	Date	Meeting Location	Stakeholder Organization/ Groups	Number of Attendees	Methods of Engagement	Key Topics Discussed and Stakeholder Feedback	Relevance in the ESIA
<b>Engagement with Other Interested Stakeholders for EIA Preparation</b>							
1	July 2018	Meeting room of the Provincial Department of Natural Resources and Environment of Sekong Province	<ul style="list-style-type: none"> <li>Mr. Phouvong Luangxaysana, Director General of Department of Natural Resources and Environment Policy (now Department of Environment),</li> <li>Mr. Phetdaovong Bounmysavat, Deputy Director of Provincial Department of Natural Resources and Environment of Sekong Province,</li> <li>Mr. Phounsouk Phichit, Deputy Director of Provincial Department of Natural Resources and Environment of Attapeu Province, and</li> <li>Participants from other agencies of central, provincial and district levels,</li> </ul>	63	Consultation Meeting at Technical Level	<p>The opinions and proposals of the participants of this meeting may be summarized as follows:</p> <ol style="list-style-type: none"> <li>The study on risk of impacts shall separate and analyze to allow to see clearly the direct impacts and indirect impacts, such as: <ul style="list-style-type: none"> <li>Impact on production land;</li> <li>Impact on area which is overlapping with the area of other development project located nearby;</li> <li>Plan of the access road to the tower foundations;</li> <li>Budget for environmental management activities;</li> <li>Plan of road use for transport of materials to the project;</li> <li>Wastes and wastewater management;</li> <li>Supervision of workers;</li> <li>Plan of management and restoration of borrow pits;</li> <li>Prohibitions of the project relating to the environmental management, such as: hunting, logging, fishing, etc.;</li> <li>Impact on forests; and</li> <li>Impact on birds.</li> </ul> </li> <li>In order to ensure clear analysis of the risk of impacts on each aspect, it is required to make more detailed and clearer analysis, such as: <ul style="list-style-type: none"> <li>The impact assessment shall be based on each activity of the project and shall be summarized in the table that show the impacts in full.</li> <li>Data of the project development plan to allow to see the overall picture of the project development plan.</li> </ul> </li> </ol>	
2	May 2016	Meeting room of the District Administration	<ul style="list-style-type: none"> <li>Deputy Chief of Environmental and Social Impact Assessment Unit,</li> </ul>	70	Consultation Meeting at District Level	<ol style="list-style-type: none"> <li>The general opinions show agreement and consensus with the construction and development of the 600 MW Monsoon Wind Farm Project.</li> </ol>	6.

	Office of Dakcheung District of Sekong Province	<ul style="list-style-type: none"> <li>• Deputy Chief of District of Dakcheung District of Sekong</li> <li>• Deputy Chief of District of Sanxay District of Attapeu Province</li> <li>• Deputy Director of Provincial Department of Natural Resources and Environment of Sekong Province</li> <li>• Deputy Director of Provincial Department of Natural Resources and Environment of Attapeu Province</li> <li>• Other participants</li> </ul>			<ol style="list-style-type: none"> <li>2. Request to have the Environmental Management and Monitoring Plan including the Socio-Economic Development Plan and budget of this investment project.</li> <li>3. Request to conduct detailed study of data on impacts to the peoples and to closely coordinate with the locality to clearly determine compensation for production land of the peoples; and to ensure the coordination and consultation in each level to create awareness and understanding about this project development plan. Request to increase the technical information of the project to allow to know the risks and impacts and avoid the anxieties relating to the construction of the project.</li> <li>4. Request to conduct the study on the impacts in each phase of the project and the activities of the project in a detailed and clear manner and make comparison of the data of the environmental standards values in the project area.</li> <li>5. Request to contribute to assist in the construction and improvement of infrastructure, improvement of livelihood of the people in the project area in order to ensure public participation in various activities of the project.</li> </ol>	
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## **APPENDIX J      FGD AND KII SUMMARY**

## Summary of FGDs and KIIs

**Table 1: Engagement with Affected Communities during ESIA Preparation**

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
<b>Consultation for Supplementary ESIA Preparation in Xanxai District, 6 – 10 December 2021 (8 villages)</b>							
1	8 December 2021	Dak Padoo Village	5	3	8	Socio-economic data collection FGDs and KIIs with relevant groups (women, livelihoods, local authorities, youth, healthcare personnel, and CBO)	<ul style="list-style-type: none"> <li>■ Major concern is on road safety due to road improvements and increased traffic</li> <li>■ Questions on the when the Project construction will start, Project details and what developments the Project will support the village with</li> <li>■ The Project should allows the village to have access to energy for public infrastructure (schools, healthcare centers) from the Project</li> <li>■ Concerns about the influx of labor into the village because there will be a large number of local workers coming into the village</li> <li>■ Concerns have been raised about road divisions, as transport routes are being used to transport various types of equipment through the village.</li> <li>■ Impact of the project on the type of village resources in the water,</li> <li>■ The Project to follow the belief and tradition of the village if the project affects the sacred area</li> <li>■ The suggestion is to be able to bring electricity into the home on a regular basis, for homes that are insufficient or non-existent.</li> <li>■ Recommendations Community project development plans and coffee growing initiatives are intended to promote coffee product development and storage plans.</li> <li>■ Development needs are assistance in the construction of irrigation, paved roads and coffee processing</li> <li>■ The village wants to have a program to help paved roads, improve the economy and expand education, establish a health center, a village office and a village market in the village</li> </ul>
2	8 December 2021	Nam Ngon Neua Village	5	2	7	As above	<ul style="list-style-type: none"> <li>■ Questions on the when the Project construction will start, Project details and what developments the Project will support the village with</li> <li>■ The Project may potentially forest area, grazing area and some farm land within the village</li> <li>■ The recommendations for community development plans are to improve agricultural, infrastructure, education and healthcare for the village</li> </ul>
3	7 December 2021	Dak Xuem Village				As above	<ul style="list-style-type: none"> <li>■ The Project to help improve village's infrastructures including roads, school, healthcare centers, headman's office, and gravity flow system</li> <li>■ Concern on safety of women and children in the village due to worker influx</li> <li>■ Concerns that natural resources particularly NTFP products such as Dok Hangsing, Dok Lai will be impacted by the Project</li> <li>■ Concerns about noise impact on wildlife which may cause wildlife to relocate to other areas</li> <li>■ Concern on Project impact's on forest resources</li> <li>■ The Project to help support development of agriculture and livestock</li> <li>■ The Project to provide support on coffee plantation, breeding, collection, storage and factory, as well as linkage of coffee products to the markets</li> <li>■ Not sufficient information about the Project</li> </ul>
4	7 December 2021	Dak Dor Village	6	5	11	As above	<ul style="list-style-type: none"> <li>■ The Project to help improve village's infrastructures including roads, school, healthcare centers, headman's office, irrigation system, electricity and gravity flow system</li> <li>■ The village needs programs to support handicraft and weaving for women</li> <li>■ Not sufficient information about the Project</li> <li>■ The Project should provide job opportunities for the village</li> <li>■ Concerns that natural resources particularly NTFP products such as Dok Hangsing, Dok Lai will be impacted by the Project</li> <li>■ The Project to help support development of agriculture and livestock</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>■ The Project to provide support on coffee plantation, breeding, collection, storage and factory, as well as linkage of coffee products to the markets</li> <li>■ The village need some project or programs to support to building of the irrigation or water sources for developing agriculture activities</li> <li>■ Concerns about drug issues, and women and child safety due to increase traffic and worker influx</li> <li>■ The Project should provide support on</li> </ul>
5	6 December 2021	Dak Xied Village	3	2	5	As above	<ul style="list-style-type: none"> <li>■ If project will development need project help improve infrastructure in the village including schools and healthcare centers</li> <li>■ Concerns about children safety due to road improvement and increased traffic</li> <li>■ The Project to help with create occupations for people</li> <li>■ The Project to support development of agriculture cultivation and livestock</li> <li>■ Request for more programs to help with education and nutrition</li> </ul>
6	6 December 2021	Dak Nong Village	4	3	7	As above	<ul style="list-style-type: none"> <li>■ The village needs water sources for drinking water in the village</li> <li>■ The village needs healthcare centers and sanitation in the village to be improved</li> <li>■ The village needs Project's support or improve infrastructures, education and sanitation in the village</li> <li>■ The Project will increase job opportunities for the village</li> <li>■ NFTP products in which people collect to sell are likely to be affected form project</li> <li>■ The village needs the Project help with improve about of agriculture activity and livestock</li> <li>■ Need the gravity flow system for supply, agriculture and education in the area</li> <li>■ Concern on safety of women and children in the village due to worker influx</li> </ul>
7	5 December 2021	Dak Samor Village	7	4	11	As above	<ul style="list-style-type: none"> <li>■ Questions on the when the Project construction will start</li> <li>■ Question on what support will the Project provide to the village</li> <li>■ Question on how the Project will compensate for affected land</li> <li>■ Question on if the people can continue using land under the wind turbine towers and the transmission line</li> <li>■ Need the Project to help with infrastructure improvement, particularly education facility for village</li> <li>■ Deforestation will pose risk on water resource</li> <li>■ The Project should help promote agriculture and livestock</li> <li>■ Concern on safety of women and children in the village due to worker influx</li> </ul>
8	5 December 2021	Dak Yok Village	5	4	9	As above	<ul style="list-style-type: none"> <li>■ Concern that if cultivation lands are affected, they will not have replacement plan for cultivation and/or livestock</li> <li>■ Concerns about shadow flickers and noise impacts of the wind turbines</li> <li>■ Concerns that natural resources particularly NFTP products such as Dok Hangsing, Dok Lai will be impacted by the Project</li> <li>■ The Project to provide appropriate and fair compensation and assistance for affected households</li> <li>■ The Project should help improve infrastructures in the village including health center and school</li> <li>■ Request the project to hire the people in the village to work as workers in the Project</li> <li>■ The Project to provide assistance in building gravity flow water system for the village, so people will have sufficient water and food</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>The Project should support development of coffee farm, cassava farm to have higher productivity</li> </ul>
<b>Consultation for Supplementary ESIA Preparation in Dakcheung District, 6 – 23 November 2021 (23 villages)</b>							
9	23 November 21	Dak Treb Village	6	4	10	As above	<ul style="list-style-type: none"> <li>The Project should inform the village prior construction commencement</li> <li>The Project should provide support on cultivation of coffee, cassava, passion fruit and rice farms</li> <li>The Project should provide vocational training such as handicrafts and weaving</li> <li>The Project should provide support on cassava and coffee processing</li> <li>Concerns that women and children maybe trafficked as the communities will be more exposed to outsiders</li> <li>The Project should provide support on improved access to markets and trade</li> <li>Natural resources will decrease as a result of Project development</li> <li>The Project should promote tourism in the area once the wind farm is in operation</li> <li>The Project should provide job opportunities for youth and people in the affected villages</li> </ul>
10	23 November 21	Dak Ran Village	12	6	18	As above	<ul style="list-style-type: none"> <li>Villagers do not have sufficient information about the Project</li> <li>Concerns about impacts on their cultivation land</li> <li>Concern about noise and shadow flicker impacts of the wind turbines</li> <li>Concerns that women and children maybe trafficked as the communities will be more exposed to outsiders</li> <li>The Project is expected to hire people from the villages to work in the Project construction</li> <li>Concerns about the Project impact on cemetery and productive forests</li> <li>The Project to provide assistance to poor households</li> <li>The Project should support improvement of agriculture, livestock, road and mobile phone signal</li> </ul>
11	21 November 21	Dak Bong Village	1	8	9	As above	<ul style="list-style-type: none"> <li>Concern about Project's impacts on cultivation land and inappropriate/unfair compensation</li> <li>The Project should support on coffee processing</li> <li>Concerns that women and children maybe trafficked as the communities will be more exposed to outsiders</li> <li>The Project should help on building school, village office and other development plan</li> <li>The Project should hire local labor from the village to work in the Project construction</li> <li>Impacts to NTFPs due to decreased forest areas</li> <li>The Project should provide support on vocational training for youth</li> </ul>
31	20 November 20221	Dak Chueng Village	3	5	8	As above	<ul style="list-style-type: none"> <li>The Project should inform the village prior construction commencement</li> <li>The Project should provide support on cultivation of coffee, cassava, passion fruit and rice farms</li> <li>Support to educate people about trade</li> <li>The village needs help with food, clothing and fund for do agriculture activities</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>■ The village needs vocational skill (handicraft and weaving), processing the cassava and coffee</li> <li>■ The Project should promote tourism in the area</li> <li>■ Concern on the Project's impact on cultivation land</li> <li>■ Natural resources will decreasing</li> <li>■ Concern on landslides induced by the Project activities</li> </ul>
12	20 November 21	Ngon Don Village	4	4	8	As above	<ul style="list-style-type: none"> <li>■ Concern that the Project will not help with village development as promised</li> <li>■ Concern about COVID-19 as there will be workers and people from outside communities</li> <li>■ The Project should have agricultural development plan and livestock development plan</li> <li>■ The Project activities may affect water resources and wildlife</li> </ul>
13	18 November 21	Dak Muan Village	7	6	13	As above	<ul style="list-style-type: none"> <li>■ Concern that the Project will affect people's houses and compensation for affected cultivation land</li> <li>■ Cultivation land might be affected by the Project</li> <li>■ They have questions regarding the construction commencement date and which country the owner of the Project is</li> <li>■ The Project should provide support on agriculture and product processing, and irrigation system to rice farms</li> <li>■ The Project should provide vocational trainings, particularly for women</li> <li>■ The Project should provide scholarships to students</li> <li>■ The Project should provide job opportunities to people in the village and promote tourism in the area</li> </ul>
14	18 November 21	Dak Yang Village	10	9	19	As above	<ul style="list-style-type: none"> <li>■ The Project should inform the village prior construction commencement</li> <li>■ The Project should provide support on cultivation of coffee, cassava, passion fruit and rice farms</li> <li>■ Concerns that women and children maybe trafficked into sex labors as the communities will be more exposed to outsiders</li> <li>■ The Project should support on improvement of roads, education, healthcare centers and productivity of cultivation</li> </ul>
15	17 November 21	Dak Ta-ok Noi Village	5	4	9	As above	<ul style="list-style-type: none"> <li>■ Concern about safety related to Project construction and operation</li> <li>■ The Project should avoid impacts to cultivation land as much as possible</li> <li>■ The Project has to ensure safety for villagers who farm under the wind turbine towers and transmission line</li> <li>■ The Project should hire labors from the village for the Project construction</li> <li>■ The Project should provide support on improvement of education and economic</li> <li>■ They need equipment and supply for healthcare centers</li> <li>■ The Project should provide vocational training for the village such as cultivation of crops that have higher value to generate more income, agriculture methods and equipment and access to markets</li> <li>■ Concern about COVID-19 as there will be workers and people from outside communities</li> <li>■ The village need support on food and clothes</li> <li>■ Natural resources will decrease as a result of the Project development</li> </ul>



No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
16	17 November 21	Dak Pum Village	2	4	6	As above	<ul style="list-style-type: none"> <li>■ The Project should provide vocational training for youth</li> <li>■ Concerns about landslides induced by the Project</li> </ul>
17	16 November 21	Dak Dom Village	2	1	3	As above	<ul style="list-style-type: none"> <li>■ The Project should inform the village prior construction commencement</li> <li>■ The Project should provide support people education, health, economic, and agriculture</li> <li>■ The Project should support on processing of agricultural product</li> </ul>
18	16 November 21	Dak Jom Village	2	1	3	As above	<ul style="list-style-type: none"> <li>■ Concern about COVID-19 as there will be workers and people from outside communities</li> <li>■ The Project should provide support on cultivation of coffee, cassava, passion fruit and rice farms</li> <li>■ Job opportunities for the people in the village from the Project</li> </ul>
19	15 November 21	Tong Xieng Village	9	9	18	As above	<ul style="list-style-type: none"> <li>■ Concern about Project's impacts on cultivation land and inappropriate/unfair compensation</li> <li>■ The Project should inform the village prior construction commencement</li> <li>■ Concern about COVID-19 as there will be workers and people from outside communities</li> <li>■ The people request for more compensation details</li> <li>■ The Project should support improvement of income, agriculture and healthcare facilities</li> <li>■ The people questioned if they can farm under the wind turbine towers and transmission line</li> </ul>
20	14 November 21	Dak Kang Village	1	0	1	As above	<ul style="list-style-type: none"> <li>■ The Project should provide support on education, health, economic and agriculture</li> <li>■ The Project should protect the forest resources</li> </ul>
21	14 November 21	Prao Village	11	5	16	As above	<ul style="list-style-type: none"> <li>■ Concern about impact on cultivation land and crop productivity</li> <li>■ They need more area for rice cultivation for people to have occupation and sufficient rice for consumption</li> <li>■ They need support on agriculture, coffee cultivation and processing, and livestock</li> <li>■ There should be a management plan in place for logging activities</li> <li>■ Concerns that women and children maybe trafficked as the communities will be more exposed to outsiders</li> <li>■ The Project should provide job opportunities for the people in the village</li> <li>■ The Project should avoid protected forest to avoid impacts on wildlife</li> <li>■ The village need secondary school, road improvement and linkage to the markets to sell their products</li> <li>■ Accidents related to Project construction and operation activities</li> </ul>
22	13 November 21	Dak Lern Village	8	9	17	As above	<ul style="list-style-type: none"> <li>■ The Project should hire local labor from the village to work in the Project construction</li> <li>■ The Project should provide vocational skill (handicraft and weaving) and support sexual education</li> <li>■ The Project to help with irrigation system, livestock breeding and plant breeding</li> <li>■ The Project to support economic development in the village</li> <li>■ Concern about Project's impacts on cultivation land and inappropriate/unfair compensation</li> <li>■ Natural resources will decrease</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
23	12 November 21	Dak Xieng A Village	2	1	3	As above	<ul style="list-style-type: none"> <li>Project related concerns and suggestions were not discussed during FGDs.</li> </ul>
24	11 November 21	Dak Dor Village	6	5	11	As above	<ul style="list-style-type: none"> <li>Concerns about labor influx into the village</li> <li>The Project should avoid impacts on sacred forest and households as much as possible</li> <li>Concern about nuisance and safety from the outsiders that will come into the villages</li> <li>The Project should provide support on road improvement and building of bridge</li> <li>They expect the Project to hire youth from the village to work in the Project</li> <li>The Project should work together with the government and private sector to improve socio-economic development in the village such as provide vocational trainings to the villagers and increase access to markets and trade for the villagers.</li> </ul>
25	11 November 21	Dak Den Village	2	1	3	As above	<ul style="list-style-type: none"> <li>Concerns about the impacts of the Project land acquisition on cultivation land and that they will not get compensation from the Project</li> <li>Concerns that the Project will not follow the proposed mitigation measures</li> <li>Concerns about decrease natural resources</li> <li>The Project should consult with village head before taking any actions to ensure that the Project follow the local belief and rituals</li> </ul>
26	10 November 21	Dak Xeng Village	2	0	2	As above	<ul style="list-style-type: none"> <li>Some households will lose their land due to the Project land acquisition, and they may not have land for cultivation</li> <li>Concerns about the diseases, particularly COVID-19</li> <li>Concerns about accidents related to road traffic</li> <li>Ecosystem and animals are important for livelihoods of the local</li> </ul>
27	10 November 21	Xieng Luang Village	3	4	7	As above	<ul style="list-style-type: none"> <li>They do not have sufficient knowledge about the Project</li> <li>If the Project transmission line affects any households, it should be moved to avoid impacts on households</li> <li>Concern over girls and children may be deceived and trafficked by outsiders</li> <li>The Project should provide assistance on processing and trade of coffee</li> <li>The forests will be impacted by the Project transmission line</li> <li>The Project should communicate with village heads and villagers on affected land</li> <li>The Project should provide support on livestock raising, irrigation, education and health facilities</li> </ul>
28	10 November 21	Trong Muang Village	2	0	2	As above	<ul style="list-style-type: none"> <li>Concern about COVID-19 as there will be workers and people from outside communities</li> <li>The village was affected by road development; however, they did not receive compensation from such project. Therefore, they are concerned about compensation from the Project.</li> </ul>
29	8 November 21	Dak Tiem Village	33	49	82	As above	<ul style="list-style-type: none"> <li>The local people asked if the land under the Project transmission line and wind turbine towers can be used as per usual</li> <li>Concerns about safety related to road and Project construction and operation</li> <li>Concerns about safety related to high voltage transmission line</li> <li>During construction, if the Project dredge in the rivers or streams which are used by people, the Project must compensate to the affected people</li> </ul>

No.	Date	Meeting Location and Communities	Number of Attendees			Methods of Engagement	Key Topics Discussed and Stakeholder Feedback
			Male	Female	Total		
							<ul style="list-style-type: none"> <li>■ Concerns about shadow flickers and noise impacts of the wind turbines</li> <li>■ The Project should provide assistance for improvement of education, healthcare and coffee plantation</li> <li>■ Concerns that the Project will impact cemeteries</li> <li>■ Concern about loss of production land and livestock raising land and unfair compensation</li> </ul>
30	6 November 21	Dak Yen Village	8	3	11	As above	<ul style="list-style-type: none"> <li>■ Concern that the Project will affect the village cemeteries</li> <li>■ Concern about noise and shadow flicker impacts of the wind turbines</li> <li>■ Question on farming under the transmission line and wind turbine towers</li> <li>■ Question if the villagers in the Project area will be able to use electricity generated by the Project</li> <li>■ The Project may result in decreased forest areas</li> <li>■ Concern about COVID-19 as there will be workers and people from outside communities</li> <li>■ The Project should provide support on improvement education, healthcare centers, agriculture and irrigation and vocational training such as weaving training for women</li> </ul>

## **APPENDIX K      SPECIFICATIONS OF THE TRANSMISSION LINE**

## **APPENDIX K\_1    35 kV TRANSMISSION LINE**

# 600 MW Monsoon Onshore Wind Farm in Laos

## Proposed 35 kV transmission line

### 1. 35kV underground and overhead Transmission Line Design and concept

Underground cable will be directly buried under 0.8 meters, consider the protection of pipes when crossing the road, cable wells at the joints area only, and there will be no cable wells at other locations.

Overhead lines should avoid residential areas, grave areas, and protected areas, and the line should try to go direct way to be as short as possible. The path should be kept at least 40 meters away from the WTG, and the cable is at least 7 meters above the ground, structure of double-circuit on the same tower or single-circuit on the same tower where it is applicable.

### 2. Proposed conductor and ground wire

The conductor is steel core aluminum stranded wire, and the ground wire is Optical Fiber Composite Overhead Ground Wire (OPGW).

### 3. Proposed insulation coordination

35kV shall conform to the latest applicable IEC standards.

### 4. Proposed insulator strings

The material of insulator strings is glass, porcelain or composite materials, and the quantity is to be determined with the material, voltage level and local altitude conditions.

### 5. Proposed load condition and wire arrangement

The structure of double-circuit on the same tower or single-circuit on the same tower where it is applicable, the load is confirmed according to the weather conditions on site.

### 6. Proposed support structure and foundation design concept

The iron tower adopts angle steel tower, which is designed and calculated according to weather conditions such as span, wire type, wind load, etc. The height of the tower is about 20-30m, all tower materials are hot-dip galvanized for corrosion protection, and the foundation adopts an extended foundation, using soil and concrete. The weight bears the load transferred from the upper part.

### 7. Lighting protection and grounding

This project adopts the lighting protection by installation OPGW on the top of the tower, the tower itself is grounded through grounding material, which is galvanized flat steel.

## **APPENDIX K\_2    115 kV TRANSMISSION LINE**

# **600MW Monsoon Onshore Wind Farm in Laos**

## **Q.6 Proposed 115kV transmission line**

**February 2021**



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## 1 Project Description

The Owner is developing an onshore wind farm project, with a total installed capacity of approximately 600MW, in Sekong and Attapeu provinces, Laos (the “Project” or “Wind Farm”). The Project has been developed under an exclusive right granted by the Government of Laos (“GOL”), through the Memorandum of Understanding (“MoU”) and Project Development Agreement (“PDA”) executed in November 2011 and August 2015, respectively, on land with a total area of approximately 680sqkm (the “PDA Exclusive Land” or the “Site”).

The Project has been approved by the Government of Vietnam (“GOV”) and the GOL as the first cross-border wind power project under a collaboration for the power sector in accordance with a Memorandum of Understanding between the GOV and the GOL for the supply electrical energy from power projects located within Laos to Vietnam Electricity (“EVN”).

In September 2019, IEAD executed a Tariff Memorandum of Understanding (“Tariff MOU”) with EVN which was approved by the Ministry of Industry and Trades of Vietnam for the export and sale of all power generated from the Project to the Vietnamese grid. Subsequently, in July 2020, the Prime Minister of Vietnam approved the plan for importing power generated from the Project to Vietnam’s power system via a 500kV grid connection and approved the addition of a 500kV transmission line from the Project to the Thanh My Substation to the Revised Power Development Plan VII of Vietnam.

Although the Project is located in Laos, it plans to export and sell all generated power to the Vietnamese grid. The EVN will act as a power off taker while the EVN National Power Transmission Corporation (“EVN-NPT”) will act as a grid operator of the Project.

## **1.1 Scope of Work**

The transmission lines to be supplied, constructed and installed under this Project includes:

Design, supply, delivery, transport, construction, installation, testing and commissioning of the Project from the WTGs, BOP (including intermediate onsite substations and 500kV onsite substation) and up to the interface point between the 500kV onsite substation and the 500kV transmission line (section in Laos).

## **2 General Requirement**

### **2.1 Contractor Organization**

The EPC Contractor shall maintain in its project site offices, the project organization charts of management, control and execution of the Contract. The EPC Contractor's organization and personnel shall be as stated in the proposal. Any changes in the organization and personnel will be allowed only upon approval of the Engineer of his written request.

The EPC Contractor shall maintain an up-to-date project organization charts, which shall be submitted to the Engineer for approval in the event of any changes.

### **2.2 Key Personnel**

The key positions in the organization charts of the EPC Contractor pertain to individuals assigned to management/supervisory positions, who at any time during the execution of the work can give decision and recommendation to the Engineer on matters pertaining to the proper and curly completion of the Work.

The appointment, transfer and replacement of personnel to all key positions shall be subject to the Engineer 's prior approval.

Engineering and procurement in key positions shall be committed to continue through the Contract period in order to maintain continuity.

### **2.4 Standards ad Codes**

All equipment, materials, fabrication and tests under these Specifications shall conform to the latest applicable standards, manuals and specifications contained in the following list or to equivalent applicable standards, manuals and specifications established and approved in the country of manufacture,

and accepted as equivalent by the Engineer:

◆	ACI	American Concrete Institute
◆	AISC	American Institute of Steel Construction
◆	ANSI	American National Standard Institute, Inc.
◆	ASCE	American Society of Civil Engineer
◆	ASME	American Society of Mechanical Engineer
◆	ASTM	American Society for Testing Materials
◆	AWS	American Welding Society
◆	CCITT	International Telegraph Consultative Committee
◆	IEC	International Electromechanical Commission
◆	IEEE	Institute of Electrical and Electronics Engineer
◆	ISO	International Standards Organization
◆	NEMA	National Electric Manufacturers Association
◆	TISI	Thai Industrial Standard Institute

Any details not specifically covered by these Standards and Specifications shall be subject to acceptance of the Engineer. In the event of contradictory requirements between the standards and these specification requirements, the terms of the Specifications shall be applicable.

In some places, reference is made to certain manufacturers' products, brand-name materials and items identified by registered trade-marks. This has been done to define and establish standard of quality and/or performance, and is not intended to restrict the procurement of materials or equipment to a particular manufacturer.

Any Reference made to standards and specifications, or to equipment and materials of a particular manufacture shall be identified as "or equivalent". The EPC Contractor may propose equivalent standards, specifications, materials or equipment which shall be equal in every respects to that specified. If the EPC Contractor, for any reason, proposes any equipment equivalent to, or deviated from, the above standards, the EPC Contractor shall state the exact nature of the change and the reason for making the change, and shall submit complete specifications of the materials, as well as copies of pertinent standards, for the acceptance of the Engineer, and the decision of the Engineer regarding the matter of quality will be final.

The EPC Contractor is required to provide two original copies of all standards referred in this

Specification to the Engineer within 60 days after receipt of award of the contract. All cost incurred shall be borne by the EPC Contractor.

### **3 Technical Requirement**

#### **3.1 Survey**

##### ***3.1.1 Location survey***

The location survey of the transmission line route had been performed by the Engineer. Two (2) copies of key map, plan & profile drawings and structure list for the work covered by this Contract will be furnished to the EPC Contractor after award of the Contract. All points of reference such as angle points on tangent and termination points, throughout the entire route of location survey, have been established in the field with concrete posts. However, some or all posts and / or reference points may be destroyed or undiscovered at the time of construction and some discrepancy may be found, the EPC Contractor shall be required to perform re-locating to ensure the correctness of those posts or reference points at his own expenses.

##### ***3.1.2 Check Survey***

Not less than 15 days prior to the commencement of the work, the EPC Contractor shall submit qualifications of personnel, work program, and list of survey equipment for reviewing by the Engineer.

The EPC Contractor shall perform all necessary check survey work which consists of determination, checking and laying out the accurate center line and elevation of all the reference points, based on the key map and plan & profile drawings furnished. Should an angle point marker be disturbed or destroyed, it shall be re-established by the EPC Contractor using reference ties set by the Engineer. The EPC Contractor shall determine the overall length of each tangent and any discrepancy from the plan and profile length in excess on 5 k meters where k is the length in kilometers, shall be equally prorated among all of the span lengths in that tangent. Where a major distance measurement error can be isolated to a certain span or spans or where the cumulative error over the entire tangent is in excess of 10 k meters, the matter shall be referred to the Engineer for resolution. Furthermore, the EPC Contractor shall check the minimum clearance of conductor crossing the existing the existing highway, railway, major waterway, telecommunication lines, power lines and any other object that will create less vertical clearance than that required.

During the check survey, if not enough side clearance is found, then the EPC Contractor shall perform

side clearance survey and submit to the Engineer along with recommendation for the solution of problem.

### ***3.1.3 Tower Location***

The EPC Contractor shall locate all towers at the stations shown on the plan and profile drawings. If the site of any tower as spotted in the plan & profile drawings is not suitable by reason of topographical, geological or any other affecting conditions, the EPC Contractor shall be required to recommend the proper locations of towers to the Engineer for consideration. The EPC Contractor shall carry on the work in accordance with the Engineer decision.

In case of the transmission line passing over hilly and mountaineous country and unequal legs of towers to be required, the EPC Contractor shall perform the diagonal profile and plan drawings for the selection of individual leg extension.

In the event of the EPC Contractor requesting to increase the height of the tower due to unavailability of any leg extension to suit his design, he shall be entitled to no claim for any material furnished or work performed in this respect.

Two (2) copies of corrected key map, plan & profile drawings, structure lists, check survey data, four (4) copies of diagonal profile and plan drawings of hill side structures including the proposed individual leg extension shall be submitted to the Engineer for approval.

### ***3.1.4 Tower Staking***

a. At each tower site, the EPC Contractor shall provide three red stakes on the center line of the transmission line. One stake is to be located at the center of the proposed tower location with the other two reference stakes located on the center line of the transmission line, 15 m ahead and behind the centre stake. The top of the centre stake shall be driven to an elevation to be known as the working point from which the line and level of the tower shall be established.

b. At deviation or angle towers, the EPC Contractor shall also provide red orientation pegs along the bisector of the deviation angle of the line.

c. The tower site number and elevation of the top of the stakes shall be marked on the sides of each stake. The EPC Contractor shall provide adequate protection for all stakes to prevent disturbance during Right-of-Way clearing, site preparation and tower construction.

d. The EPC Contractor shall install any stakes and carry out any and all survey required to complete the design and construction of the line.

### ***3.1.5 Survey Personnel and Instruments***

The surveys, tower staking and other associated survey shall be performed and responsible by qualified and experienced surveyors and other experienced personnel. The survey instruments shall be in good operating conditions suitable for the works intended and shall be well calibrated before being utilized in the field.

### ***3.1.6 Clearing of Right-of-Way and Danger Trees***

All right-of-way clearing and trimming of danger trees shall be as specified herein and shown on the drawing unless specifically directed by the Engineer. The area to be cleared shall be determined from the check survey reviewed by the Engineer.

(1) Within 8 Meters of Any tower Leg.

All trees, brush and stumps within 8 meters of any tower legs shall be cut off as close to the ground as practicable except trees to be stamped "Forest Department" according to the applicable Forest Act. These trees shall be cut to a height of not more than 30 centimeters above the ground.

(2) Outside 8 Meters of Any Tower Leg.

All trees, brush and stumps within the right-of-way but not within 8 meters of any tower leg shall be cut to a height of not more than 30 centimeters above the ground with the exception of trees, crops and other vegetation of commercial value which shall be cut according to the guidelines specified herein or as directed by the Engineer.

## **3.2 Soil Investigation**

### ***3.2.1 Soil Investigation***

The EPC Contractor shall be required to perform soil investigation at each tower location to the depth specified in the Contract. The sub-soil investigation shall be performed by Light Ram Sound (Kunzelstab) Test. The details of performing the test, tools and equipment to be used shall be submitted to the Engineer for approval.



The test shall be performed in such a manner that the number of blows per 10 cm of penetration can be obtained continuously along the boring depth. The data obtained from soil investigation shall include date of test, tower number, station, ground surface condition, sample elevation, natural density of soil, limit of strata, maximum water level, ground water level and soil classification up to the depth of sub-soil test. The data thus obtained shall be prepared in the form to show the nature and extent of the soil strata over the area under consideration and submitted to the Engineer.

Selection of foundation type shall be made for each tower foundation to suit its particular site conditions. The determination of pile length for pile type foundation shall be based on the result of sub-soil test, employing over load factors specified on the drawing. The Engineer reserves the right to make final selection of foundation type for each tower site based upon its judgment of the nature of sub-soil conditions or other factors affecting construction or operation of the transmission line.

Four copies of the foundation list shall be submitted for approval of the Engineer.

### ***3.2.2 Ground Resistance and Ground Resistivity***

The EPC Contractor is required to perform ground resistance test and ground resistivity test at every tower location. Method of measurement, tools and instruments shall be submitted to the Engineer for approval.

The measurement of ground resistance shall be performed at each meter to the depth of not more than 10 m from ground surface or until ground resistance value of 5 ohms or less are obtained at any adjacent levels. The procedure of each measurement shall be in accordance with Article 9.00, Methods of Measuring Ground Resistance of IEEE Standard No.81

Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Ground.

The EPC Contractor may use drilling rod (s) of soil investigation equipment during performing the soil investigation test as grounding electrodes for measuring the ground resistance.

The measurement of ground resistivity expressed in ohm-meter shall be performed in accordance with Article 8.02, Four-Point Method of IEEE Standard No.81.

The EPC Contractor shall recommend the type of grounding electrodes in accordance with the results of ground resistances and ground resistivity obtained. Selection of grounding electrode type shall be suitable for each tower and its particular site conditions. The data obtained shall be prepared in the form and submitted to the Engineer for approval.

Four copies of list of ground electrode shall be submitted for approval of the Engineer.

### 3.3 Foundation Work

#### 3.3.1 General

The EPC Contractor is required to design, for each tower type, suitable foundations for each kind of soil classified hereunder.

The responsibility for proving the adequacy of the foundation type at each tower site shall remain to the EPC Contractor according to the results of soil investigation performed by the EPC Contractor and reviewed by the Engineer.

#### 3.3.2 Soil Classification

The soil has been classified into six classes as follows :

Soil Class	Description	Density kg/cu. m.	Angle of Repose	Ultimate Bearing Capacity kg/sq.m.
I	Very Soft	900	0	-
II	Soft	1,000	4	10,000
III	Fair	1,500	15	20,000
IV	Good	1,700	16	40,000
V	Hard	1,900	24	60,000

Soil class I, II are submerged Soil Condition. Rock shall be classified into soil class V.

#### 3.3.3 Foundation Type

Foundation type for each soil class shall be as follows:

Soil Class	Foundation Type
------------	-----------------

I II III, IV, V	Long Pile Short Pile Pad & Dug FND
--------------------	------------------------------------

Configuration and minimum requirements of each foundation type shall be as shown on the drawings.

### **3.3.4 Design Requirement of Foundation**

Foundation design shall be such that the tower shall be securely supported and unbalanced displacement that may cause harmful effect to the tower shall not be produced.

The loads acting on the foundation shall be the maximum loads determined from each tower loading condition and shall take the leg extension of tower into account.

Stability of foundation shall conform to the following requirements :

a. Resistance to uplift and overturning plus uplift Load factor ( )

Suspension Tower 1.6

Tension Towers 1.9

b. Resistance to compression and overturning plus compression

Load factor ( )

Suspension Tower 1.9

Tension Towers 2.2

Foundation design loads shall be calculated on the basis of the maximum axial and horizontal tower base reactions exclusive of tower overload factor and further multiplied by the load factors specified above. Maximum foundation shear force from any load combination for the download leg will be assumed to act simultaneously with the maximum foundation compression force. Maximum foundation shear force from any load combination for the uplift leg will be assumed to act simultaneously.

All combinations of tower and leg extension heights, as stated in the tower design specification, shall be considered in determining the maximum tower base reactions.

Concrete for foundation shall have a minimum 28-day cylindrical strength of 210 kg/cm<sup>2</sup>, using 300 kg cement content per cubic meter.

Steel reinforcement shall conform to TIS 20 for round bar and TIS 24 for deformed bars.

Maximum stresses in concrete and steel reinforcement, taking the specified overload factors shall be as specified in ACI 318.

### 3.3.5 Design Requirements of Piles

Piles shall be prestressed concrete piles, reinforced concrete piles or cast in situ piles. Design and manufacturing of piles shall conform to the requirements of ACI Recommendation for Design, Manufacture and Installation of Concrete Pile except as specified herein.

Piles shall have the following characteristics :

Type of Pile	Min. Effective Perimeter, cm	Length, m	Allowable Structural Capacity		Moment Bending
			Tension, kg	Compression, kg	
Short Pile	80	Upto 10	7,000	14,000	As required
Long Pile	120	8-20	15,000	30,000	As required
Long Pile	160	8-24	20,000	40,000	As required
Cast-in-Situ	35	upto 20	15,000	30,000	As required
Dug Foundation	100	10	18,000	34,000	As required

Piles shall also be designed to provide adequate strength to resist stresses produced during handling and transportation as well as the expected driving stresses without damaging the piles.

Concrete for pile shall have a minimum 28-day cylindrical strength of 350 kg/cm<sup>2</sup>, using minimum cement content of 400 kg per cubic meter.

Dug Foundation is used in Slope areas in order to protect the environment and decrease excavation.

Prestressing wires and plain round bars shall conform to TIS 95 and TIS 20 respectively.

To anchor each pile with the pile cap, dowel bars shall be provided. Dowel bars shall be designed to

develop full allowable tension load of the pile. The length of the dowel bars pre-embedded in the top part of pile during manufacturing shall be as follows :

• Short pile	2	m
• Long pile	3.3	m

### ***3.3.6 Drawing for Approval***

Design calculation and detail for each type of foundation and pile shall be submitted for approval of the Engineer. Such details shall show the following requirements :

- a. Design
  - 1.) Detailed calculation of loads acting on foundation for each loading condition.
  - 2.) Calculation showing stability of foundations as specified in Clause 3.2.1.4.
  - 3.) Maximum stresses in concrete and in steel reinforcement at any critical section.
  - 4.) Loads acting on each pile for each loading condition.
  - 5.) Detailed calculation of stub angle and cleat angle, if any.
  - 6.) Design of piles.
- b. Detail
  - 1.) Detailed dimensions of foundation.
  - 2.) Details of setting dimensions of foundation for every type of leg extension.
  - 3.) Details of placing of all reinforcing steel which shall conform to the Building Code Requirements for Reinforced Concrete (ACI 318) and the Manual of Standard Practice for Detailing Reinforced Concrete Structure (ACI 315) unless otherwise as specified herein and shown on the drawings.
  - 4.) Details of type, size and length of each reinforcing steel including details of bar bending.

- 5.) Details of concrete covering for protection of steel reinforcement which shall not be less than 5 cm for structure exposed to weather or backfill or submerged, and 7.5 cm for concrete placed directly against ground, rock and surfaces subject to corrosion caused by sulphates or corrosive chemicals.
- 6.) Details of cut off elevation of piles which shall not be less than 15 cm above the bottom of base pad of the foundation.
- 7.) Details of spacing of piles which shall not be less than 3.0 times diameter or the largest side of the pile.
- 8.) Details of size and length of dowel bars embedded in the base pad of the foundation.
- 9.) Details of piles which shall conform to the following requirements :
- Pile tip shall be flat
  - Covering of concrete over main reinforcement shall be 25 mm
  - Edge and corner shall be chamfered
  - Lifting point shall be indicated and provided

### ***3.3.7 Foundation Orientation For Towers***

The EPC Contractor shall assume full responsibility for the accuracy of the exact location and orientation of each tower foundation. If not specified, the foundation orientation of each tower shall be placed in such a manner that the position of the longitudinal axis of the tower crossarm will lie

- a. in a plane perpendicular to the traverse of the line for the foundation of each tower in a straight line section.
- b. in a plane bisecting the interior angle formed by the intersection of the adjacent line traverses for the foundations of each angle towers.
- c. in a plane perpendicular to the traverse of the line route (regardless of the traverse of the slack span) for foundations of each dead end tower except where otherwise indicated on the drawing(s).

### ***3.3.8 Installation of Piles***

a. Handling, Transportation and Storage

Piles shall not be handled, transported or stored in any way which will result in damage to the pile. Piles shall be lifted and blocked for storage at pre-designated points in such a manner that bending stresses will be within acceptable limits specified in the design of piles.

The Engineer reserves the right to reject any pile at any time throughout the delivery and storage if it is determined that the pile may be unsuitable due to improper fabrication, handling or storage.

b. Installation

Piles shall be installed accurately to the required position, alignment and depth with gravity steam, internal combustion hammers or by other means accepted by the Engineer. The drop length of the hammer shall not exceed 90 cm. The weight of the hammer and the striking part shall be at least equal to the weight of the pile being driven and shall develop an energy per blow of not less than 3 kg-m per 10 kg of weight driven.

During driving, an accurate record of the penetration and blow count of each pile driven shall be kept by the EPC Contractor. These records shall be available to the Engineer at all times.

For estimating and evaluation purpose, the ultimate resistance of vertical piles shall be determined by the following formula :

$$Q = \frac{WH}{(S + S_0/2)} S_0 = (2 \frac{WHL}{AE})^{1/2}$$

Where

- = Ultimate resistance to driving in kg
- = Weight of striking parts of hammer in kg
- = Height of drop for the hammer in cm
- = Average penetration, in cm per blow for the last 5 blows
- = Elastic compression of pile in cm if all available hammer energy is used for compression of pile
- = Length of pile as driven in cm
- = Cross-sectional area of pile, sq.cm

E = Modulus of elasticity for pile material, kg/sq.cm (recommended value of  $2.2 \times 10^5$  kg/sq.cm)

= Efficiency of hammer. Values given below may be substituted by manufacturer's efficiencies or net delivered energies if based on actual tests:

Diesel hammer: 100%

Single-acting air or steam hammer: 80%

Gravity hammers: 100% for hammers released by triggers 75% for hammers actuated by rope and friction winch

The pile driving procedure shall not subject piles to excessive and undue abuse producing crushing and spalling of the concrete, injurious splitting, deformation of the steel or misalignment. The pile to be driven shall be ensured that the top face is perpendicular to the longitudinal axis of the pile and that no steel reinforcement or dowel bars protrude from the head.

Piles being driven shall have an adequate driving head to distribute the blow of the hammer to the head of the pile. The driving head shall be axially aligned with the hammer and the pile. Between the driving head and the hammer, there shall be a cap block to protect the pile and the hammer from damage. Cap blocks may be made of hard wood or other materials capable to transmit the energy to the pile effectively without excessive elastic energy losses.

The top of the piles shall be covered by suitable cushion while they are being driven. Cushions shall be at least 10 cm thick of soft wood block or 16 layers of gunny sacks. A new cushion shall be provided for each pile, or replaced during driving when the cushion becomes highly compressed, charred or burned.

Piles shall be secured against lateral movement during driving by leads or other suitable means. Excessive manipulation of piles during or after driving to force them into proper positions will not be permitted. All piles pushed up by the driving of adjacent piles or by other causes shall be driven down. The top of the piles at cut-off elevation shall not be out of position shown on the drawings more than 1 per cent of pile length nor more than 15 cm after driving.

Any pile damaged by reason of internal defects, or by improper driving, or driven out of its proper location shall be corrected at the EPC Contractor's expenses by one of the following methods accepted by the Engineer for pile in question:



1. pile shall be withdrawn and replaced by a new pile and, if necessary, a longer one.
2. second pile shall be driven adjacent to the defective pile.

All materials forced up between the piles shall be removed to the base elevation accepted by the Engineer before gravel subbase or concrete is placed.

All piles, except the reinforcement therein, shall be cut-off to true horizontal plan at the specified elevation. Reinforcement steel shall be left extending from all piles above the specified cut-off planes for anchorage into the base pad of the footings as shown on the drawings.

When the pile has been driven a short distance below grade, the extension of pile or lowering of the pile cap may be employed.

If the extension of pile is exercised, the use of epoxy grout and a doveled splice is recommended. Splices should develop the requisite strength in compression, bending, tension, shear and torsion at the point of splices during driving and in service.

### ***3.3.9 Soil Excavation***

Soil excavation for footings shall include all excavation required for installation of footings, leveling around the individual tower footings and grading or preparation for construction at the tower site. Where necessary or as directed by the Engineer, adequate drainage shall be provided around the tower site. Excavated materials shall be laid aside and shall be used for backfill and embankment at the tower site from which it was excavated, and the excess materials shall be spread evenly around the site. Where excavation is on farm or cultivated land, the top soil should be stripped and laid aside, separate from other excavated soil, and placed back on top of the backfill to be made after the concrete foundation has been constructed.

Foundation excavation shall be sufficient to result in concrete footings with lines and dimensions as shown on the drawings and within the tolerances herein specified. Embedment depths shown on the drawing shall be maintained at the shallowest part of an excavation, if on sloping ground.

Excavation for footing shall conform to the dimensions and elevations shown. The excavation shall extend a sufficient distance from footings to allow inspection and placing and removal of forms, except where concrete footings are authorized to be deposited directly against excavated surface. When concrete is to rest on a surface other than solid rock, special care shall be taken not to disturb soil at the bottom of the excavation. Excavation to the final level shall not be made until just before the concrete is to be

placed. Such grading shall be done as may be required to prevent surface water from flowing into the excavation. If necessary, the excavation shall be shored to retain the hole and to protect the workers. The shoring shall be removed as the hole is backfilled. Any

mud, silt, or other objectionable material which accumulate in the bottom of the excavation shall be removed prior to pouring of concrete. In case of over excavation without specific direction or required to remove loose, muddy, or objectionable material which has accumulated in the bottom of the excavation, the base of the concrete pad shall be extended to the bottom of the excavation. All additional work of this nature shall be at the EPC Contractor's expense.

During excavation, if it is discovered that underground water level different from that specified in the Foundation Lists, the EPC Contractor shall notify the Engineer for resolution.

Foundation excavations when unattended shall be covered to prevent injury to humans, livestock or wildlife. Excavation subject to caving shall be properly shored before allowing workmen to enter.

### ***3.3.10 Rock Excavation***

The EPC Contractor shall furnish all materials and equipment to perform all work required for excavation of rock at the location where concrete or rock foundation is to be constructed. Rock excavation may be made by drilling, barring, wedging, blasting or compressed-air tools.

Blasting will be permitted only when proper precautions are taken for the protection of persons, work and public or private property. Any harm or damage done to the persons, work or property by blasting shall be the sole responsibility of the EPC Contractor.

Hauling, storage and handling of explosives shall be carried out in strict compliance with the requirements of the applicable laws and regulations.

Plans and methods of operation for blasting including sites and schedule shall be submitted to the Engineer for reviewing prior to implementation. Caps, exploders, or fuses shall not be kept or transported in the same place as dynamite or other explosives. An inventory of all explosive materials shall be kept and the Engineer shall be notified immediately of loss or theft. The Engineer shall be notified a minimum of 48 hours prior to each use of blasting.

All expenses of rock excavation shall be included in the price of foundation.

### **3.3.11 Backfill**

Backfilling shall not be carried out until the Engineer has inspected the foundation.

Suitable excavated soil may be used as backfill material. Rock and soil not suitable for compaction shall at the EPC Contractor's own cost be removed and replaced with a suitable backfill to the acceptance of the Engineer. Organic matter and silt shall not be used as backfill material. All temporary timbering, shuttering, etc. and all decomposable or perishable material shall be removed from the excavations prior to backfilling.

Backfill shall be placed in layers of approximately 15 cm thickness. Each layer shall be carefully compacted by the use of mechanically operated tamping machines. The material to be compacted shall contain no stones greater than 10 cm in diameter.

In backfilling for concrete footings, the pad of the footing shall be covered first with a 30 cm layer of fine material before any coarse material is deposited.

Prior to and during compacting operation, the backfill shall have the optimum practicable moisture content required for the purpose of compaction.

The material shall be compacted to 85 per cent of the maximum density obtainable in the Standard Proctor Density Test as specified in ASTM D698(Method A).

The Engineer will periodically perform backfill soil density tests to insure the desired degree of backfill compaction is achieved. The test apparatus and man-power to perform the tests shall be provided by the EPC Contractor at his expenses.

Backfill shall be carried out to a minimum height of 20 cm above the original ground surface to compensate for future settlement of the filling. All backfill of tower foundation shall be protected in an accepted manner from being washed away by running water. At all tower positions, the surface of the ground shall be sloping from the tower legs to provide drainage as required. No additional payment will be made for such work.

### **3.3.12 Stub Setting**

Stub angles shall be placed in the tower footings and set accurately to the grade and alignment

designated on the drawing. The stub angles shall be supported in the proper position by means of a rigid frame or equivalent suitable device to prevent displacement during the placing of concrete and to insure placement of the stub angles within the tolerances specified below:

1. *Vertical Dimensions.* The difference in elevation between identical parts of any two stub angles shall not exceed 1/1000 of the computed horizontal distance between the two stub angles. The actual elevation of any stub angle shall not differ from the prescribed elevation by more than 6 mm of its correct position.
2. *Horizontal Dimensions.* The difference in horizontal distance from the computed distance between identical parts of any two stub angles shall not exceed 1/1000 of the computed distance between two stub angles.
3. *Stub Alignment.* The faces of each stub angle shall not deviate from parallel with the corresponding faces of the tower by more than 3.3/1000 horizontally. The batter of the stub angles shall not differ from the correct batter by more than 1/200 of the exposed stub.
4. *Rotation.* The transverse axis of each tower shall not deviate from the bisector of the interior line angle at the tower by more than 12 minutes of arc, or one part in 300 whichever is smaller.

### **3.3.13 Concrete Work**

#### **a. General**

The EPC Contractor shall supply all labour, materials and equipment required for the concrete work for tower foundations.

The mix proportions shall be submitted to the Engineer for approval on the basis of producing concrete having suitable workability, density, impermeability, durability, and required strength, without the use of an excessive amount of cement and without exceeding a net water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) of 0.60 by weight.

The slump of the concrete, after the concrete has been deposited but before it has been consolidated, shall not be less than 5 cm and not exceed 7.5 cm for concrete not placed under water.

#### **b. Cement**

The cement shall be Portland cement conforming to ASTM C150 or TIS

15. It shall be delivered to the site in bulk cement containers or in sealed bags clearly marked with the maker's name and shall be carefully stored in a water proof shed with a raised floor or in a silo of approved design. Each consignment of cement shall be stored apart from earlier consignment and the cement shall be used in the order in which it is delivered. Any consignment which has become caked or otherwise adversely affected, shall not be used and shall be removed from site immediately.

If required by the Engineer, samples from the cement to be used on Site are to be taken to a laboratory or testing station accepted by the Engineer to demonstrate compliance with the Specification. The cost of test shall be borne by the EPC Contractor.

c. Aggregate

All aggregates shall be obtained from sources accepted by the Engineer, and shall be clean and free of clay, earth, organic matter, salt or other impurities.

For both the fine and coarse aggregates proposed to be used for the works, the EPC Contractor shall furnish samples to the Engineer together with such full details and test results as the Engineer may require. No aggregates may be used in the works until they have been accepted by the Engineer.

During the work, the Engineer shall order such tests as he may consider necessary on the aggregates and any aggregates found to have unsuitable characteristics at any time shall not be used in the work and shall be immediately removed from the site, at no extra costs.

The various fractions of fine and coarse aggregates shall be stored separately and in such a manner as to avoid the admixture of dirt in the concrete. Aggregates shall be handled in such a way that separation is avoided.

The grading of the fine and coarse aggregates shall be such that when they are mixed in the proportions decided for the required class of concrete, the grading of the combined aggregate shall be suitable for making a dense concrete of appropriate workability, containing the proportions of cement and water prescribed.

The proportions of fine and coarse aggregates and the maximum size of coarse aggregates to be used shall be accepted by the Engineer.

The EPC Contractor shall be responsible for mixing the aggregates in the proportions accepted by the Engineer. He shall submit samples of the concrete material to the Engineer well in advance of commencing any concrete work, and also have test cylinders made and tested for the aggregates and the cement he intends to use. Concrete works must not commence until such samples and test are to the Engineer's acceptance. All cost of tests shall be borne by the EPC Contractor.

d. Water

The water to be used for mixing and curing of concrete shall at all times be kept clean and free from deleterious matters such as oil, acid, alkali, silt, salts, organic materials, etc., and shall be obtained only from sources accepted by the Engineer.

e. Admixtures

The EPC Contractor may use admixture, if required, listed below in order to improve the quality of concrete or mortar such as workability

and finish and water tightness as per Manufacturer's instructions only with the acceptance of the Engineer.

1) Water-reducing and set-retarding agent to ASTM C494.

2) Plastizer.

f. Steel Reinforcement.

The steel reinforcement shall conform to TIS 20 or TIS 24. All steel reinforcement shall be tested for compliance with those applicable standards at the EPC Contractor's expenses.

Steel reinforcement shall be placed in the concrete wherever shown on the drawings or as directed by the Engineer. Bending of all bars shall be made to smooth curves. Standard hooks shall have 180-degree bend and extend of 4 bar diameters parallel to the main leg of the bar. Kinked bars shall not be used.

Splicing of reinforcing bars not shown on the drawings will be permitted only with prior acceptance of the Engineer and shall be placed at points of minimum stress, if possible. All reinforcing bar splices shall meet the requirements of ACI Standard 318.

Before the reinforcing bars are placed, the surfaces of the bars and any bar supports shall be cleaned of

heavy or flaky rust, loose mill scale, dirt, greese, or other foreign substance which in the opinion of the Engineer are objectionable. Heavy or flaky rust which cannot be removed by firm rubbing with burlap or equivalent treatment is considered objectionable. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in the concrete.

Reinforcing bars shall be accurately placed on concrete or metal chairs or spacers and secured in position so that they will not be displaced during the placing of the concrete. Special care shall be exercised to prevent any disturbance or the reinforcement in concrete that has already been placed.

All bars, dowels, spacers and stirrups shall be securely tied at all intersections with not less than 1.2 mm diameter black, annealed tie wire.

Reinforcing bars will be inspected in compliance with the requirements as to size, shape, grade, length, position and amount after they have been placed and prior to the placing of concrete.

All reinforcing bars shall be placed and spaced in the foundations such that the concrete cover indicated on the drawings is maintained within a tolerance of plus or minus 7 mm and the center-to-center bar spacings are maintained within a tolerance of plus or minus 26 mm.

g. Concrete Mixing

Cement shall be measured by weight, either by use of one or more complete bags or by weighing on site. Other ingredients shall be measured by weight or by volume, and concrete shall be mixed in batches using one or more complete bags of cement. When mixing by volume is adopted, suitable batch boxes of approved dimensions shall be made and used for the measurement of coarse and fine aggregates. A suitable container for the measurement of water shall also be used.

All concrete shall be thoroughly mixed by machine with only sufficient water to ensure a workable mix. Consistency tests shall be made when required by the Engineer. The slump in a truncated cone 300 mm high and of standard dimensions shall be between 50 and 75 mm, corresponding to a stiff plastic consistency.

h. Formwork

All formwork shall be accurately constructed to prevent loss of concrete and to produce the correct foundation shape. Formwork shall be sufficiently strong to withstand the pressure arising from the

concrete during compaction and shall be capable of removal without undue disturbance to the concrete. Wooden formers shall be kept wet if necessary to prevent shrinkage. Formwork shall not be removed before the concrete has sufficiently hardened and in no case less than 24 hours after pouring. Where undercutting of the excavations is permitted the EPC Contractor shall ensure the soil is excavated correctly to template and the surfaces lined with waterproof paper to prevent of cement or fine aggregate from the concrete block.

i.                   Placing and Compacting

Concrete shall be transported from the mixer to the place of casting in such a manner that separation of the aggregates does not occur.

The concrete shall be placed in its final position as soon as possible and in no case more than half an hour after mixing. The method of placing shall be such as to ensure that the concrete in its final position may be dense and homogenous.

Compacting shall be carried out in a manner accepted by the Engineer and vibrators and other compacting equipment shall be to the acceptance of the Engineer.

Joints in the concrete foundations are to be avoided as much as possible. Where the construction of the foundation is such that joints are unavoidable adequate bond between the old and new concrete shall be ensured by chipping the old concrete to a rough, clean surface free from loose particles. immediately before placing the new concrete, this

Cleaned surface shall be primed with a layer approximately 15 mm thick of a wet mix of cement and fine sand in equal proportions. The Engineer may require the EPC Contractor to use bonding agent at no additional cost.

The Engineer can stop any concrete work whenever weather conditions are unfavorable and the EPC Contractor has not taken necessary precautions.

j.                   Surface Finish

Unless otherwise shown on the drawings. All permanently visible concrete surfaces shall have a regular finish of uniform texture, free from holes, pins and formwork.

Concrete that is damaged or honeycombed must be removed by chipping to sound concrete and replaced with mortar or concrete or non-shrink concrete as shall be directed by the Engineer at the EPC



Contractor's expenses. If major defects occur, the Engineer has the right to refuse the defective parts, if necessary a whole foundation should then be removed.

The upper surface of the concrete for all types of foundations shall be sloped in an approved manner to prevent accumulation of water and the whole exposed surface shall be rendered with concrete composed of one part of cement to two parts of sand.

The EPC Contractor shall protect all concrete against injury until final acceptance by the Engineer.

k. Curing

All concrete shall be cured by being kept continuously moist for a period of at least 14 days after casting, though in certain cases the Engineer may vary this period. The curing shall be effected by covering all concrete surfaces with a layer of sand, to be kept wet by continuous watering.

Curing compounds shall not be used without the permission of the Engineer.

l. Concrete tests

The EPC Contractor shall provide testing equipment and one set of three cylinders taken from fresh concrete for each tower foundation but not less than three cylinders for each day of concreting. The test cylinder shall be made and cured in accordance with ASTM C31 and shall be tested in accordance with ASTM C39 under the supervision of the Engineer and at the EPC Contractor's expense.

The strength of concrete shall be represented by at least five sets of tests (15 specimens) for one mixed design using same source of material. To

conform to the requirements of the Specification, the average of any five consecutive strength tests shall be equal to or greater than the specified strength and not more than 20 per cent of the strength tests shall have values less than the specified strength.

If strength tests fail to conform to the requirements, the Engineer may require changes in concrete proportion considered necessary to secure the required strength at no extra cost.

Furthermore, the Engineer may require compression tests on hardened concrete in accordance with ASTM C42 for that portion of the foundation where the questionable concrete has been placed. All expenses incurred in the performance of additional tests shall be borne by the EPC Contractor.

## Termite Treatment

Termites are wily, elusive and stubborn. They multiply fast and, if you destroy them in one place, they will 'pop up' in other places with greater vigour and in larger numbers. In fact, any attempt to get rid of them superficially only serves to scatter the infestation.

Chemical treatment is the only method of termite prevention and control ever proven to be totally effective. The basic principle of termite control is to treat the soil under the building with chemicals that remain in the soil for a long period and do not allow termites to pass through. This can be achieved through different procedures on buildings under construction.

Pre-construction soil treatment is the one ideal method of termite control for buildings under construction. The soil all around the foundations and under the floor slab is first charged with termiticide to seal it. This creates the chemical barrier that termites cannot pass through.

After Excavation and before laying foundations lean concrete placement application of Anti termite is applied to keep the termites out. This is another method of termite treatment.

### 3.4 Steel Towers

#### 3.4.1 Tower Family

Tower family to be designed, supplied and erected shall be as follows:

500 kV Transmission Line Double Circuits (Steel Tower, 400 meter ruling span)

Tower Type	Application	Line Angle (Degree)	Wind Span (m)	Weight Span (m)
5-SZC1	Suspension	0	500	750
5-SZC2	Suspension	0-3	700	950
5-SZC3	Suspension	0-3	900	1200
5-SZC4	Suspension	0	1200	1800
5-SZCK	Suspension	0	500	750
5-SJC1	Light Angle Tension	0-20	450	800
5-SJC2	Medium Angle Tension	20-40	450	800
5-SJC3	Heavy Angle Tension	40-60	450	800
5-SDJC	Terminal	0-60	300	400
5-SHJC	Transposition	0-20	300	400

### ***3.4.2 Tower Outline***

The outlines of the towers shall, in general, conform to those indicated on the drawings, and shall be such as to provide the required minimum clearance between conductors, and between conductors and tower steel, indicated in the clearance diagrams.

Towers shall be designed for leg extensions of heights indicated on the drawings, and for use with any combination thereof. The effect of maximum height differential of leg extension combination shall be taken into account.

Plan bracing of towers at the levels of crossarms shall be such a type to prevent the cross section of the towers from deforming from the original form under tensional loading.

The included angle between any two connecting stressed members shall not be less than 15 degrees.

The dimensions of the tower bases shall be such as to give the most economical structures, considering foundations and right-of-way conditions.

### ***3.4.3 Material***

Material shall be as follows :

a.           Shapes and Plates

All shapes and plates shall be hot-rolled conforming to EN 10025 S235J for structural grade and EN 10025 S355J & S420J for high strength grade.

b.                           Connection Bolts and Nuts

Connection bolts and nuts shall conform to ASTM A394.

c.                           Lock Washers

Lock washers shall conform to ASA B27.1

d. Cable Attachment Devices

Cable attachment devices shall conform to ASTM A36 or ASTM A572 Grade 50.

e. Step Bolts

Step bolts shall conform to ASTM A307

f. Tower Signs

Tower signs shall be mild steel. The thickness shall not be less than 2 mm.

### ***3.4.4 Load and Resistance of Towers***

Towers shall be designed following Load and Resistance Factor Design as described in ASCE Manual and Report on Engineering Practice No. 74, Guideline for Electrical Transmission Line Structural Loading in which represented by the following equation:

$$\gamma Q \leq \phi R_i$$

Where Q is the design loads,  $R_i$  is the mean strength of any component to be designed and  $\gamma$  and  $\phi$  are load and strength factors specified hereunder.

- Load factor

( $\gamma$ )

Wind Load

Other Loads

500 kV

1.15

1.0

- Strength factor ( $\phi$ ) for member and bolt : 0.85

### ***3.4.5 Tower Design Criteria***

The recommended loadings (Q) are as follows:

### *3.4.5.1 Extreme Wind Loading, Transverse*

All wires intact, with a transverse wind of 132 and 105 kg/sq.m on shield wire and conductor respectively and 520 kg/sq.m on the projected area of one face of tower, 26°C final tension. Load factor ( $\gamma$ ) and strength factor ( $\phi$ ) as specified.

### *3.4.5.2 Extreme Wind Loading, Longitudinal*

All wires intact, with a longitudinal wind of 520 kg/sq.m on the projected area of one face of tower, 26°C final tension. Load factor ( $\gamma$ ) and strength factor ( $\phi$ ) as specified

### *3.4.5.3 Oblique Wind*

On Conductor and Optical Ground Wire / Shield Wire

Transverse Load = (Normal extreme wind load)  $\cos^2 \theta$  Where  $\theta$  = an angle of wind direction to the transverse axis of the tower.

On Tower

Transverse Load = (Normal extreme wind load)  $k \cos^2 \theta$  Longitudinal Load = (Normal extreme wind load)  $k \sin^2 \theta$  Where  $k = 1.0 + 0.55 \times \text{SR} \times \sin^2(2\theta)$

In which SR is the solidity ratio of the tower.

### *3.4.5.4 Failure Containment Loading*

All wires intact, 26°C no wind plus unbalanced longitudinal load equal to 100% of the tension in one shield wire and / or a percentage, defined below, of the tension in phase conductor.

- Suspension tower - 70% of the tension in conductor
- Tension tower - 100% of the tension in conductor Load factor ( $\gamma$ ) and strength factor ( $\phi$ ) as specified.

Two shield wires or combination of one shield wire and any one of phase conductor or combination of any two phase conductors shall be considered at a time.

#### *3.4.5.5 Stringing and/or Maintenance Loading*

All wires intact, everyday temperature (EDT) no wind, plus 200 per cent of vertical load and longitudinal load defined below.

- Suspension tower - 100% of everyday stringing tension
- Tension tower - 200% of everyday stringing tension Two shield wires or combination of one shield wire and any one of phase conductor or combination of any two phase conductors shall be considered at a time.

Load factor ( $\gamma$ ) and strength factor ( $\phi$ ) as specified.

#### *3.4.5.6 Uplift Loads*

All tower components of tension towers shall be capable to withstand vertical uplift loads equal to downward vertical loads specified in each loading case.

### **3.4.6 Tower Design**

The towers shall be designed in accordance with the stiffness method and shall follow all requirements of ANSI / ASCE Standard 10-90, "Design of Lattice Steel Towers", unless otherwise specified herein.

#### a. Loading

Tower loading shall be in accordance with those specified in Clause 3.3.5.

#### b. Members

The ultimate stresses in tension and compression allowed in design shall not be greater than the yield point of the steel. The buckling stresses of compression member shall be as specified in ASCE Guide for Design of Steel Transmission Towers.

The determination of the stresses allowed in design shall take the strength factor specified in Clause 3.3.4 into consideration.

In computing the net section for tension members, the diameter of the bolt hole shall be taken as 2.5 mm greater than the nominal diameter of the bolt. The determination of net section area shall be as specified in the ASCE, Guide for Design of Steel Transmission Towers.

The minimum thickness of members shall be as follows:

Legs and main compression members in crossarms and galvanized steel wire peak	6 mm
• All other member having computed stresses	5 mm
• Redundant members	5 mm
• Gusset plates	6 mm

The slenderness ratio for members shall not exceed the following limits :

- Legs and compression members in crossarms 120
- Other compression members 200
- Redundant members 250
- Tension members 375

Redundant members supporting leg members or supporting other members shall be designed for a transverse load at each node point of minimum 2.0% of the maximum load in the leg member or the other member respectively.

All members which can be subject to the weight of a linesman shall be designed for an ultimate load of



1.5 kN, at the most unfavorable point, without permanent deformation.

c. **Connections**

All connections shall be bolted. Welding may be used for minor details subject to the acceptance of the Engineer.

The minimum number of bolt for stressed members for 500 kV towers shall be two.

The minimum diameter of connection bolts shall be 16 mm for 500 kV lines respectively.

The ultimate shear and bearing stresses for bolts and members allowed in design shall take the strength factor specified in Clause 3.3.4 into consideration.

### ***3.4.7 Detailing***

#### ***3.4.7.1 General***

Tower dimensions, framing, member sizes and length, number, size and length of bolts, thickness of each filler, and other necessary details to fabricate each piece shall be shown on the detailed drawings. No change shall be made without the written acceptance of the Engineer.

All web members shall be in one piece where practicable. All double diagonal web system members shall be connected at their point of intersection by at least one bolt.

Lowest bolt hole in stub for connection of the main bracing member shall be at 50 mm level above the concrete level.

#### ***3.4.7.2 Joints***

All joints shall be such that eccentric stresses are kept minimum as practicable.

Opening between members at the bolt tightening points, created by tower structure, shall be completely filled by the use of fillers with proper thickness.

Gusset plates, where used, shall be designed by the EPC Contractor.

#### ***3.4.7.3 Bolt Spacing***

Minimum bolt spacing shall be two point five (2.5) times the bolt diameter.

The distance from the center of a fastener hole to the end of any connected part shall not be less than two (2.0) times the bolt diameter minus five (5.0) mm and the distance to the adjacent edge shall not be less than one point five (1.5) times the bolt diameter.

#### ***3.4.7.4 Leg Attachment***

The connection of the tower to concrete foundation shall be by means of a stub angle. The stub angle shall be of the same size as the leg of the tallest tower.

#### ***3.4.7.5 Conductor and Overhead Ground Wire / Shield Wire Attachment***

Conductor and overhead ground wire or shield wire attachment devices shall be suitably furnished on all crossarms to suspend or terminate insulator strings or overhead ground wire or shield wire assemblies. The devices shall have minimum ultimate tensile strength equal to that of the hardware.

#### ***3.4.7.6 Step Bolts***

The minimum diameter of step bolt shall be of 16 mm and shall have round or hexagonal head. Each step bolt shall be provided with two hexagonal nuts. The minimum bolt length and length of unthreaded portion shall be 180 and 125 mm respectively. Step bolts shall not be used as connection bolts.

The step bolts shall be spaced alternatively on the inner gauge line on each face of the angle about 400 mm on centers. They shall be furnished for one leg of each tower from a point 2.5 m above the top of the concrete to ladder starts for 500 kV line.

#### ***3.4.7.7 Ladder***

Ladders are required on 500 kV towers. Ladders shall be fastened securely to the tower with sufficient intermediate supports to furnish a safe and rigid structure for climbing. Ladders shall be centered on a face of the tower which is perpendicular to the line (transverse face) and shall extend from the base elevation up to the peak of the tower. Rungs shall be spaced approximately 35 cm on centers. Guardrail shall be provided to protect lineman from falling.

#### *3.4.7.8 Anti-climbing Devices.*

Each tower shall be fitted with an anti-climbing device to prevent unauthorized persons from climbing the tower. The anti-climbing device shall be fixed at a height of approx. 3 meters above the foundation. It shall provide suitable lockable gates adjacent to the step bolt legs.

#### *3.4.7.9 Tower Signs*

The EPC Contractor shall furnish all materials for tower signs as shown on the drawing, including all bolts, nuts, washers, brass eyelets fitted with the holes and supporting structures, if required, for attaching tower signs to the towers as specified in the structure list.

The colors of figure and background shall be as described on the drawing and shall be weather-proof, baked enamel finish paint, vitreous or stove enamel.

The EPC Contractor is required to make shop holes in the tower members for attaching signs at the locations described hereunder.

- *Aerial Patrol Signs.* Aerial patrol signs shall be attached to upper member of the top crossarm.
- *Phasing Signs.* Phasing signs shall be attached to upper member of the crossarms.
- *Danger Signs.* Danger signs shall be attached to bracing members at the level about two meters from ground level.
- *Circuit Name Signs.* Circuit name signs shall be attached to the upper member

of the crossarm.

### **3.4.8 Fabrication**

#### **3.4.8.1 General**

Workmanship for fabrication shall be first class throughout. All pieces must be straight, true to detailed drawings and free from lamination flaws and other defects. All clipping, back-cuts, grindings, bends, holes and etc. must be true to detailed drawings and free of burrs.

All identical pieces bearing the same erection number must be exactly interchangeable with each other and interchangeable in their relative position in all towers of structures or which they form a part.

Threads of bolts and nuts shall be cleanly rolled or cut and the face and head of nut shall be truly at right angle to the axis of the bolt.

#### **3.4.8.2 Cutting**

Members shall be cut or sheared to length. The ends, unless as shown on the drawings, must be square with the length. The use of burning torch is not permitted for cutting.

#### **3.4.8.3 Punching**

The diameter of bolt hole shall not exceed 1.5 mm plus the bolt diameter.

Holes are to be punched with racks and jigs employed to ensure accuracy throughout. The punches and dies for this work must be maintained sufficiently sharp so as to produce clean round holes normal to the plane of material, free of burrs, folds, depressed or upset edges.

Holes in bent members which may be affected by the bending operation shall be laid out and punched or drilled after bending. Holes which are elongated or otherwise distorted by bending will not be accepted.

Mis-drilled or mis-punched hole shall not be refilled. Member of such hole shall be discarded.

#### **3.4.8.4 Bending**

All bending of high strength structural steel must be done hot. Bends of a difficult nature on structural steel must be done hot, but otherwise cold bending can be employed.

#### *3.4.8.5 Welding*

Welding shall not be made without the acceptance of the Engineer and when so given the following shall apply:

Welding shall be executed only by certified welders. Lap joints shall be avoided wherever possible.

Welds intended for pickling before galvanizing must be continuous and free from cavities and pits which might form acid receptacles.

No field welding will be accepted.

#### *3.4.8.6 Marking*

All individual pieces shall be marked with the correct designations shown on the detailed drawings. Markings shall be done by stamping the marks into the metal before galvanizing, and details shall be clearly legible after galvanizing. The number and letter shall be a minimum of 12 mm in height.

Marking of bolts shall be made on bolt heads to identify manufacturer, grade, size, length and threaded length. Markings may be raised or depressed.

#### *3.4.8.7 Galvanizing*

Galvanizing for structural steel products shall meet the requirements of ASTM A123. In addition, welded assemblies, which may be particularly susceptible to cracking and/or distortion, shall be galvanized and tested in accordance with ASTM A143. All holes in material shall be free of excess spelter after galvanizing.

Galvanizing for bolts, step bolts, U-bolts, shackles, nuts, locknuts, fillers, washers, spring washers, and similar hardware shall meet the requirements of ASTM A153.

Excess spelter shall be removed by appropriate means acceptable to the Engineer.

Nuts shall be galvanized after threading. Retapping of nuts after galvanizing, if required to insure free running of nut on bolt, shall be such that sufficient protective zinc or tapping oil will remain on threads in nuts.

The uniformity of coating test shall be made in accordance with ASTM A239. The minimum repetition times for one minute dip in uniformity test shall be as follows :

Steel shapes and plates	6
Bolts, nuts and similar hardware except threaded parts	4

Finished galvanized materials shall be dipped into the solution of dichromate after galvanizing for white rust protection during sea transportation and storage.

### 3.4.9 Test

#### 3.4.9.1 Quality Assurance Test

##### a. Routine Test

The EPC Contractor is required to perform the following tests at his own expense on samples selected at random by and at the presentation of the Engineer or the Engineer's representatives, if any.

1. *Dimensional Check.* The dimensional checks of all material shall be performed to meet the requirements of ASTM A6
2. *Visual inspection of all material before and after galvanizing shall be made.* Embitterment tests shall be made in accordance with ASTM A143. Uniformity of coating tests shall be made in accordance with ASTM A239. Thickness of coating tests shall be in accordance with ASTM A90. Size of test "lot" and number of tests shall be in accordance with the appropriate ASTM standards.
3. *Physical tests on samples of structural steel section.* The tests to be carried out shall include yield strength, ultimate tensile strength and percentage elongation. One set of tests shall be carried out for each 50 tons of steel passing through the fabrication plant.
4. *Galvanizing tests on samples of structural steel sections.* The tests to be carried out shall include determination of weight of zinc coating, adherence of zinc coating and uniformity of zinc coating. One set of tests shall be carried out for each 50 tons of steel passing through the fabrication

plant.

5. *Mechanical and galvanizing tests on bolts and nuts.* Mechanical property and galvanizing tests on samples of bolts and nuts shall be carried out in accordance with the requirements of ASTM A394.

b. Shop Assembly Test

One tower of each type and height, including every combination of leg extensions, shall be assembled in the shop to such an extent as to ensure proper field erection. Any member distorted, twisted or bent due to incorrectness of detailed drawing shall be corrected. Towers those have been previously assembled for load testing will not be required to be reassembled in the shop, except as necessary to prove the details of every combination of leg extension for the towers. Reaming of unfair holes will not be permitted. A reasonable amount of drifting will be allowed in assembling.

If any errors on the drawings or fabrication are discovered, all incorrect drawings shall be revised and the corrected part shall be re-fabricated and re-assembled. All revised drawings shall be resubmitted for reviewing.

#### ***3.4.9.2 Load Test***

The load test shall, in general conform to the requirements of IEC-60652, Loadings Tests on Overhead Line Towers except otherwise specified here under :

1. Loads shall be incremented to 50%, 75%, 90% and 100% of the maximum specified loads, including all load factors and strength factor. Each load increment shall be maintained for 2 minutes except the 100% load for which case the loads shall be held for 5 minutes.
2. Load increments for destruction test shall be 5% after 100% of the maximum specified load has been applied successfully. Each load increment shall be held for 2 minutes.
3. Deflections shall be measured at each increment of loading to provide transverse and longitudinal deflections at the structure top center, at the elevation of middle crossarms and at least one intermediate point of tower body.

4. The tested tower shall not be used for construction.
5. Two set of three specimens selected from failed member(s) and undisturbed members shall be physically tested after destruction of tower at the EPC Contractor's expenses.

#### ***3.4.10 Packing and Shipping***

The tower members shall be satisfactorily containerized or packaged in such a manner to protect them from damage during transportation, handling and for outdoor storage in hot, wet, humid and dusty condition. Where necessary, heavy parts shall be mounted on skid so that cable slings for handling can readily be attached. Where it is unsafe to apply external sling to a package, attached sling shall be provided and shall project through the package so that attachment can readily be made.

Plastic or rubber cushion shall be provided between layers of steel members in a package. Steel belts used for wrapping shall have gunny sack bounded underneath in such a manner to protect galvanizing of tower members.

Plates, bolts, nuts and washers shall be supplied in the rigid cases.

#### ***3.4.11 Data and Drawings.***

##### ***3.4.11.1 Design Drawings.***

The design drawings shall show the following data and information:

1. Scaled line diagram of the tower showing all redundant, bracing members and their sizes completely dimensioned and proved in compliance with all clearance requirements.
2. All loadings and their manners of application including the determination of wind load on tower. Wind load on towers shall be applied at each panel point along the height of the towers.
3. Tables showing :
  - 3.1 Total stresses in each member for each loading case and the critical case.



- 3.2 The effective slenderness ratio, calculated capacity and ratio of maximum total stress to calculated capacity for each member and connection.
- 3.3 Size and type of steel for each member and number of bolts required for its connection.
- 3.4 The compression and uplift reactions and corresponding horizontal shears at each leg of all towers for all loading cases.

#### ***3.4.11.2 Detailed Drawings***

Detailed drawings shall be complete with sizes and detailed dimensions of all members. At each joint, there shall be the number, size and length of bolts, number and size of fillers and detailed dimensions of gusset plate, if any.

All members and plates shall be designated on drawings, the EPC Contractor shall endeavor to use as few designation as possible, and each member of identical size and detail shall have the same designation, regardless of its position in the structure.

The member and plate designation shall be successively grouped on individual drawing. The groups of designation shall be indicated on the drawings.

A proper cross-index shall be furnished, correlating the tower part numbers with the tower types and the drawing number.

Drawings shall include material list which shall give the size, length and galvanized weight of each member and the total weights of body, body extension, leg extension and stub conforming to detailed drawing. It shall also include the number of bolts, nuts, washers and cable attachment devices per tower.

#### ***3.4.12 Handling and Storage***

Care shall be taken during handling and storage to prevent tower injury to members or damage to galvanized or other protective surfaces. No steelwork shall be dragged over the ground surface or handled in such a manner as to damage the galvanized surfaces. Throwing of tower steel into piles on conveyances, onto the ground, or skidding of steel members over each other is not permitted.

All superficial rust stains, corrosive salts and other foreign materials deposited prior to or during installation of the towers shall be removed without causing damage to the protective surfaces.

In addition, any foreign material that will tend to adhere permanently to the towers shall be removed.

### ***3.4.13 Tower Erection***

The EPC Contractor shall erect the tower and accessories in accordance with the approval detailed drawings. Towers shall be complete with all members in place and bolts including step bolts and ladder (if any) securely tightened before any stringing work is started. No steel tower shall be installed until at least seven days after the last placing of the concrete in the footing and back-filling has been completed

Towers may be erected by any suitable method, provided that no overstressing of any component parts, footings, stubs, etc., occurs. Horizontal loads on foundations during tower erections shall be avoided or reduced to a minimum.

Prior to commencing any erection the EPC Contractor shall submit four copies of the method(s) of erection and the erection plant proposed for use to the Engineer. All necessary tools and equipment shall be provided by the EPC Contractor. Erection towers shall be performed with first- class workmanship and under the supervision of well qualified site engineer and foremen.

The bolts shall be installed in such a manner that the nuts and spring washers are in “up” or “out” position.

Upto the height of three meters above ground level, the threads of all bolts left over the nuts shall be flattened.

If shop errors in the steel members are discovered, the EPC Contractor shall notify the Engineer who will decide whether the errors may be corrected in the field, or the members returned to the fabricator for correction or replacement at the EPC Contractor’s expense.

A reasonable amount of drifting will be allowed in assembling towers, but reaming for correction of mismatched holes due to shop errors will not be permitted.

Members that are bent, twisted or otherwise deformed in storage, transportation, handling or erecting operations shall be straightened or replaced by the EPC Contractor. Straightening shall be done only by

the use of methods that will not injure the galvanized coating.

Members that are injured in a manner causing reduction in their strength shall be replaced.

#### ***3.4.14 Damaged Galvanizing***

All galvanizing damages as a result of transportation, handling, storage, repair operations of deformed or bent members, field drilling or installing shall be repaired by the EPC Contractor. The damage area shall be cleaned by wiping with clean rags saturated with mineral spirits of xylene followed by wire brushing. After wire brushing, the area shall be recleaned with solvent to remove residue and shall be given a minimum of two coats of an accepted galvanizing repair paint.

The percentage of pure zinc by weight in dry film of galvanizing repair paint shall not be less than 85.

#### ***3.4.15 Tower Signs***

The EPC Contractor shall install the tower signs on the tower in a manner described hereunder and as specified on the drawing.

- a. *Tower-Number Signs.* The EPC Contractor is required to stencil each towers with a number (final) as indicated on the plan & profile drawings on legs designated by The Engineer at a height about 4 m above the ground level. The letters shall be 8 cm high in black paint over a two- coat yellow background. The background shall extend 2.5 cm above and below the numbers and shall be the full width of the numbers.
- b. *Aerial Patrol Signs.* Aerial patrol signs shall be installed on the first tower in each five station kilometer as specified in the structure lists.
- c. *Phasing Signs.* Phasing signs shall be installed on terminal towers, the first tower in each ten station kilometer and both towers adjacent to a transposition towers.
- d. *Danger Signs.* Danger signs shall be installed on each tower located at the terminal, near roadways and on the river banks or where directed by the Engineer in such a manner that they can be seen by the passer-by.
- e. *Circuit Name Signs.* Circuit name signs shall be installed on the terminal towers

approaching substation.

### ***3.4.16 Water-Proof Painting of Bottom Part of Towers***

For protection of the stub angles and the bottom part of the tower up to 0.50 m above the pedestal top, two coatings of bituminous paint shall be applied on each pedestal top and each bottom part of the tower. Before proceeding with the paint coating operation, all objectionable surface irregularities shall be removed, and the surfaces cleaned of dirt and grit. Preparation of surfaces and method of application of paint coatings shall be done in accordance with manufacturer recommendation, or as directed by the Engineer.

The paint shall conform to ASTM D1187: Asphalt-Base Emulsions for Use as Protective Coatings for Metal. The EPC Contractor shall be required to submit full details of the paint, inhibitor, cleaning solvent and other related materials, together with recommended method of application to the Engineer. No paint coating operation shall be done before direction of the Engineer.

### ***3.4.17 Air Navigation Obstruction Marking***

#### **3.4.17.1 General**

If required in the Contract and in the portion of River Crossing, the Contractor shall furnish and install or apply materials for markings of towers and shield wire and for lightings of towers as shown on the drawing and specified hereafter.

#### ***3.4.17.2 Marking of Steel Tower***

The Contractor shall apply all cleaning and painting materials for the air navigation obstruction marking of the required steel towers according to the following requirements.

##### **a. Paints**

The colour of the paint shall be orange and white. Standard colour of the paint shall be as follows :

Colour Munsell's Number	
Orange (Yellowish-red)	2.5 YR 6 / 13
White	N – 9.5

The primer paint shall be zinc dust zinc oxide.

b. Painting

All painting operations shall be performed after the steel towers have been completely erected and the air navigation obstruction lighting installed, if any. All oil, grease and dirt shall be removed from surfaces before paint is applied. No painting shall be done in cold, damp, foggy or dusty atmospheres.

One coat of priming paint followed by two coats of finish paints shall be applied to all exposed surfaces of the required steel towers. The colours of finish coats shall be applied alternately orange and white in approximately equal vertical sections, beginning at the top with orange. Each section of furnish coats shall be approximately equal to tower base width. Section lines between colour shall be sharply defined but in no case shall be less than seven sections.

The quantity of paint and thickness of each coat shall not be less than the following values :

	Quantity kg / sq.m	Minimum Thickness m
Primer	0.07 – 0.09	10
First finish	0.13 – 0.16	30
Second finish	0.13 – 0.16	30

Each coat shall be allowed to dry or harden thoroughly before the next coat is applied. A minimum of 4 days are required for drying of each operation.

Prior to commencement of the painting work, the Contractor shall submit a work program including the quality of paint and dimension of painting sections for the acceptance of the Engineer.

#### ***3.4.18 Marking of Shield Wire***

The shield wire shall be marked with orange and white colored fiber glass spheres. The spheres shall be 600 mm in diameter and shall have appropriate preformed armor set suitable for overhead

ground wire. Any metal parts, if used, for holding the spheres in position shall be made of stainless steel and shall not cause rust or harmful effects to the overhead ground wire / shield wire.

The position of the spheres shall meet the following requirements :

- a. In any span, the spheres shall be spaced at a minimum distance of 40 m from each other along the span.
- b. The spheres on the two overhead ground wires of any span shall be so staggered that the maximum distance between any two spheres is not greater than 40 m.
- c. The first and the last spheres in any span shall be approximately 10 m from the towers defining span.

#### ***3.4.19 Lighting of Steel Tower***

If required in the Contract and in the portion of Mekong River Crossing, the detailed specifications of air navigation obstruction lights shall be as shown on the Drawing.

#### **4 Attentions**

The design is for reference only, it may be adjusted and subject to the final detail engineering design.

## **APPENDIX K\_3    500 kV TRANSMISSION LINE**

# 600 MW Monsoon Onshore Wind Farm in Laos

## Proposed 500 kV transmission line

### 1. TECHNICAL SOLUTION FOR FOUNDATION

**Applicable standards, regulation-** Concrete and reinforced concrete- Design standard TCVN 5574-2012- Specifications for design of foundation for buildings and structures TCXD 9362- 2012- Bolts and Nuts TCVN 1896-76; TCVN 1915-76.- All documents used for design of foundation for buildings and structures.

**Foundation Types** -According to the geotechnical engineering investigation report and the hydro meteorological reports, combined with the various types of tower construction.

#### **Foundation Material**

- Concrete:
  - + Concrete lining has grade: B7.5
  - + Other Concrete has grade: B15All shall conform to Vietnam Standard: TCVN 5574-2018
- Reinforcement: Foundation deformed bars and plain round bars shall conform to Vietnam Standard: TCVN 1651-2018 and TCVN 5574-2018

### 2. TECHNICAL SOLUTION FOR TOWER

#### **Selecting phase distance and phase arrangement on the tower**

For the current double-circuit lines, the pyramid-shaped steel tower layout with 3-phase vertical conductor, the two circuits located on both sides of the tower are widely used because it has the advantage of the right of way as well as the less landoccupied area.

The distance between the cross arm: Suspension tower: 10.5m;  
Tension tower:10.9m the length of cross arm: Suspension tower: 7.5m, 7.8m, 8.0m; Tension tower:11m. The length of ground wire cross arm: Suspension tower: 7.5m; Tension tower:8.2m.



The distance between the conductor cross-arm and the ground wire cross-arm:  
Suspension tower: 9.0m; Tension tower: 9 m.

The distance from the ground to the lowest cross-arm is Suspension towers: 33m, 38m, and 43m; Tension tower: 24m, 30m, 36m.

The distance from the conductor to the tower shall be ensured according to the conditions from the electricity bring part to the earthing parts according to current regulations.

### **Selecting material of the tower**

On the line, two circuits galvanized steel towers, assembled by bolts shall be used. The tower is calculated with standard wind pressure at a height of 10m with  $Q = 60 \text{ daN/m}^2$ .

- Material making tower:
  - + Towers are made of shaped steel and plate steel embedded by bolts
  - + Bars/members with  $L \geq 120 \times 120 \text{ mm}$  shall use SS540 steel or type with equivalent strength.
  - + Bars/members with  $L \leq 100 \times 100 \text{ mm}$  shall use SS400 steel or type with equivalence strength.
  - + Bolts with durability grade of 4.6; 5.6 and 6.6 according to standards TCVN 1816-76 and TCVN 1915-76 shall be used.

### **Load Cases**

#### **a. Suspension towers calculated in 4 modes**

- Normal mode, the wind is perpendicular to the line, maximum wind pressure  $Q_{\max}$ , the conductor and the lightning conductor are not failure.
- Normal mode, the wind is oblique 45 degrees to the line, maximum wind pressure  $Q_{\max}$ , the conductor and the lightning conductor are not failure.
- Failure mode of one lightning conductor, failure conductor, maximum wind pressure  $Q_{\max}$ .
- Failure mode of 1 phase conductor on the same circuit, lightning conductor and other conductors without failure, maximum wind pressure  $Q_{\max}$ .

#### **b. Tension towers calculated in 4 modes**

- Normal mode, the wind is perpendicular to the line, maximum wind pressure  $Q_{\max}$ . Conductor and earth wire no failure.
- Normal mode, the wind is 45 to

the line, maximum wind pressure  $Q_{max}$ . Conductor and earth wire no failure. - Failure mode of one lightning conductor, conductor is not failure, maximum wind pressure  $Q_{max}$ . - Failure mode of one phase on same circuit; lightning conductor and conductor are not failure, maximum wind pressure  $Q_{max}$ . - Erection mode (it is calculated with wind velocity  $V=10\text{m/s}$ , corresponding to wind pressure  $Q = 6.5 \text{ daN/m}^2$  at basic elevation of 30m), corresponding to 2 cases: + Case 1: Stringing 3 conductors toward one side, lightning wire is not stringed. + Case 2: Lightning wire is not stringed toward one side; conductor is not stringed.

### Tower Family

- The following sixteen types of towers shall be designed for the 500kV double circuit transmission line. Specific conditions of use are shown as follow:

Types of Suspension	Wind Stress	Wind Span (m)	Weight Span (m)
Type A	$60\text{daN/m}^2$	$L_{wind} \leq 400$	$L_{max} = 700$
Type B	$400 < L_{wind} \leq 700$	$L_{max} = 800$	

Type of Tension	Wind Stress	Wind Span (m)	Weight Span (m)	Deviation Angle (°)
Type A (N522)	IA ( $60\text{daN/m}^2$ )	$L_{wind} \leq 600$	$L_{max} = 850$	$\alpha \leq 20^\circ$
Type A (N511)		$L_{wind} \leq 550$	$L_{max} = 600$	$20 < \alpha \leq 40^\circ$
Type B (N511)		$L_{wind} \leq 650$	$L_{max} = 1800$	$40 < \alpha$
		Dead end		

### 3. CONDUCTOR AND OVERHEAD GROUND WIRE

#### Select voltage level, number of circuits

According Pursuant to the Prime Minister's Documentary No. 938/TTg-CN dated 21<sup>st</sup> July, 2020 on the policy of importing electricity from the MonSoon Wind Farm and 500kV T/L projects for connection. Therefore, the voltage level is selected is 500kV. To ensure stable power transmission from MonSoon Wind farm, then transmit power through 500kV Thanh My Substation, the

transmission line is selected with two circuits. When one circuit is fault, the other circuit still ensures the transmission ability all the capacity of MonSoon Wind Farm, maintaining capacity on the regional system.

Technical specification of conductor ACSR330/43  
(TCVN 6483-1999; IEC 61089; IEC 61957):

<b>Material of conductor: aluminum strands reinforced with a core of galvanized steel wires</b>		
Number and diameter of wires: Aluminum	mm	54/2.8
Steel	mm	7/2.8
Overall diameter of stranded conductor	mm	25.2
Total area of conductor Aluminum	mm <sup>2</sup>	332
Steel	mm <sup>2</sup>	43.1
Total	mm <sup>2</sup>	375.1
Mass of conductor Without grease	kg/km	1255
Grease	kg/km	7.5
Total	kg/km	1262.5
Rated strength	daN	10378 (min)
Modulus of elasticity of conductor	daN/mm <sup>2</sup>	7050
Coefficient of linear expansion of conductor	per °C	19.4 x 10 <sup>-6</sup>
Maximum DC resistance of conductor per 1km at 20°C	Ω/km	0.0869 (max)
Assumed maximum full load current per conductor	A	≥ 749

### **Selecting lightning wire and fiber optical cable**

#### ***Ground wire conductor***

To avoid direct lightning strikes on the conductor, it is necessary to using a ground wire conductor. For 230kV and above, T/L of two circuits with a large distance between the two circuits, to ensure lightning protection for conductors (Protection angle is not greater than 20°), it is necessary to using 2 ground wire conductors (one ground wire conductor and one ground wire conductor combined with optical fiber cable).

#### **Insulator specifications**

Insulator string used on the transmission line uses glass or ceramic insulators. In this project, the insulation is selected in accordance with IEC 305, 383 and 120, which has been widely applied in the world. To reduce corrosion of Pin

insulator, insulators are selected with zinc - sleeve around the pin. The insulator is manufactured according to standards IEC-60305; IEC-60120; IEC-60383-1.

## **APPENDIX L      TURBINE COORDINATES**

### Coordinates of the Project's Wind Turbines

No.	Wind Turbine	Coordinates	
		Easting	Northing
1	W001	722223	1715518.002
2	W002	722557	1715355.002
3	W003	722704	1715043.001
4	W004	722952	1714776.002
5	W007	722194	1713628.001
6	W008	722061	1713248.002
7	W009	722255	1712963.002
8	W010	722258	1712602.002
9	W011	722483	1712331.002
10	W012	722490	1711967.002
11	W013	722588	1711634.001
12	W014	722550	1711244.002
13	W015	740051	1712014.002
14	W016	740236	1711666.002
15	W017	740734	1711167.002
16	W018	741133	1710965.001
17	W019	740947	1710401.001
18	W020	740995	1710026.002
19	W021	734023	1708218.002
20	W022	734874	1708263.002
21	W023	734923	1707918.001
22	W024	735123	1707618.002
23	W029	730947	1708129.001
24	W030	731320	1707696.002
25	W031	731522.999	1707345.001
26	W032	731815	1706947.001
27	W033	732804	1707480.002
28	W034	732967	1707157.002
29	W035	733548	1707034.002
30	W036	733830	1706768.002
31	W037	734123	1706518.002
32	W038	734482	1706183.002
33	W039	734892	1706053.002

No.	Wind Turbine	Coordinates	
		Easting	Northing
34	W040	735023	1705718.002
35	W041	735221	1705425.002
36	W042	735079.001	1704875.001
37	W043	736076	1705486.002
38	W044	736281	1705211.002
39	W045	736528	1704945.001
40	W046	736874	1704743.001
41	W047	737406	1704573.002
42	W048	738998.001	1705221.002
43	W049	738946	1704800.002
44	W050	738701	1704346.002
45	W051	738904	1704056.001
46	W052	738924	1703119.002
47	W053	738846	1702684.002
48	W054	738871	1702311.002
49	W055	723204	1710076.002
50	W056	740795	1702050.002
51	W057	740973	1701756.001
52	W058	741266	1701529.001
53	W059	741539	1701277.001
54	W060	722547	1709228.002
55	W061	742658	1701409.001
56	W062	742817	1701098.001
57	W063	743172	1700894.002
58	W064	742963	1700259.002
59	W065	743211	1700016.002
60	W066	731949.001	1700694.002
61	W067	732299	1700139.002
62	W068	732459	1699780.002
63	W069	732870	1699532.002
64	W070	732876	1699158.002
65	W071	733160	1698969.002
66	W073	732876	1697666.002
67	W074	733160	1697432.002

No.	Wind Turbine	Coordinates	
		Easting	Northing
68	W075	734035	1698362.002
69	W076	732835	1696849.002
70	W077	733299	1696643.002
71	W078	733393	1696228.001
72	W079	733702	1695842.002
73	W080	732469	1695637.001
74	W081	732862.999	1695399.002
75	W082	733114	1695120.001
76	W083	733389.001	1694899.001
77	W084	733589.999	1694594.002
78	W085	734416.001	1694327.002
79	W086	734982	1694195.002
80	W087	735436	1694003.002
81	W088	734258	1693548.002
82	W089	734313	1693073.001
83	W090	734724	1692926.001
84	W091	734901	1692635.002
85	W092	735095	1692349.001
86	W093	734970	1691918.002
87	W094	730319	1699102.002
88	W095	730515	1698830.002
89	W096	730665	1698501.002
90	W097	730261	1697726.002
91	W099	729889	1700007.002
92	W102	718068	1698230.002
93	W103	718260	1697803.002
94	W104	718593	1697458.002
95	W110	726158	1695400.002
96	W111	726433	1695072.002
97	W112	726523	1694718.002
98	W113	726450	1694276.002
99	W117	724618	1693835.002
100	W118	724233	1694066.002
101	W119	723687	1694209.002



No.	Wind Turbine	Coordinates	
		Easting	Northing
102	W120	722430	1693856.001
103	W121	722350	1694248.001
104	W122	722245	1694773.002
105	W123	721796	1695293.001
106	W124	721407	1695612.002
107	W125	720775	1696066.002
108	W126	724127	1692167.002
109	W128	724438	1691100.001
110	W130	725079	1691036.002
111	W131	725052.001	1690273.002
112	W132	725095	1689891.001
113	W133	720974	1696565.002
114	W134	721073	1695833.002
115	W135	722442	1693463.002
116	W136	726031	1693417.002
117	W138	725079	1691036.002
118	W140	725052.001	1690273.002
119	W141	725095	1689891.001
120	W142	723423	1685618.002
121	W143	723719	1685390.002
122	W144	723946	1685118.001
123	W145	724187	1684853.002
124	W146	724369	1684518.002
125	W147	724987	1684372.001
126	W148	725045.999	1684021.002
127	W150	725084	1683027.002
128	W151	726611	1692866.002
129	W152	726705	1692511.001
130	W153	721181	1697253.002
131	W154	742238	1710045.002
132	W155	723081	1710538.002
133	W0050	721736	1714178.002
134	W0060	721955	1713898.002
135	W0250	730684	1709529.002

No.	Wind Turbine	Coordinates	
		Easting	Northing
136	W0260	730741	1709156.002
137	W0270	730860	1708834.002
138	W0280	730908	1708480.001
139	W0980	730916	1697746.001
140	W1000	727957	1698120.001
141	W1010	728008.001	1698527.002
142	W1050	729817	1694260.001
143	W1060	730017	1693874.002
144	W1070	728157	1694478.002
145	W1080	728048	1694837.002
146	W1090	727791	1695327.002
147	W1390	728500	1694303.002
148	W1490	725070	1683408.002