DIRECTION DES ÉVALUATIONS ENVIRONNEMENTALES

NORTHLAND POWER INC.

PROJET D'AMÉNAGEMENT DU PARC ÉOLIEN DU MONT-LOUIS
MUNICIPALITÉ DE SAINT-MAXIME-DU-MONT-LOUIS

AVIS DE PROJET

Octobre 2006

Développement durable, Environnement et Parcs
Québec

INTRODUCTION

La section IV.1 de la Loi sur la qualité de l'environnement (L.R.Q., c. Q-2) oblige toute personne ou groupe à suivre la *Procédure d'évaluation et d'examen des impacts sur l'environnement* et à obtenir un certificat d'autorisation du gouvernement, avant d'entreprendre la réalisation d'un projet visé par le Règlement sur l'évaluation et l'examen des impacts sur l'environnement (R.R.Q., c. Q-2, r. 9). Entrée en vigueur le 30 décembre 1980, cette procédure s'applique uniquement aux projets localisés dans la partie sud du Québec. D'autres procédures d'évaluation environnementale s'appliquent aux territoires ayant fait l'objet de conventions avec les Cris, les Inuits et les Naskapis.

Depuis l'entrée en vigueur, le 18 juin 1993, de la Loi sur l'établissement et l'agrandissement de certains lieux d'élimination de déchets (chap. 44), tout projet d'établissement ou d'agrandissement d'un lieu d'enfouissement sanitaire ou de dépôt de matériaux secs, au sens du Règlement sur les déchets solides, est aussi assujetti à la procédure prévue à la section IV.1 de la Loi sur la qualité sur l'environnement.

Le dépôt de l'avis de projet constitue la première étape de la procédure. Il s'agit d'un avis écrit par lequel l'initiateur informe le ministre du Développement durable, de l'Environnement et des Parcs de son intention d'entreprendre la réalisation d'un projet. Il permet aussi au Ministère de s'assurer que le projet est effectivement assujetti à la procédure et, le cas échéant, de préparer une directive indiquant la nature, la portée et l'étendue de l'étude d'impact que l'initiateur doit préparer.

Le formulaire avis de projet sert à décrire les caractéristiques générales du projet. Il doit être présenté d'une façon claire et concise et se limiter aux éléments pertinents à la bonne compréhension du projet et de ses impacts appréhendés. Ce formulaire et tout document annexé doivent être fournis en trente copies. Dès sa réception par le ministère, l'avis de projet est transmis à toute personne qui en fait la demande et, comme prévu à la procédure, l'avis de projet doit être mis à la disposition du public pour information et consultation publiques du dossier.

Dûment rempli par l'initiateur du projet ou le mandataire de son choix, l'avis de projet est ensuite retourné à l'adresse suivante :

Ministère du Développement durable, de l'Environnement et des Parcs
Direction des évaluations environnementales
Édifice Marie-Guyart, 6e étage
675, boul. René-Lévesque Est, boîte 83
Québec (Québec) G1R 5V7
Téléphone : (418) 521-3933
Télécopieur : (418) 644-8222
Internet : www.menv.gouv.qc.ca

Par ailleurs, en vertu de l'Entente de collaboration Canada-Québec en matière d'évaluation environnementale de mai 2004, le ministère du Développement durable, de l'Environnement et des Parcs transmettra une copie de l'avis de projet à l'Agence canadienne d'évaluation environnementale afin qu'il soit déterminé si le projet est également assujetti à la Loi canadienne sur l'évaluation environnementale. Le cas échéant, le projet fera l'objet d'une évaluation environnementale coopérative et l'avis de projet sera inscrit au registre public prévu à la Loi canadienne sur l'évaluation environnementale. L'initiateur de projet sera avisé par lettre si son projet fait l'objet d'une évaluation environnementale coopérative.

À l'usage du ministère du Développement durable, de l'Environnement et des Parcs	Date de réception Numéro de dossier

1. Initiateur du projet

Nom :	Northland Power inc.
Adresse :	30 St. Clair Ave. W., Floor 17 TORONTO, Ontario M4V 3A1
Téléphone :	416-962-6262
Télécopieur :	416-962-6266
Courriel :	davidcheungatkinson@northlandpower.ca
Responsable du projet :	David Cheung Atkinson

Northland Power inc. est un important développeur et opérateur de projets énergétiques de l'Ontario. Northland Power est actif dans le domaine de l'éolien, notamment par sa participation dans la coentreprise Énergie Éolienne du mont Miller inc. qui a permis de développer le projet éolien de 54 MW du Mont Miller à Murdochville. Northland Power travaille également à la mise sur pied d'un projet éolien de 150 MW situé à Saint-Ulric et Saint-Léandre, près de Matane. Northland Power a également développé plusieurs projets de biomasse dont ceux de Kirkland Lake et Cochrane, ainsi que le projet de cogénération de Iroquois Falls. Actuellement des projets similaires sont en développement dans les régions de York et Thorold en Ontario. Northland Power est le propriétaire majoritaire dans un projet de chauffage urbain en Ukraine ainsi que partenaire dans un projet de cogénération à Kingston en Ontario.

2. Consultant mandaté par l'initiateur du projet (s'il y a lieu)

Nom :	SNC-Lavalin inc.
Adresse :	5955, rue Saint-Laurent, bureau 300 Lévis, Québec G6V 3P5
Téléphone :	418-837-3621
Télécopieur :	418-837-2039
Courriel :	robert.demers@snclavalin.com
Responsable du projet :	Robert Demers

3. Titre du projet

Projet d'aménagement du parc éolien du Mont-Louis

4. Objectifs et justification du projet

Mentionner les principaux objectifs poursuivis et faire ressortir les raisons motivant la réalisation du projet.

Le projet d'aménagement du parc éolien du Mont-Louis est divisé en deux phases distinctes. La première consiste en l'installation d'un parc d'éoliennes pour une puissance installée de 100,5 MW dans le but de produire de l'électricité. Ce projet vise à répondre au contrat obtenu dans le cadre de l'appel d'offre (A/O 2003-02) d'Hydro-Québec Distribution pour 1 000 MW de production d'énergie éolienne. L'appel d'offre découle de l'adoption par le gouvernement du Québec du décret numéro 352-2003, édictant le *Règlement sur l'énergie éolienne et sur l'énergie produite avec de la biomasse* et du décret 353-2003 concernant les préoccupations économiques, sociales et environnementales indiquées à la *Régie de l'énergie à l'égard de l'énergie éolienne et de l'énergie produite avec de la biomasse*.

La seconde phase consiste en l'élaboration d'un projet éolien d'une puissance de 160 MW qui sera soumis dans le cadre du second appel d'offre d'Hydro-Québec Distribution (A/O 2005-03). Cette phase est constituée des phases 2 et 3 du projet (ci-après, phase 2). La zone d'étude présentée dans ce document englobe les phases 1 et 2 du projet. Mentionnons également que l'étude d'impact présentera également les 2 phases du projet de façon globale, pour les sections similaires, alors que l'analyse des impacts et la description technique des projets se fera de façon partagée.

La région de Saint-Maxime-du-Mont-Louis possède un bon potentiel pour un développement éolien d'envergure en raison de la qualité des vents du secteur et d'un réseau routier possédant des chemins bien élaborés facilitant ainsi l'accès aux différents sites. L'énergie produite sera acheminée au poste Goémon, pour ce faire Hydro-Québec construira une ligne électrique de 230 kV qui permettra d'intégrer l'énergie produite au réseau de distribution existant.

5. Localisation du projet

Mentionner l'emplacement ou les emplacements où le projet est susceptible de se réaliser et inscrire, si connus, les numéros cadastraux (en termes de lot, rang, canton et municipalités). Préciser la Municipalité Régionale de Comté. Ajouter en annexe une carte topographique ou cadastrale de localisation du projet.

Le projet est situé dans la Municipalité de Saint-Maxime-du-Mont-Louis dans la MRC de La Haute-Gaspésie. La carte 1 illustre la localisation de la zone d'étude. La carte 2 montre la localisation projetée des éoliennes pour les différentes phases du projet. Cependant, la microlocalisation des éoliennes n'étant pas déterminée, celle-ci pourra être appelée à changer ou à se préciser.

6. Propriété des terrains

Indiquer, s'il y a lieu, le statut de propriété des terrains où la réalisation du projet est prévue. Fournir ces renseignements sur une carte si possible.

La majeure partie du parc éolien sera aménagée sur des terres publiques, une carte placée à l'annexe 1 illustre les terres demandées ainsi que celles visées par une lettre d'intention du MRNF. Cette carte montre également les informations cadastrales pour la municipalité de Saint-Maxime-du-Mont-Louis.

Le tableau 1 présenté à la page suivante montre les coordonnées pour l'implantation des éoliennes ainsi que les propriétaires des terrains lorsque disponibles à ce stade-ci de l'étude.

ÉTUDE D'IMPACT SUR ENVIRONNEMENT

AMÉNAGEMENT D'UN PARC ÉOLIEN À MONT-LOUIS

Figure 2.1

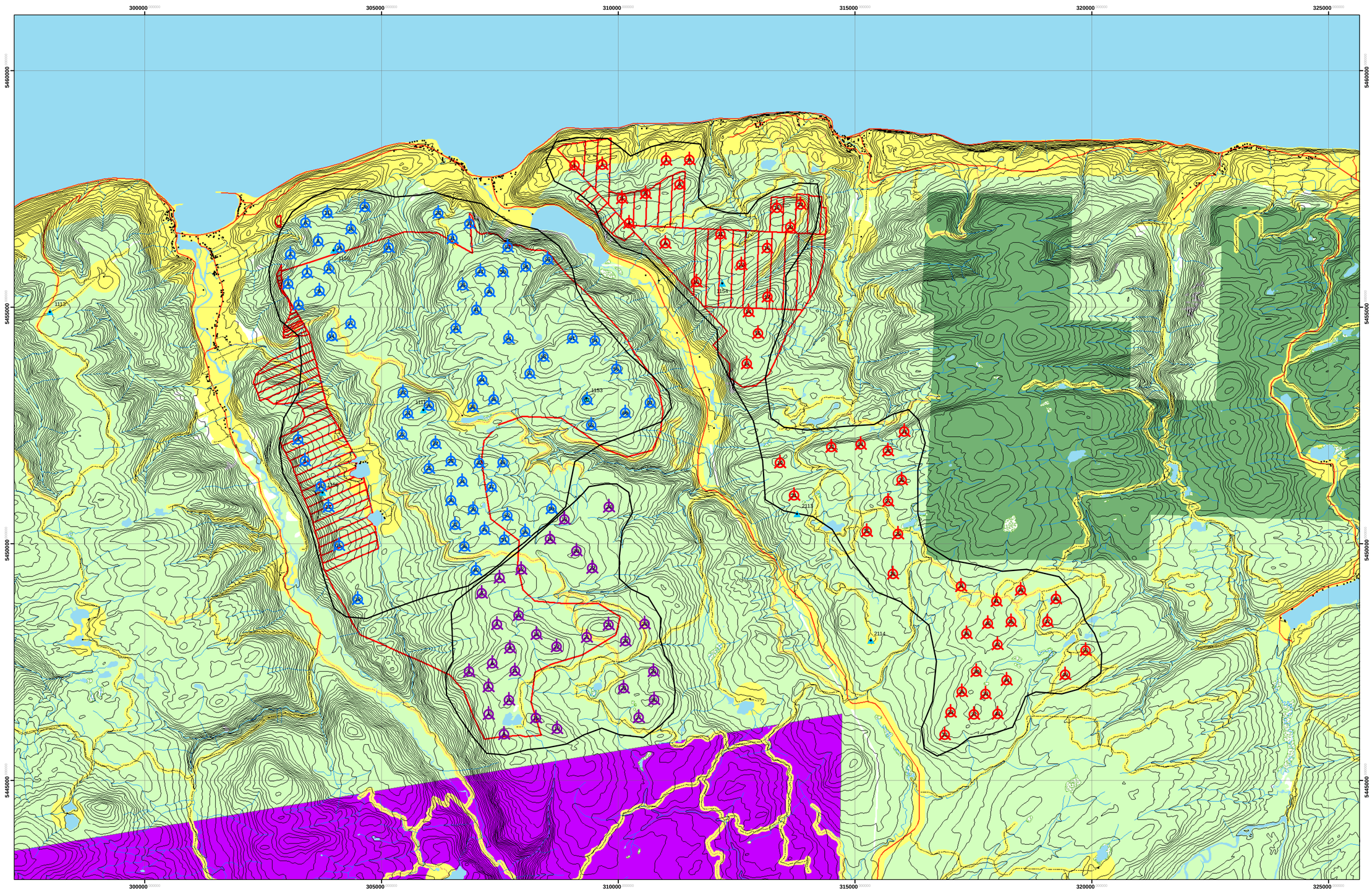
Localisation du projet

Zone d'étude
Réserve faunique
Parc de conservation
Limite provinciale

0 50 100 km

SNC LAVALIN

Mont-Louis : Implantation des éoliennes P1, P2 et P3 - 20 Octobre 2006



N
W
E
S

Légende

- Tour de mesure
- Éolienne P1_Lay4 (100MW)
- Éolienne P2_lay2 (100MW)
- Éolienne P3_lay2 (60MW)
- Limite de projet
- Bâtiment
- Courbe de niveau

Route

- Route locale
- Route régionale
- Route non-pavé
- Chemin forestier
- Rivière
- Lac
- Terre humide
- Végétation
- Projet éolien de Gros-Morne
- Chic Choc
- Lettre d'intention
- Restriction

1 0.5 0 1 2 Kilomètre

1:40,000

Préparé par:

GPCo

Mont-Louis : Implantation des éoliennes P1, P2 et P3 - 20 Octobre 2006

Projection UTM - Nad 83

AVERTISSEMENT

MTL_P1 -100MW_GE1.5 sle - 1.5MW

Total estimated road length = 74.67 km
Existing road included in the total estimated road length (based on the NTDB maps) = 26.6 km

TURBINE_ ID	X_COORD UTM 20 NAD 83	Y_COORD UTM 20 NAD 83	Rang	Lot	Canton	Landowner	Letter of intention	Status	Name	Address	Phone
1	303027	5455493					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
2	303076	5456116	1	274	Taschereau	Not Signed		4: Not Signed	Donna Daiute	102 Charlton Street Apt 11 New York NY 10014-3604	212-243-7291
3	303237	5452205	1	205-1	Taschereau	Public Land	X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
4	303248	5455049					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
5	303382	5451751	1	203-1	Taschereau	Public Land	X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
6	303392	5456789	1	275-P	Taschereau	Lots signed by NPI		3: Successfully Signed	Suzanne Dessureault	4 7ieme rue E. Mont-Louis Qc G0E1T0	797-2862
7	303426	5455728					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
8	303661	5456396	1	276-P	Taschereau	Not Signed		4: Not Signed	Gaetan Cabot	99 chemin de la Riviere Grande-Vallee Qc	393-3139 ou 393-9448
9	303688	5455346					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
10	303719	5451215	1	199-1	Taschereau	Public Land	X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
11	303855	5456993	1	277-1	Taschereau	Lots signed by NPI		3: Successfully Signed	Jules Pelletier	49 Place du Lynx Ste-Anne-des-Monts Qc G4V2A6	763-3435 cell:763-4664
12	303876	5450780	1	196-1	Taschereau	Public Land	X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
13	303889	5455815					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
14	303949	5454390					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
15	304101	5449963	1	192	Taschereau	Public Land	X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
16	304113	5456255	1	279-P	Taschereau	Lots signed by NPI		3: Successfully Signed	Andre Kalfon	1775 rue Duchame Outremont Qc H2V1H2	514-735-2611
17	304346	5454659					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
18	304355	5456657	1	281-2-P	Taschereau	Lots signed by NPI		3: Successfully Signed	Andre Kalfon	1775 rue Duchame Outremont Qc H2V1H2	514-735-2611
19	304497	5448828					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
20	304645	5457120	1	283-A-P	Tashereau	Lots signed by NPI		3: Successfully Signed	James-Henri, Charles, Bernard Atkins	3 Chemin des Cotes Anse-Pleureuse Qc G0E2E0	797-2619
21	305149	5456259					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
22	305432	5452310					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
23	305451	5453199					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
24	305553	5452756					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
25	306001	5451597					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
26	306002	5452919					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
27	306138	5452119					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
28	306198	5456989	1	293-P	Taschereau	Lots signed by NPI		3: Successfully Signed	Francois Lapointe	50 1ere Ave O. Anse-Pleureuse Qc G0E2E0	797-2116
29	306463	5451752					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
30	306467	5450917					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
31	306495	5456453	1	294-1-P	Taschereau	Lots signed by NPI		3: Successfully Signed	4128664 Canada Inc. (Stephane Castonguay)	903-A rue Dunlop Montreal Qc H2V2N9	418-763-9195
32	306550	5450402					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
33	306565	5454559					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
34	306700	5451318					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
35	306713	5455462					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
36	306748	5449945					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
37	306853	5456765	1	301-1-P	Taschereau	Not Signed		4: Not Signed	Jean-Yves Campion	391 rue de la Fabrique Pointe-du-Lac Qc	819-377-0684
38	306925	5452891					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
39	306936	5450725					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
40	306994	5449443					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
41	307004	5454946					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
42	307059	5451711					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
43	307089	5455755					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
44	307121	5453461					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
45	307171	5450300					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
46	307278	5455329					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
47	307320	5451204						n/a			
48	307369	5453053					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
49	307558	5451721						n/a			
50	307565	5455745					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
51	307594	5450088					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
52	307656	5450598						n/a			
53	307664	5456271					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
54	307681	5454342					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
55	308033	5450256						n/a			
56	308047	5455856					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
57	308127	5453598					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
58	308418	5453956					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
59	308506	5456009					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
60	308589	5450746						n/a			
61	309029	5454345					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
62	309340	5453043					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
63	309427	5452507					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
64	309507	5454296					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
65	309959	5453699					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
66	310145	5452768					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
67	310667	5452982					X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec

MTL_P2 -100MW_E-82 - 2MW

Total estimated road length = 63.31 km
Existing road included in the total estimated road length (based on the NTDB maps) = 31.11 km

TURBINE_ID	X_COORD UTM20 NAD 83	Y_COORD UTM20 NAD 83	Rang	Lot	Canton	Letter of intention	Status	Name	Address	Phone	OWNERSHIPS
1	309075	5458000				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
2	309660	5458012				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
3	310076	5457299				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
4	310227	5456778				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
5	310577	5457400				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
6	310993	5456349					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
7	311008	5458104					4: Not Signed	Pierre Roberge	4 rue de la Chute Anse-Pleureuse Qc G0E2E0		Not Signed
8	311293	5457594				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
9	311501	5458115					3: Successfully Signed	David Element	4 rue de l'Eglise Gros-Morne Qc	797-2467	Lots signed by NPI
10	311649	5455534				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
11	312158	5456544				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
12	312597	5455896				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
13	312713	5453808				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
14	312749	5454905				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
15	312950	5454449				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
16	313142	5456251				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
17	313149	5455218				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
18	313350	5457100				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
19	313415	5451712					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
20	313630	5456693				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
21	313711	5451022					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
22	313849	5457170				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
23	314497	5452046					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
24	315119	5452102					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
25	315246	5450262					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
26	315694	5451965					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
27	315697	5450902					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
28	315798	5449364					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
29	315907	5450207					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
30	315985	5451351					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
31	316038	5452370					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
32	316892	5445964					n/a				
33	317018	5446440					n/a				
34	317238	5449104					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
35	317255	5446876					n/a				
36	317352	5448102					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
37	317507	5446394					n/a				
38	317560	5447300					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
39	317756	5446828					n/a				
40	317802	5448316					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
41	317986	5448790					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
42	318007	5447869					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
43	318011	5446405					n/a				
44	318199	5447119					n/a				
45	318293	5448354					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
46	318496	5449023					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
47	319063	5448355					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
48	319241	5448836					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land
49	319435	5447233					n/a				
50	319869	5447746					2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec	Public Land

MTL_P3 -60MW_E-82 - 2MW

Total estimated road length = 35.84 km
Existing road included in the total estimated road length (based on the NTDB maps) = 18.24 km

TURBINE_ID	X_COORD UTM20 NAD 83	Y_COORD UTM20 NAD 83	Rang	Lot	Canton	Letter of intention	Status	Name	Address	Phone
1	306848	5447300				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
2	307116	5448953				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
3	307257	5446981				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
4	307261	5446398				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
5	307490	5449279				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
6	307340	5447474				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
7	307436	5448297				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
8	307585	5445973				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
9	307712	5447797				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
10	307690	5446694				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
11	307817	5447316				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
13	307893	5448487				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
14	308268	5448089				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
17	308698	5447825				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
21	309333	5448028				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
23	309794	5448286				X	2: Public Land	Gov. Of Quebec	Gov. Of Quebec	Gov. Of Quebec
12	307948	5449459					n/a			
15	308261	5446318					n/a			
16	308556	5450104					n/a			
18	308862	5450516					n/a			
19	308707	5446094					n/a			
20	309117	5449850					n/a			
22	309448	5449486					n/a			
24	309801	5450779					n/a			
25	310111	5446950					n/a			
26	310150	5447946					n/a			
27	310430	5446330					n/a			
28	310554	5448307					n/a			
29	310741	5447305					n/a			
30	310754	5446706					n/a			

7. Description du projet et de ses variantes

Pour chacune des phases (aménagement, construction et exploitation), décrire les principales caractéristiques associées à chacune des variantes du projet, incluant les activités, aménagements et travaux prévus (déboisement, expropriation, dynamitage, remblayage, etc.). Décrire sommairement les modalités d'exécution, les technologies utilisées, les équipements requis, les matières premières et matériaux utilisés, etc. Ajouter en annexe tous les documents permettant de mieux cerner les caractéristiques du projet (plan, croquis, vue en coupe, etc.).

Les principales composantes du projet sont présentées ci-dessous :

Phase 1

- 67 éoliennes GE 1.5 sle
- Un réseau de chemins d'accès d'environ 75 kilomètres
- Construction d'une sous-station, la localisation n'est pas encore déterminée
- Une ligne de transmission à 230 kV jusqu'au poste au Goémon, cette ligne sera construite par Hydro-Québec

Phase 2

- 80 éoliennes Enercon E-82
- Un réseau de chemins d'accès d'environ 100 kilomètres
- Construction d'une sous-station, la localisation n'est pas encore déterminée
- Une ligne de transmission à 230 kV jusqu'au poste au Goémon, cette ligne sera construite par Hydro-Québec

Les fiches techniques des éoliennes sont présentées à l'annexe 2.

Note : Les phases 1 et 2 seront desservies par la même ligne de transmission de 230 kV.

L'aménagement des sites

Les informations suivantes sont valables pour les phases 1 et 2 du projet.

L'aménagement des sites comprendra des travaux de réfection et construction des chemins d'accès. Du déboisement sera également nécessaire considérant que le projet sera développé dans un secteur forestier. Des traversées de cours d'eau (ponceaux) devront également être mises en place. Ces travaux nécessiteront la mise en place d'ouvrage de stabilisation des rives et la mise en place de remblais. Par la suite, les aires d'assemblage et de travail nécessaire pour l'installation des éoliennes et des infrastructures seront déboisées (si requis) et adaptées aux caractéristiques requises pour permettre les travaux. Les surfaces de travail seront nivelées à l'aide d'un bouteur. Mentionnons également qu'en raison de la nature du substrat, le promoteur pourrait utiliser des explosifs, cependant celui-ci désire limiter au minimum l'utilisation de la dynamite. L'ensemble des travaux se fera en respectant le *Règlement sur les normes d'intervention des les forêts du domaine de l'État* (RNI).

Construction

Les activités de construction comprendront notamment la préparation des fondations des éoliennes. Celles-ci seront des fondations en béton de type « spread footed » d'environ 2,5 mètres de profondeur et de 17 mètres de largeur.

Les activités de construction comprendront également l'implantation d'un réseau de communication par fibre optique et d'un réseau de collecte d'électricité. Ce réseau sera partiellement souterrain et partiellement aérien. Les portions souterraines seront présentes dans les secteurs de plus forte densité des éoliennes ainsi que dans les secteurs à forte sensibilité visuelle. Le réseau de collecte aérien prédominera dans les secteurs de moindre visibilité et lors des traversées de cours d'eau.

L'installation des éoliennes en tant qu'unités énergétiques autonomes se fera par l'érection des pièces composant la tour, la nacelle et le rotor. Ces différentes pièces seront installées à l'aide de grues. Celles-ci seront installées sur des aires spécialement aménagées selon les spécifications de portance et de type de sol adapté à l'équipement. Une caractérisation géotechnique sera préalablement effectuée sur chacun des sites d'implantation des éoliennes.

Le projet comprendra également la construction de sous-stations électriques qui permettra de recueillir l'énergie générée par le projet et d'augmenter le voltage afin de relier le projet à la ligne à haute tension de 230 kV qui sera construite par Hydro-Québec. Le nombre de sous-station ainsi que leur localisation n'est pas encore déterminée. Cette future ligne permettra de relier le parc éolien au poste au Goémon.

Exploitation

Les activités associées à la phase d'exploitation du site seront minimes et reliées à l'entretien et le remplacement de composantes de façon normale pour un projet éolien. L'entretien préventif prévoit des vérifications régulières à tous les trois mois lors de la première année d'exploitation, et de façon bi-annuel par la suite.

Les activités d'entretien comprendront le remplacement des huiles et le graissage des équipements, la vérification et la calibration des équipements, les tests diagnostics du fonctionnement et l'usure des composantes de l'éolienne. Celles-ci comprennent les pales, l'arbre de transmission principal, la boite de vitesse, les divers moteurs servant à diriger les pales et l'orientation de l'éolienne, le système de refroidissement, la génératrice et le transformateur. Ce dernier sera installé à la base de l'éolienne dans une armoire de protection équipée d'une contenance en cas de déversement et permettant de recueillir plus que la capacité du transformateur en huile de refroidissement.

Des activités d'entretien des accès seront également réalisées au cours de la période d'exploitation. Celles-ci comprendront le déneigement lors de la période hivernale et le resurfaçage au besoin pour les chemins d'accès principaux.

Désaffectation

Suite à la période de vie utile du projet, l'ensemble des infrastructures en place seront démantelées, les socles de béton seront arasés de 1 mètre de profondeur et recouvert de sédiments propres. Les fils électriques enfouis seront enlevés, seul les chemins d'accès demeureront en place.

8. Composantes du milieu et principales contraintes à la réalisation du projet

Pour l'emplacement envisagé, décrire brièvement les milieux naturel et humain tels qu'ils se présentent avant la réalisation du projet, ainsi que les principales contraintes prévisibles (zonage, espace disponible, milieux sensibles, compatibilité avec les usages actuels, disponibilité des services, topographie, présence de bâtiments, préoccupations majeures de la population, etc.).

Les informations suivantes sont valables pour les phases 1 et 2 du projet.

Description du territoire

Le territoire de la zone d'étude se caractérise par deux éléments géographiques distincts, soit la frange littorale du Saint-Laurent ainsi que le massif appalachien. La zone côtière est étroite et fait rapidement place aux pentes abruptes des Appalaches. La topographie est accidentée et présente quelques vallées encaissées, comme celles des rivières Mont-Louis et L'Anse Pleureuse. Dans l'ensemble de la zone d'étude, l'altitude moyenne est d'environ 450 mètres.

La géologie du secteur est formée de roches sédimentaires (shale, shale calcaireux et grès). On retrouve d'importants affleurements rocheux sur le territoire. Les dépôts de surface sont composés d'altérites, parfois le socle rocheux est recouvert d'un till mince sur le sommet des plateaux, entre les vallées, dans les dépressions on retrouve un till épais. En certains endroits, au pied des versants abrupts, on peut retrouver des dépôts d'éboulis.

Le territoire à l'étude est drainé par deux bassins hydrographiques, soit celui de la rivière Mont-Louis et celui de la rivière l'Anse Pleureuse. Ces deux rivières sont encaissées dans de profondes vallées. On retrouve également dans la zone d'étude quelques lacs ainsi que plusieurs ruisseaux de nature permanente ou intermittente. Le principal lac dans la zone d'étude est le lac de l'Anse Pleureuse.

Le territoire est fréquenté par diverses espèces fauniques, dont certaines présentent un grand intérêt pour la collectivité. Par exemple, mentionnons entre autre la présence de l'Orignal, ainsi que de l'Omble de fontaine et du Saumon dans les rivières de la zone d'étude. Le Cerf de Virginie a également été aperçu dans la zone d'étude.

Description du couvert forestier

La majeure partie du territoire fait partie de la sapinière à bouleau jaune, seule la portion située au sud de la zone d'étude est comprise dans le domaine bioclimatique de la sapinière à bouleau blanc. Le couvert forestier est dominé principalement par des peuplements résineux, dans une proportion d'environ 70 %, les peuplements mélangés représentent environ 20 % alors que les peuplements de feuilles constituent 10 % du milieu forestier. On ne retrouve que quelques milieux humides sur le territoire, ceux-ci sont de petites superficies et situés uniquement à proximité de petits cours d'eau. Mentionnons que certaines espèces végétales ayant un statut précaire ont été signalées dans la zone d'étude, celles-ci sont principalement situées au nord à proximité du Saint-Laurent.

Utilisation du territoire

La majeure partie du territoire de la zone d'étude est située en milieu forestier, les noyaux villageois se situent en bordure du fleuve et s'étendent sur de faible superficie. L'exploitation forestière constitue une activité importante dans la région, le parc éolien s'insère donc dans un milieu perturbé. On retrouve quelques lieux de villégiature dans la zone d'étude, principalement situés sur les rives des lacs à la Truite et lac de la Dame.

Sur le plan récréotouristique, on retrouve quelques sentiers de VTT et motoneige dans la zone d'étude. Signalons également la présence du sentier international des Appalaches, situé au nord de la zone d'étude. Un secteur d'encadrement visuel est également présent à proximité du lac de l'Anse Pleureuse. Mentionnons que celui-ci est utilisé comme lac d'écopage par le service aérien gouvernemental. Finalement, mentionnons la présence de ligne électrique dans l'axe de la route 198.

Agriculture

L'agriculture ne représente pas une activité importante dans la zone d'étude.

9. Principaux impacts appréhendés

Pour les phases d'aménagement, de construction et d'exploitation du projet, décrire sommairement les principaux impacts (milieux biophysique et humain) susceptibles d'être causés par la réalisation du projet.

Les informations suivantes sont valables pour les phases 1 et 2 du projet.

Pour la phase de construction, des impacts mineurs sont appréhendés au niveau de la végétation qui devra être enlevée pour la mise en place des chemins d'accès et des éoliennes. Quelques ruisseaux seront traversés par les chemins où des impacts potentiels sont prévus sur l'habitat du poisson et la qualité de l'eau. Rappelons que la construction des chemins incluant la traversée des cours d'eau se fera en conformité avec le *Règlement sur les normes d'intervention dans les forêts du domaine de l'État* (RNI). Des impacts résultant de l'accroissement de la circulation en période de construction sont anticipés, cela entraînera un dérangement potentiel pour la population ainsi que la faune présente dans le secteur. Une coordination des travaux sera effectuée afin de minimiser cet impact.

Au niveau de l'économie régionale, des retombées positives très importantes sont anticipées.

Pour la phase d'exploitation, selon la littérature et nos expériences précédentes, des impacts peuvent être appréhendés au niveau visuel et du bruit, l'importance de ces impacts anticipés devra faire l'objet d'une attention particulière près des secteurs de villégiature et des noyaux villageois. Un facteur d'atténuation important est l'aménagement du projet sur plusieurs kilomètres, principalement en terre publique hors des lieux d'habitation, ainsi que le recours à une technologie de grande puissance réduisant la densité du projet. Selon la littérature et l'expérience des différents parcs éoliens en exploitation, des impacts mineurs sont appréhendés au niveau de la faune avienne. Sur le plan récréotouristique des impacts positifs peuvent être appréhendés par l'ouverture de nouveau territoire. Généralement, ce type de projet suscite l'intérêt des touristes. L'entretien du parc éolien entraînera des retombées positives par la création d'emplois locaux.

10. Calendrier de réalisation du projet

Indiquer le calendrier selon les différentes phases de réalisation du projet et en tenant compte du temps requis pour la préparation de l'étude d'impact et le déroulement de la procédure.

Échéancier du projet

Activités	Date
Réalisation de l'étude d'impacts	Août 2006 - janvier 2007
Analyse interministérielle	Janvier – février 2007
Rapport complémentaire	Avril 2007
Avis de recevabilité	Mai 2007
Information et consultation publique (BAPE)	Juin-juillet 2007
Audiences publiques (s'il y a lieu)	Septembre-décembre 2007
Décret gouvernemental	Février 2008
Certificat d'autorisation	Mars 2008
Construction	2008-2009

11. Phases ultérieures et projets connexes

Mentionner, s'il y a lieu, les phases ultérieures du projet et tout autre projet susceptible d'influencer la conception du projet proposé.

Tel que mentionné précédemment, le projet se divise en 2 phases distinctes, la première comprend l'aménagement d'un parc éolien d'une puissance de 100,5 MW, comprenant 67 éoliennes. La deuxième phase comprend la mise en place de 80 éoliennes pour une puissance installée de 160 MW. Rappelons cependant que cette seconde phase doit préalablement être accordée suite à l'appel d'offre A/0 2005-03.

12. Modalités de consultation du public

Mentionner, s'il y a lieu, les diverses formes de consultation publique prévues au cours de l'élaboration de l'étude d'impact.

Les informations suivantes sont valables pour les phases 1 et 2 du projet.

Pour favoriser l'acceptation sociale du projet par le milieu, il est prévu d'avoir une approche en deux temps. En début de processus, dès que le projet sera suffisamment avancé, il y aura diverses rencontres et contacts d'établis avec les principaux intervenants gouvernementaux oeuvrant dans le milieu. Nous prévoyons dès cette étape une séance d'informations et de consultation publique avec la population concernée par le projet. Une fois que les impacts seront déterminés, une rencontre avec la municipalité, la MRC, les autres intervenants identifiés ainsi que la population concernée sera effectuée afin de présenter l'ensemble du projet, avec notamment les modifications apportées suites aux consultations effectuées en début de processus. L'ensemble des commentaires reçus fera l'objet d'une analyse détaillée et sera intégré à l'étude d'impact s'il y a lieu.

13. Remarques

Inscrire tout autre renseignement jugé nécessaire à une meilleure compréhension du projet et au besoin, annexer des pages supplémentaires.

Dans le cadre du présent projet, il est important de mentionner que Northland Power a déjà débuté des études d'inventaire de l'avifaune et des chiroptères. Le projet doit entrer en fonction dès 2010, pour sa 1ère phase en conséquence l'étude d'impact se doit d'être enclenchée dès l'automne 2006. Afin de réaliser une étude d'impacts la plus conforme face aux attentes du MDDEP, Northland Power inc. désire obtenir une directive dans les meilleurs délais.

Je certifie que tous les renseignements mentionnés dans le présent avis de projet sont exacts au meilleur de ma connaissance.

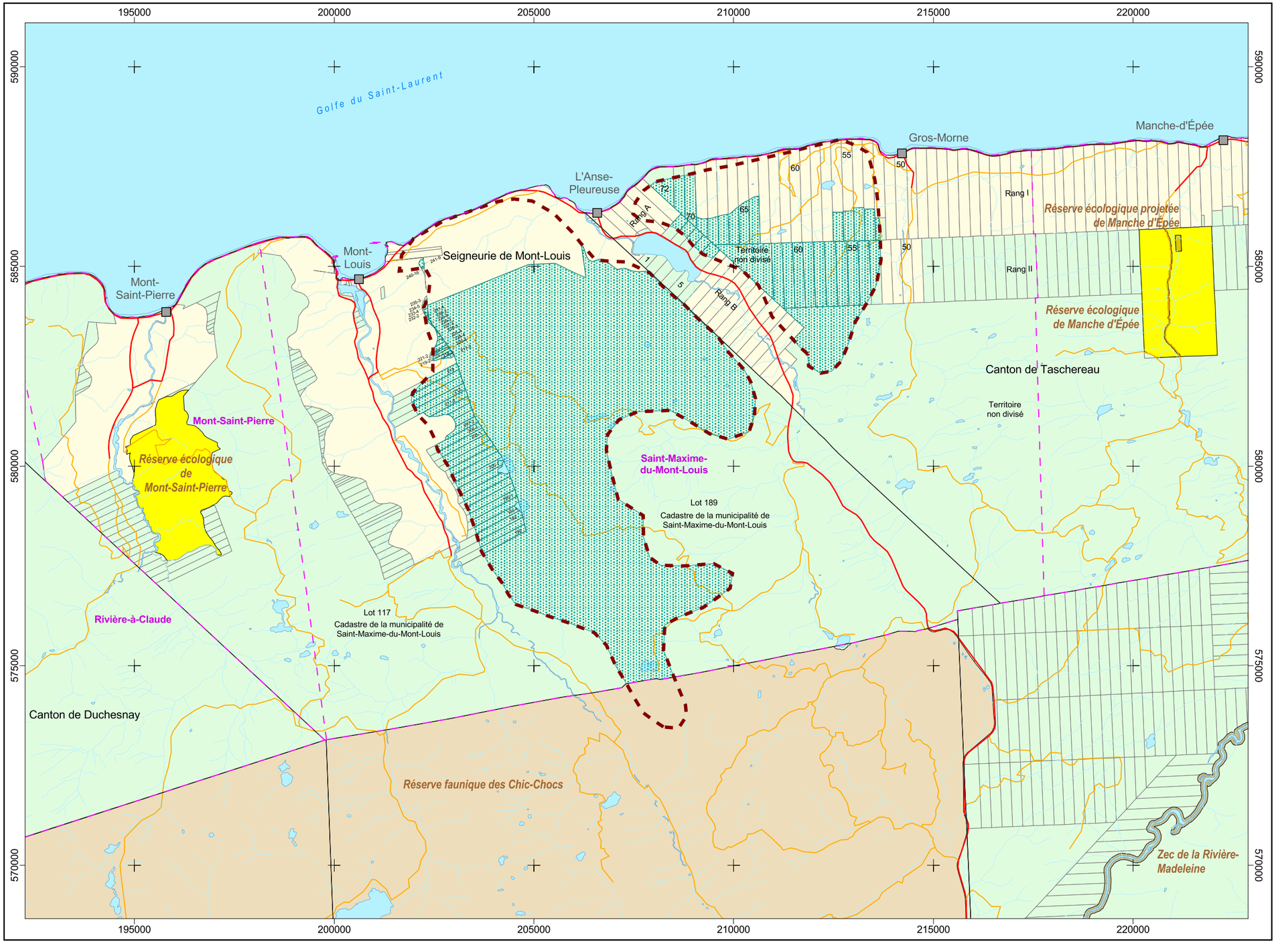
Signé le 18 novembre 2008 par

David Cheung Atkinson

ANNEXE 1

Terres visées par une lettre d’intention / MRNF

Terres visées par une lettre d'intention
Projet 01-02



Terres visées
- Terres demandées
- Terres visées par la lettre d'intention

Territoire faunique structuré
- Réserve faunique
- Zec
- Pourvoirie avec droits exclusifs

Territoire de conservation
- Parc national du Québec
- Parc national du Canada
- Réserve écologique
- Réserve écologique projetée

Limite administrative
- Frontière interprovinciale
- Région administrative
- Municipalité régionale de comté (MRC)
- Municipalité
- Canton
- Localité

Voie de communication (BDTA)
- Route
- Chemin

Tenure
- Publique
- Mixte
- Privée
- Terre publique intramunicipale déléguée

Projection cartographique
Conique de Lambert avec deux parallèles d'échelle conservée (46e et 60e)

0 1 2 3 4 Kilomètres

1/100 000

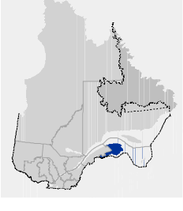
Sources

Donnée	Organisme	Année
Référence cartographique (BDTA 250k, BDTQ 20k)	MRNFP	2003
Tenure	MRNFP	2003

Réalisation

Direction régionale de la gestion du territoire public
Bas-Saint-Laurent - Gaspésie - Îles-de-la-Madeleine
Ministère des Ressources naturelles, de la Faune et des Parcs
Note : Le présent document n'est utilisé que pour les fins énoncées en titre

Localisation



Ressources naturelles, Faune et Parcs
Québec

ANNEXE 2

Détails techniques des éoliennes

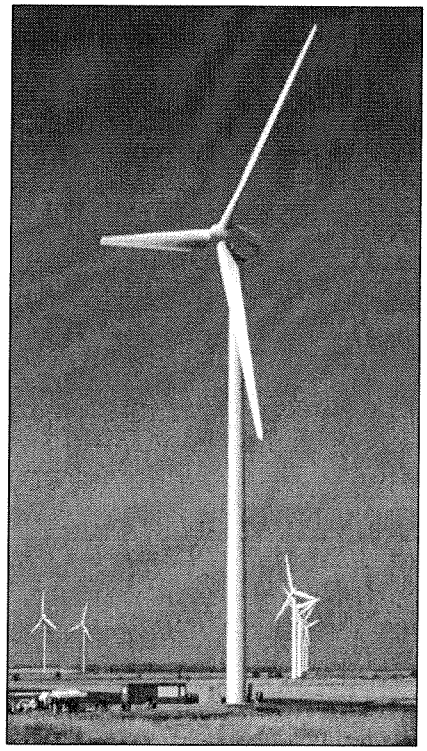
- GE 1.5 sle

- ENERCON E-82

TECHNICAL DESCRIPTION AND SPECIFICATIONS

Wind Turbine Generator System

GE Wind Energy 1.5sle 60 Hz



All technical data are subject to possible alteration due to advancing technical development!

Manufacturer: GE Wind Energy GmbH
Holsterfeld 16
D-48499 Salzbergen

Table of Contents

page no.

Tables

Figures

1 Introduction

This document summarizes the technical description and specifications of the GE Wind Energy (GEWE) 1.5sle 60Hz wind turbine generator system. GE Wind Energy (GEWE), a subsidiary of GE Power Systems (GEPS), manufactures this system. The specification is for the model GE Wind Energy 1.5sle 60Hz and is based on the data given in section 3 – Technical Description.

2 Overview multi generation product map

See product map document:
1.5serie_GD_allComp_prodmapx

3 Technical Description of the Wind Turbine and Major Components

The GE Wind Energy 1.5sle 60Hz is a three bladed, upwind, horizontal-axis wind turbine with a rotor diameter of 77 m. The turbine rotor and nacelle are mounted on top of a tubular tower giving a rotor hub height of 64.7 m, 80 m or 85 m respectively. The machine employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system from the speed variable drive train concept (designed to produce nominal 60 Hertz (Hz), 575-volt (V) electric power).

The GE Wind Energy 1.5sle 60Hz wind turbine features a distributed drive train design wherein the major drive train components including main shaft bearings, gearbox, generator, yaw drives, and control panel are attached to a bedplate (see Fig. 3.2).

Turbine installation is completed with the mounting of the three-bladed rotor hub to the main shaft after the nacelle assembly has been mounted to the top of the tower.

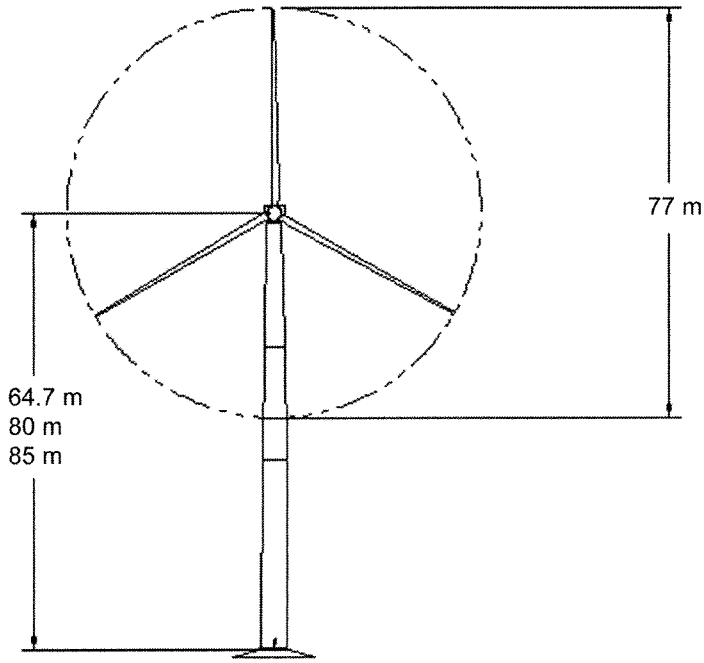


Fig. 3.1: GE Wind Energy 1.5sle 60Hz Wind Turbine Generator

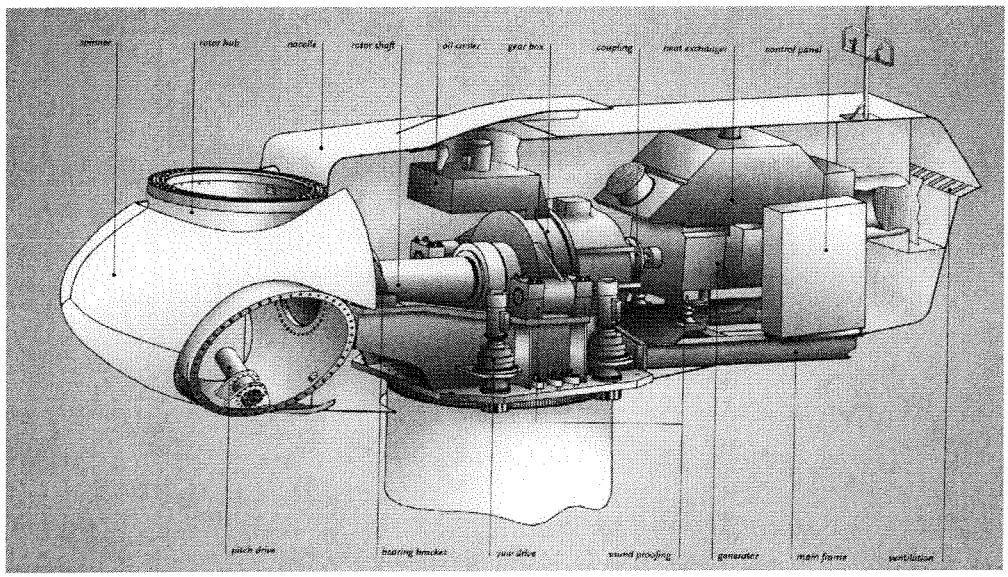


Fig. 3.2: GE Wind Energy 1.5sle 60Hz Wind Turbine Nacelle Layout

3.1 Rotor

The rotor on the GE Wind Energy 1.5sle 60Hz wind turbine is designed to operate in an upwind configuration (blades positioned upwind of the turbine tower) and is comprised of three blades mounted to a cast ductile iron hub.

The rotor diameter is 77 m, resulting in a swept area of 4,657 m^2, and is designed to operate between 10 and 20 revolutions per minute (rpm). Rotor speed is regulated by a combination of blade pitch angle adjustment and generator / converter torque control. The rotor spins in a clock-wise direction under normal operating conditions when viewed from an upwind location.

Full blade pitch angle range is approximately 90 degrees, with the zero degree position being with the airfoil chord line flat to the prevailing wind. The blades being pitched to a full feather pitch angle of approximately 90 degrees accomplishes aerodynamic braking of the rotor; whereby the blades "spill" the wind thus limiting rotor speed.

To give greater clearance between the rotor and the tower, the rotor is tilted upward and away from the tower by approximately 4 degrees and the blades have an effective coning angle of 1.25 degrees.

3.2 Blades

There are three rotor blades used on each GE Wind Energy 1.5sle 60Hz wind turbine. The blades are manufactured from fiberglass epoxy resin and with a smooth layer of gel coat on the outer surface that is designed to provide UV protection and blade color.

The rotor blades use a custom, proprietary family of airfoils that were designed specifically for use on wind turbines. The airfoils are designed to reduce sensitivity to blade-surface roughness caused by insect and dirt build-up seen during normal operation.

The airfoils transition along the blade span with the thicker airfoils being located in-board towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

3.3 Blade Pitch Control System

The GE Wind Energy 1.5sle 60Hz rotor utilizes three (one for each blade) independent electric pitch motors and controllers to provide adjustment of the blade pitch angle during normal operation. Blade pitch angle is adjusted by an electric drive that is mounted inside the rotor hub and is coupled to a ring gear mounted to the inner race of the blade pitch bearing (see Fig. 3.2).

GEWE's active-pitch controller enables the wind turbine rotor to regulate speed, when above rated wind speed, by allowing the blade to "spill" excess aerodynamic lift. Energy from wind gusts below rated windspeed is captured by allowing the rotor to speed up, transforming this gust energy into kinetic which may then be extracted from the rotor.

Three independent back-up battery packs are provided to power each individual blade pitch system to feather the blades and shut down the machine in the event of a grid line outage or other fault. By having all three blades outfitted with independent pitch systems, redundancy of individual blade aerodynamic braking capability is provided.

3.4 Hub

The hub is manufactured from cast ductile iron and is used to connect the three rotor blades to the turbine main shaft. The hub also houses the three electric blade pitch systems and is mounted directly to the main shaft. Access to the inside of the hub is provided through a hatch for inspection and service of the electric pitch system and blade mounting hardware.

3.5 Gearbox

The gearbox in the GEWE 1.5sle 60Hz wind turbine is designed to function as a speed increaser and transmit power between the low-rpm turbine rotor and high-rpm electric generator. The gearbox for the 60 Hz version of the GEWE 1.5sle 60Hz is a three-stage planetary/helical gear design with a ratio of gear 1:72. The gearbox is mounted to the machine bedplate with elastomeric elements that are designed to provide vibration damping and noise reduction between the gearbox and bedplate. The gearbox housing is cast from ductile

iron and is designed to house the drive train gearing. The gearing is designed to transfer torsional power from the wind turbine rotor to the electric generator. A parking brake is mounted on the high-speed shaft of the gearbox.

3.6 Bearings

The blade pitch bearing is a dual, four-point ball bearing designed to allow the blade to pitch about a span-wise pitch axis. The inner race of the blade pitch bearing is outfitted with a blade drive gear that enables the blade to be driven in pitch by an electric gear-driven motor/controller.

The main shaft bearing on the GEWE 1.5sle 60Hz is a double-row spherical roller bearing mounted in a pillow-block housing arrangement.

The bearings used inside the gearbox are of the cylindrical, spherical and tapered roller type. These bearings are designed to provide bearing and alignment of the internal gearing shafts and accommodate radial and axial loads.

3.7 Gearbox Lubrication System

The gearbox has a forced-lubrication system (driven by an electric pump). The fluid capacity of the gearbox is approximately 300 liters (L).

The bearings are force-lubricated by cross flow from individual spray nozzles. Before the oil is pumped through the oil lines, it passes through a filter, a heat exchanger and a pressure reduction valve designed to provide clean oil at the correct pressure to the bearings.

3.8 Brake System

The electrically actuated individual blade pitch systems act as the main braking system for the wind turbine. Braking under normal operating conditions is accomplished by feathering the blades out of the wind. Any single feathered rotor blade is designed to slow the rotor, and each rotor blade has its own back-up battery bank to provide power to the electric drive in the event of a grid line loss.

The turbine is also equipped with a mechanical brake located at the output (high-speed) shaft of the gearbox. This brake is only applied immediately on certain emergency-stops (E-stops). This brake also prevents rotation of the machinery as required by certain service activities.

3.9 Generator

The generator is a doubly fed induction-generator with wound rotor and slip rings. The generator synchronous speed is 1200 rpm, and a variable frequency power converter tied to the generator rotor allows the generator to operate at speeds ranging from 870 rpm to 1600 rpm. Nominal speed at 1.5 MW power output is 1440 rpm.

The generator meets protection class requirements of the International Standard IP 54 (totally enclosed) and is air-cooled. The generator housing is grounded and an air-to-air thermal exchanger cools the windings under normal operating conditions.

The generator is mounted to the bedplate on elastomeric foundations to reduce vibration and associated noise.

Temperature sensors are built into the generator windings to provide a temperature reading to the wind turbine controller. In the event the generator temperature is outside of the normal operating range, an automatic shutdown of the turbine is initiated if the generator is on-line. Additionally the machine will be unable to start if the windings are below their acceptable operating temperature limit.

3.10 Flexible Coupling

Designed to protect the drive train from excessive torque loads, a flexible coupling is provided between the generator and gearbox output shaft this is equipped with a torque-limiting device sized to keep the max. allowable torque below the 3 times limit of the drive train.

3.11 Yaw System

A roller bearing attached between the nacelle and tower facilitates yaw motion. Four planetary yaw drives (with brakes that engage when the drive is disabled) mesh with the outside gear of the yaw bearing and steer the machine to track the wind in yaw. The automatic yaw brakes engage in order to prevent the yaw drives from seeing peak loads from any turbulent wind.

A wind vane sensor mounted on top of the nacelle sends a signal to the turbine controller to evaluate the position of the nacelle with respect to wind direction. Within a specified time interval, the controller activates the yaw drives to align the nacelle to the average wind direction. The yaw drives require electric power to operate.

On the underside of the yaw deck, a cable twist sensor is mounted to provide a record of nacelle yaw position and cable twisting. After the sensor detects 900-degree rotation in one direction (net), the controller automatically brings the rotor to a complete stop, untwists the cable by counter yawing of the nacelle, and restarts the wind turbine.

3.12 Tower

The GE Wind Energy 1.5sle 60Hz wind turbine is mounted on top of a tubular tower, putting the wind rotor hub height at 64.7 m, 80 m and 85 m depending on the configuration.The tubular tower is tapered and manufactured in three or four sections from steel plate. Access to the turbine is through a lockable steel door at the base of the tower. Service platforms are provided. Access to the nacelle is provided by a ladder and a fall arresting safety system is included. Interior lights are installed at critical points from the base of the tower to the tower top.

3.13 Nacelle

The nacelle of the GEWE 1.5sle 60Hz turbine is constructed of fiberglass and lined with sound-insulating foam (see Fig. 3.2). This sound insulating foam helps reduce acoustic emissions from the wind turbine.

Access from the tower into the nacelle is through a manhole in the bedplate, which is located beneath the wind rotor main shaft.

The nacelle is ventilated and illuminated with electric lights and a skylight hatch.

A hatch at the front end of the nacelle provides access to the blades and hub. When the rotor is stopped and secured in position with a hydraulic rotor lock, the interior of the hub can be accessed through one of three hatches located in the rotor spinner.

3.14 Anemometer, Wind Vane, and Lightning Rod

An anemometer, wind vane, and lightning rod are mounted on top of the nacelle housing. Access to these sensors is accomplished through a hatch in the nacelle roof.

3.15 Lightning Protection

The rotor blades are equipped with a strike sensor mounted in the blade tip. Additionally a solid copper conductor from the blade tip to root provides a grounding path that leads to the grounding system at the base of the tower foundation (see Fig. 9.1). The turbine is grounded and shielded to protect against lightning, however, lightning is an unpredictable force of nature, and it is possible that a lightning strike could damage various components notwithstanding the lightning protection deployed in the machine.

3.16 Wind Turbine Control System

The GEWE 1.5sle 60Hz wind turbine machine can be controlled automatically or manually from either the control panel located inside the nacelle or from a personal computer (PC) located in a control box at the bottom of the tower. Control signals can also be sent from a remote computer via a Supervisory Control and Data Acquisition System (SCADA), with local lockout capability provided at the turbine controller.

Using the tower top control panel, the machine can be stopped, started, and turned out of the wind. Service switches at the tower top prevent service personnel at the bottom of the tower from operating certain systems of the turbine while service personnel are in the nacelle. To override any machine operation, Emergency-stop buttons located in the tower base and in the nacelle can be activated to stop the turbine in the event of an emergency.

Under partial load, the blade pitch angle is held constant and the rotor speed is controlled by the generator/converter control system. Once the rated wind speed is reached, the rotor blades operate in a servo mode whereby turbine power output and rotor speed are controlled by varying the blade pitch angle in combination with the generator/converter torque/speed control system.

3.17 Power Converter

The GEWE 1.5sle 60Hz wind turbine uses a power converter system that consists of a converter on the rotor side, a DC intermediate circuit, and a power inverter on the grid side. Altogether this complete system functions as a pulse-width-modulated converter in 4-quadrant operation.

The converter system consists of an insulated gate bipolar transistor (IGBT) power module and the associated electrical equipment. Variable output frequency of the converter allows a rotational speed-module operation of the generator within the range of 870 rpm to 1600 rpm.

3.18 Grid Connection Requirements

See Electrical Grid Data Document:
1.5serie_60Hz_EGD_allComp_xxxxxxxx

3.19 Electrical Configuration

The electrical configuration for the GE Wind Energy 1.5sle 60Hz wind turbine generator is given in Fig. 3.3 below:

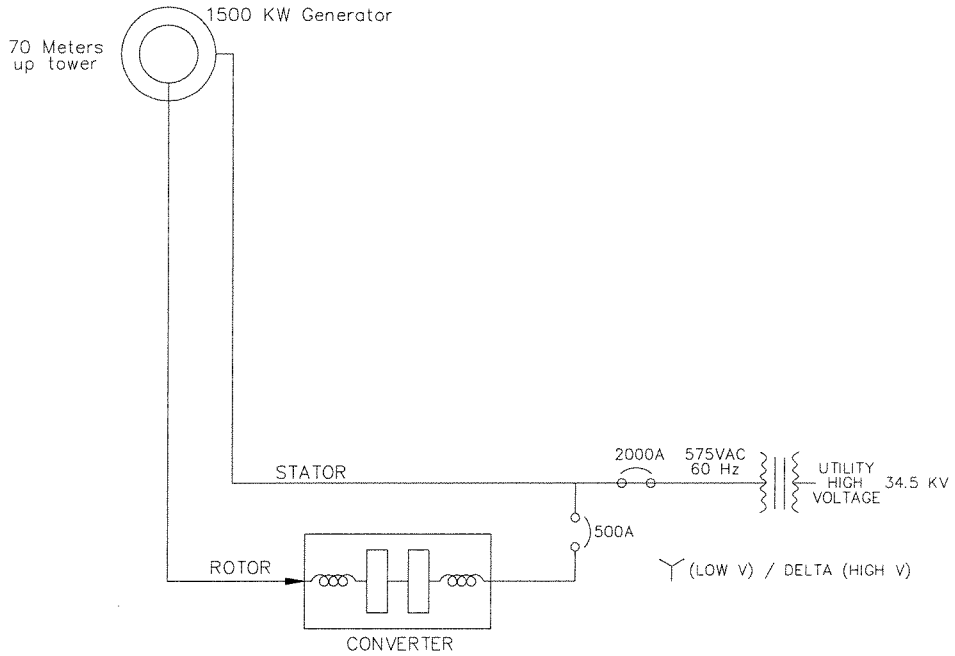


Fig. 3.3: Electrical Configuration

4 Technical Data GE Wind Energy 1.5sle 60Hz Wind Turbine

See Technical Data Document:
1.5sle60H_TD_allComp_xxxxxxxx

5 Operational limits

5.1 Operational Temperature Range

GEWE 1.5sle – Standard (former CWL version)	GEWE 1.5sle – Cold Weather Extreme Option (CWE)
+45° to –20° C	+45° to –30° C

Table 5.1: Operational Temperature Range

5.2 Survival Temperature

GEWE 1.5sle – Standard (former CWL version)	GEWE 1.5sle – Cold Weather Extreme Option (CWE)
+50° to –20° C	+50° to –40° C

Table 5.2: Survival Temperature

5.3 Survival Extreme Wind Velocity

GEWE 1.5sle – Standard (former CWL version)	GEWE 1.5sle – Cold Weather Extreme Option (CWE)
@ -10° = 55 m/s @ -20° = 52.5 m/s	@ –10° C = 55 m/s @ –40° C = 52.5 m/s

Table 5.3: Survival Extreme Wind Velocity

6 Powerperformance and Cut in / out wind speed

See Power Curve Document:
1.5sle_PCD_allComp_GE37cxxx

7 Acoustic Performance

104.0 dB(A) according to: IEC 61400-11: 1998 Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques

1.5s 50 Hz document is also relevant for the 1.5sle 60 Hz turbines since the blade tip speed are identical on both turbine variants. The blade tip speed is the key driver concerning noise emission.

See Sound Capacity Document:
1.5s_SCD_allComp_slpxxxxx

8 Electrical Interconnect Specifications

Section 8 provides information intended to assist in evaluating how the GEWE 1.5sle 60Hz wind turbine integrates with the grid electrical system.

8.1 GEWE 1.5 MW Turbine Generator Configuration

The GEWE 1.5sle 60Hz turbine has the capability of operating at leading or lagging power factor and is equipped with a doubly fed (wound rotor) asynchronous (induction) generator with slip rings and an AC-DC-AC electronic power converter.

8.2 Selectable Power Factor

The Standard GEWE 1.5sle 60Hz Wind Turbine is designed with a selectable power factor. At 1.0 pu voltage (575 V) and full power (1500 kW), a power factor of 0.95 overexcited (reactive power delivered by the wind turbine) to 0.90 underexcited (reactive power absorbed by the wind turbine) is possible. The power factor is settable at each WTG or by the wind farm SCADA system.

8.3 WINDVAR

Dynamic voltage control, commonly referred to as WindVAR, controls the wind plant's power factor or voltage. WindVAR is a high-speed closed loop controller that adjusts each WTG's reactive power output to control either the collective power factor or overall voltage at the wind farm. WindVAR optimizes local system conditions to improve plant reliability and availability. WindVAR can be customized to meet the local utility demands.

8.3.1 Closed Loop VAR Regulator

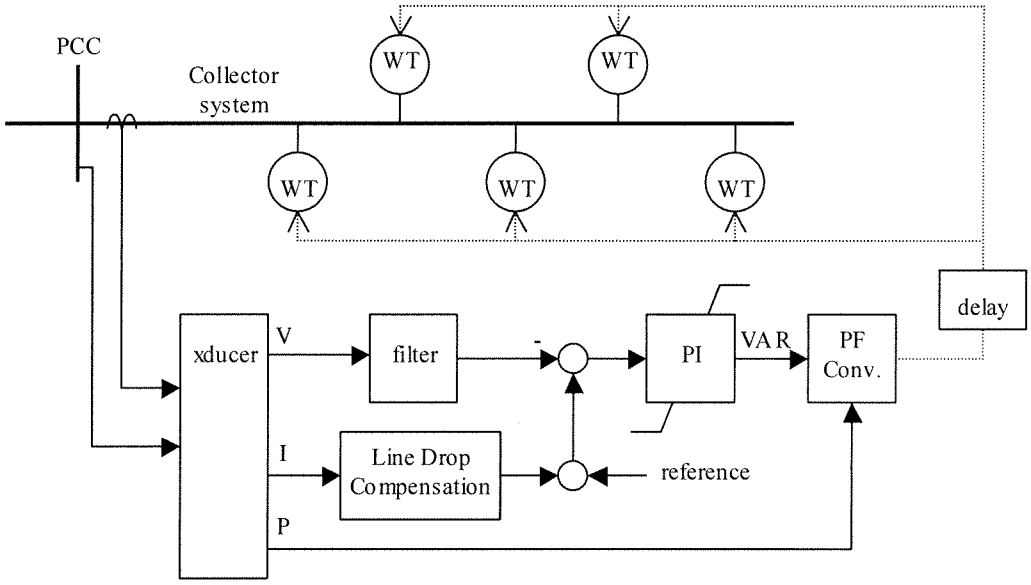


Fig. 8.1: Closed Loop VAR Regulator

A closed loop voltage regulator is implemented at the point of coupling (PCC) with the utility. Measured voltage is compared with a reference signal and the error is applied to a non-windup PI regulator. The desired windfarm VAR output is converted to a power factor set point communicated to the individual wind turbines (WT). Optional additional features include line drop compensation based on measured current at the PCC and a VAR boost function implemented at each WT. VAR boost will override watts production to deliver more VARs during emergency under-voltage conditions.

Filter	Measurement and I/O delay. Represent as simple 10ms lag.
PI – regulator	Lead term set to cancel the regulator delays roughly 40ms. Gain set for a closed loop response to meet utility needs. One-second response is common.
Delay	Communication, I/O and turbine response. Represent as simple 40 – 60 ms lag.
Line-drop comp.	Typically I*X (reactive current times system reactance) where X is provided by the utility.

Table 8.1: Closed Loop Voltage Regulator Parameters

Filter: Power Serve Power meter measures at ¼ cycle

PI Regulator: Gains Kp Ki, to be determined based on Transmission system characteristics.

Delay: 40 to 60 ms

Line Drop Compensation: To be determined, based on transmission system parameters. Power factor command is sent in terms of Phi. Phi command is sent to Wind turbine generator Converter Control Unit (CCU). The CCU measures the real power and uses the commanded phi signal to compute Q. Q = tan (phi)*P. Internal CCU computation is at 4800 Hz.

8.3.2 Open Loop VAR Regulator

An open loop regulator is implemented at the point of coupling (PCC) with the utility. The objective is to generate VARs that follow a specified VAR/Watt curve. The curve is calculated off-line to provide a desired voltage profile at some point in the utility system. The desired wind farm VAR output is converted to a power factor set point communicated to the individual wind turbines (WT). In addition a VAR boost function can be implemented at each WT. VAR boost will override watts production to deliver more VARs during emergency under voltage conditions.

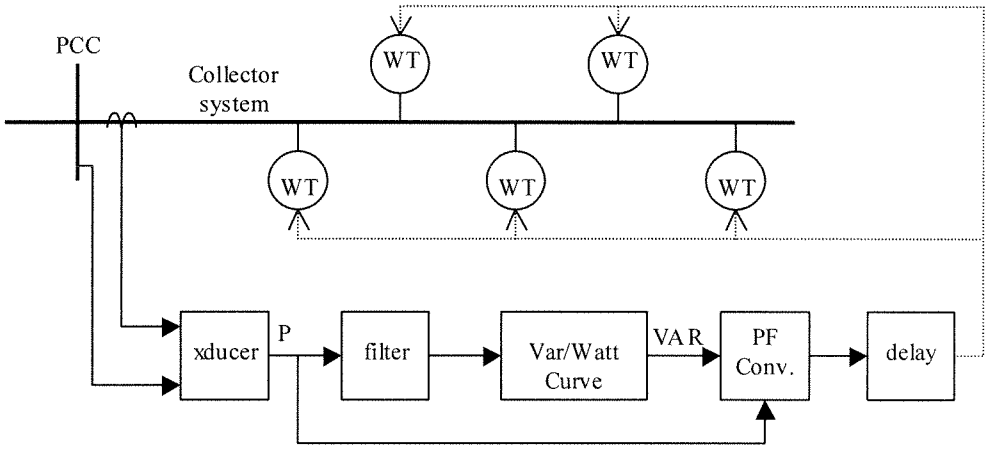


Fig. 8.2: Open Loop VAR Regulator

Filter	Measurement and I/O delay. Represent as simple 10ms lag.
Var/Watt Curve	Desired profile determined by the utility in off-line studies.
Delay	Communication, I/O and turbine response. Represent as simple 30ms lag.

Table 8.2: Open Loop VAR Regulator Parameters

8.4 Harmonics & IEEE-519

The GEWE 1.5sle 60Hz wind turbine is designed to produce power with current harmonics (based on the full load current) that are below the standard set forth in IEEE-519.

8.5 Input Parameters for Power System Studies

GEWE will assist customers and utilities in the electrical modeling of the GEWE 1.5sle 60Hz wind turbine generator system to determine the impact on utility power systems.

9 Lightening Protection/Grounding

9.1 System Grounding Requirements

The grounding system installed, as part of the wind turbine foundation pad must be designed to meet local conditions and regulations. The same grounding system is utilized for lightning protection.

A resistance to neutral earth of 2 ohms or less is preferred, and a 50 kA surge protector is provided as standard equipment in the low voltage distribution cabinet of the GEWE 1.5sle 60Hz wind turbine.

If the ground resistance is between 2-5 ohms, the addition of a 100 kA (min) surge protector at the low voltage side of the transformer is strongly recommended as part of the Owner's balance of plant obligation.

If ground resistance is more than 5 ohms, GEWE requires the addition of a 100 kA surge protector at the low voltage side of the transformer.

9.2 1.5 MW WTG and 1750 kVA Transformer Grounding System

The grounding system of the wind turbine generator must be connected to the grounding system of the transformer.

Local soil conditions and resistivity must be considered in the installation of the grounding system as noted in section 9.1 above. The ground grid must be made of closed ring conductor and connected to ground rods using CadWeld connectors. If ground resistance is not sufficiently low, the grounding system must be improved. In many cases this improvement may be accomplished by adding two ground rods at a time and spaced equally around the perimeter of the ring conductor.

The grounding system, at a minimum, is made of 250 kCM bare copper and 5/8" diameter-8' ground rods. Ring conductor must be installed 30" below ground level and approximately 18" from the foundation. Ground rods must be equally spaced around the perimeter of the ring conductor at approximately

24" from it. The 250 kCM ground conductor must be extended to the transformer at approximately 12" from the transformer pad. Two ground rods must be connected to the ground conductor at 26" apart. The H0 and X0 terminals of the transformer must be connected to the ground through the grounding pad at the high-voltage and low-voltage compartments respectively.

The lightning protection/grounding for the GE Wind Energy 1.5s 60Hz turbine is a function of site specific requirements and local state, federal electrical codes and requirements.

GEWE provides the lighting protection / grounding hardware from the blade tips to the base of the tower (Fig. 9.1). The grounding system from the transformer and tower foundation is the Owner's obligation.

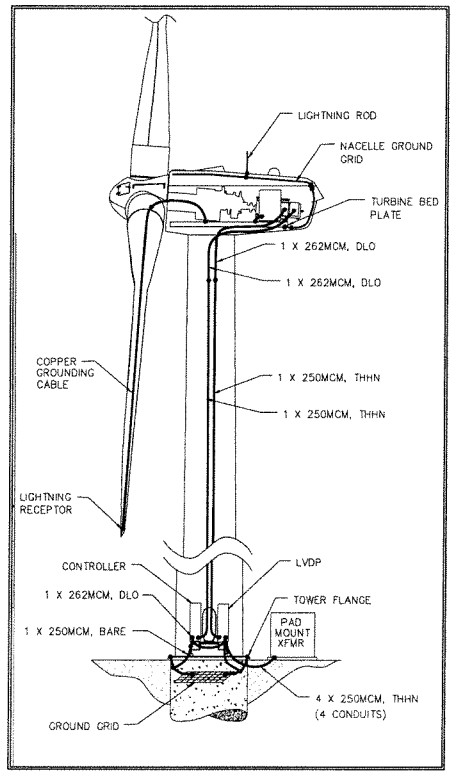


Fig. 9.1: Lightning Protection and Grounding Illustration

Document: 1.5sle60H_GD_allComp_xxxxxxxx
Originator: Ulrich Uphues
Revision: 00

10 Dynamic Model

The GEWE wind turbine should not be modeled as a synchronous generator. Additionally, the generator acts as a traditional induction generator only when the crowbar operates thus short circuiting the converter.

The generator is a doubly-fed induction generator with a power converter interfacing the rotor to the grid.
A detailed dynamic model of the GEWE 1.5 MW, 60 Hz wind turbine is currently available in PSLF V.13/14 (from GE Power Systems Energy Consulting, PSEC) and PSS/E V.28/29 (from Power Technologies, Inc., PTI). Users with current licenses of the respective software should have access to this model.
The model characterizes the prime mover (turbine, blade pitch and shaft) and the generator, converter, controls and protection.

11 Special optional features

11.1 Cold weather adaptations

See Cold weather adaptations document:
1.5serie_GD_allComp_CWxxxxxx

11.2 LVRT – Low Voltage ride through

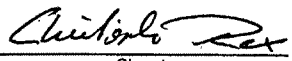
See Low Voltage ride through document:
1.5serie_60Hz_GD_allComp_LVRTxxxx

11.3 Condition monitoring

See Condition monitoring document:
1.5serie_GD_CMS_xxxxxxxx

Change List

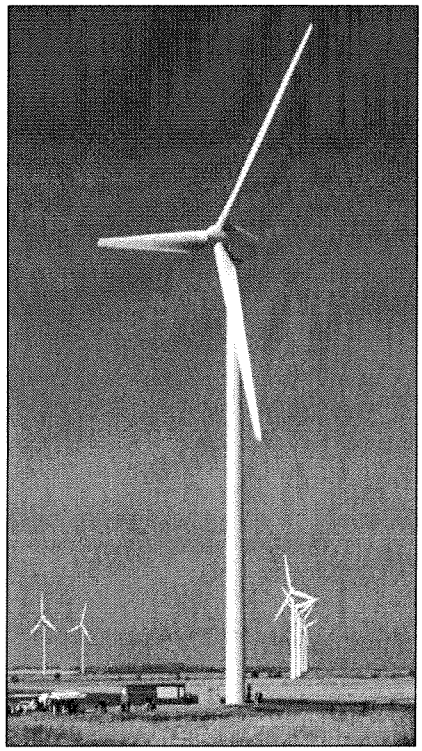
Document	Rev.	Release Date (d/m/y)	Affected Pages	Change
1.5sle60H_GD_allComp_xxxxxxxx	00	10/10/2003	all	New document

Prepared by:	10/10/2003	Christoph Rex	
	Date (d/m/y)	Name	Signature
Approved by:	10/10/2003	Ulrich Uphues	
	Date (d/m/y)	Name	Signature (system integration leader)

TECHNICAL DATA

Wind Turbine Generator System

GE Wind Energy 1.5sle 60 Hz



All technical data are subject to possible alteration due to advancing technical development!

Manufacturer: GE Wind Energy GmbH
Holsterfeld 16
D-48499 Salzbergen

Table of Contents

page no.

Tables

1 Rotor

Diameter	77 m
Number of blades	3
Swept area	4657 m^2
Rotor speed range	10 – 20 rpm
Rotational direction	Clockwise looking downwind
Nominal tip speed	73.8 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering
Rotor shaft uptilt	4 degrees

Table 1: Rotor

2 Blades

Airfoils	GEWE design and LM 37
Material	Fiberglass and epoxy resin

Table 2: Blades

3 Pitch System

Principle	Independent blade pitch control
Actuation	Individual electric drive
Back up	Battery pack
Pitch drives	Planetary gearbox, DC motor
Pitch Bearing	Dual 4-point ball bearing

Table 3: Pitch System

4 Hub

Material	Cast ductile iron
Type	Rigid
Corrosion protection	Sandblasted & multi-layer coated

Table 4: Hub

5 Drivetrain

Three-stage planetary helical gear combination	
Mechanical power	1660 kW
Gear ratio	1:72
Cooling	Oil pump with oil cooler
Fluid capacity	300 Liters (approx.)
Operation speed	800 – 1600 rpm
Operation speed at rated power	1440 rpm

Table 5: Drivetrain

6 Generator

Doubly fed asynchronous generator with slip rings	
Rated power	1500 kW
Rated Speed	1440 rpm
Rated voltage	575 V
Rated frequency	60 Hz
Power factor	0.95 overexcited (reactive power delivered by the wind turbine) to 0.90 underexcited (reactive power absorbed by the wind turbine) at 1.0 pu voltage (575 V) and full power (1500 kW).
Protection class	Totally enclosed, IP54
Insulation class	F
Synchronous speed	1200 rpm
Cooling system	Air-to-air cooled
Protection Class	IP 54

Table 6: Generator

7 Converter

Type	2 x 4 Q with DC voltage bus bar
Control	pulse width modulation
Power stacks	IGBT 1700 V
Protection Class	IP 54

Table 7: Converter

8 Tower

Type	Tubular steel
Sections	3 (for 64.7m), 4 (for 80 m); 4 (for 85m)
Heights (hub height)	64.7 m, 80.0 m and 85 m

Table 8: Tower

9 Brake System

Primary brake system	Individual blade pitch (battery backup)
Emergency brake	Hydraulic-applied disc brake mounted on the gearbox high-speed shaft

Table 9: Brake System

10 Yaw System

Number of yaw drives	4
Actuation	Electrical
Yaw rate	0.5 degree / sec
Motor type	Asynchronous, 6 pole, and 1200 rpm
Voltage / frequency	575 VAC / 60 Hz

Table 10: Yaw System

11 Wind turbine control

Type	Bachmann integrated controller
Protection Class	IP 20

Table 11: Wind turbine control

Document: 1.5sle60H_TD_allComp_xxxxxxxx
Originator: Ulrich Uphues
Revision: 00

12 Operational Limits

Height above sea level	max. 1000 m
Minimum temperature operational / survival	-20°C / -20°C
Minimum temperature with CWE option operational / survival	-30°C / -40°C
Maximum ambient operation / survive temperature	+45°C / +50°C
Wind conditions acc. IEC s	8.5 @ 18% turbulence
Maximum extreme gust (3 s)	55 m/s

Table 12: Operational limits

Change List

Document	Rev.	Release Date (d/m/y)	Affected Pages	Change
1.5sle60H_TD_allComp_xxxxxxxx	00	10/10/2003	all	New document

Table 13: Change List

Prepared by:	10/10/2003	Christoph Rex	
	Date (d/m/y)	Name	Signature
Approved by:	10/10/2003	Ulrich Uphues	
	Date (d/m/y)	Name	Signature (system integration leader)

Technical Description

E-82

Document information:		**Translation Information**	
Author/date:	S. Anlas / 21.10.05	Translated/date:	C.Carsted / 28.11.05
Department:	VI	Revised/date:	
Approved/date:	M.Kuhlmann / 04.11.05	Reference:	VI-Technical Description E-82-Rev001ger-eng
Revision	1/09.11.05		

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ENERCON reserves the right to make any technical changes and improvements at any time without prior notice.

1 BRIEF DESCRIPTION

The E-82 is a wind energy converter with a three bladed rotor, active pitch controls, variable operating speed and a rated power of 2000 kW. Its 82 m rotor diameter and 78 – 108 m hub heights enable the turbine to make efficient use of the prevailing wind conditions at the respective sites to produce electrical energy.

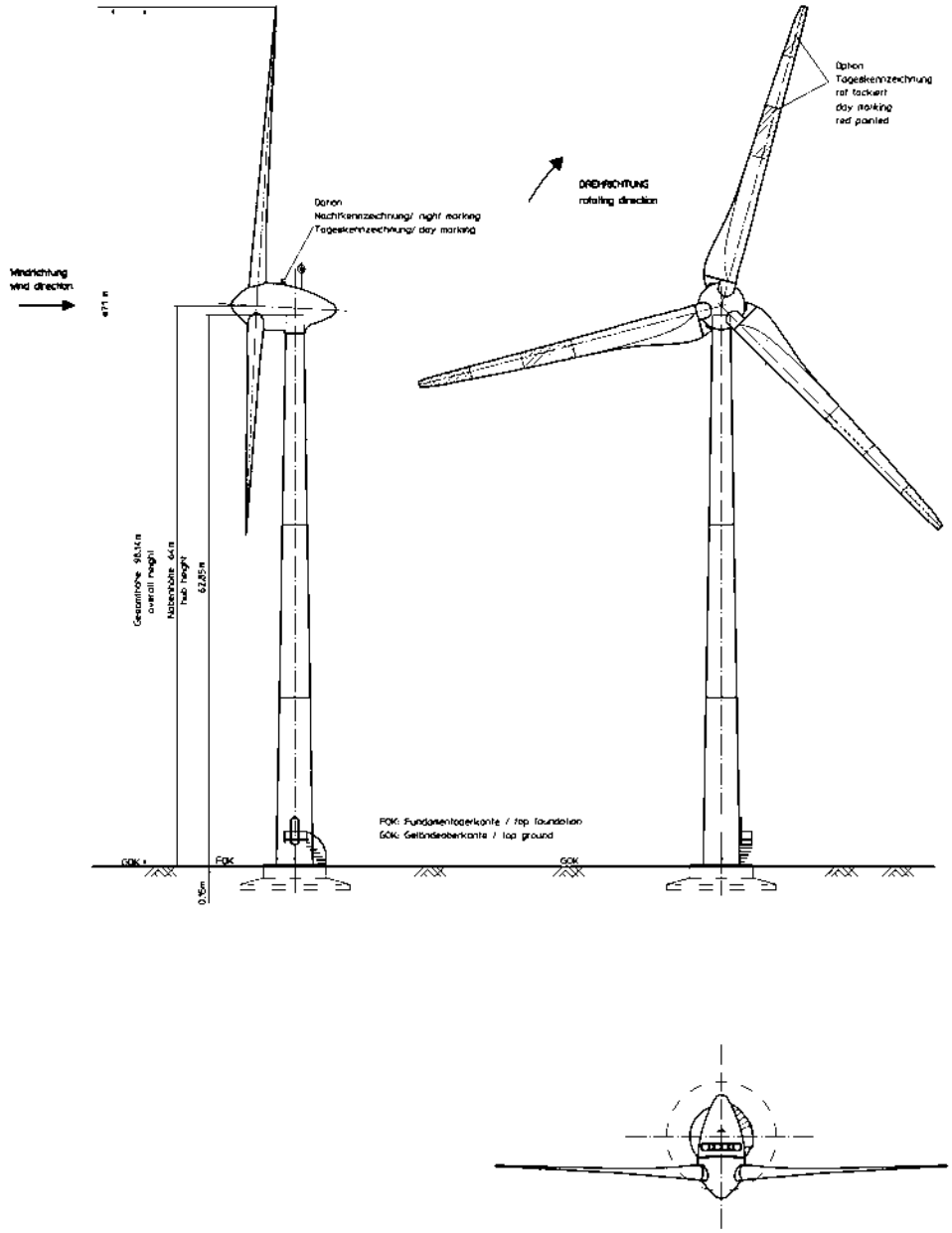


Figure 1: Illustration E-82

The main objective of ENERCON design and engineering is to minimise loads. All turbine components are developed and constructed accordingly. The result is a turbine which is, amongst other things, convincing due to its low load level and long service life.

Output controlled by variable speed allows the E-82 to attain maximum operation efficiency without increasing operating loads in the full and partial load ranges and at the same time prevents undesirable output peaks thus guaranteeing excellent yield and a high quality of power fed into the grid.

1.1 The ENERCON Concept

ENERCON wind energy converters are characterised by the following features:

The inner ring of the ENERCON annular generator and the rotor of the E-82 form one unit. These two components are flanged directly to the hub so that they both rotate at the same low speed. Since there are no gears or other fast-rotating parts, energy loss between generator and rotor, noise emissions, the use of gear oil and mechanical wear are considerably reduced.

The output produced by the E-82 generator is fed via the ENERCON grid connection system into the power supply company's grid. The ENERCON grid connection system comprises a rectifier/inverter unit (converter). This system ensures that high-quality electricity is fed into the power supply company's network.

Using the converter, this grid connection concept permits the E-82's rotor to operate at variable speeds. The rotor rotates slowly at low wind speeds and quickly at high wind speeds. This optimises wind flow on the rotor blades. Moreover, variable speed also reduces loads caused by gusts.

Each of the three rotor blades is equipped with an electrical pitch system. The pitch system limits the rotor speed and the use of the wind's power thus allowing the output of the E-82 to be reduced to rated power, even within a short period. By pitching the rotor blades into the feathered position, the rotor stops without mechanical brakes exerting load on the drive train.

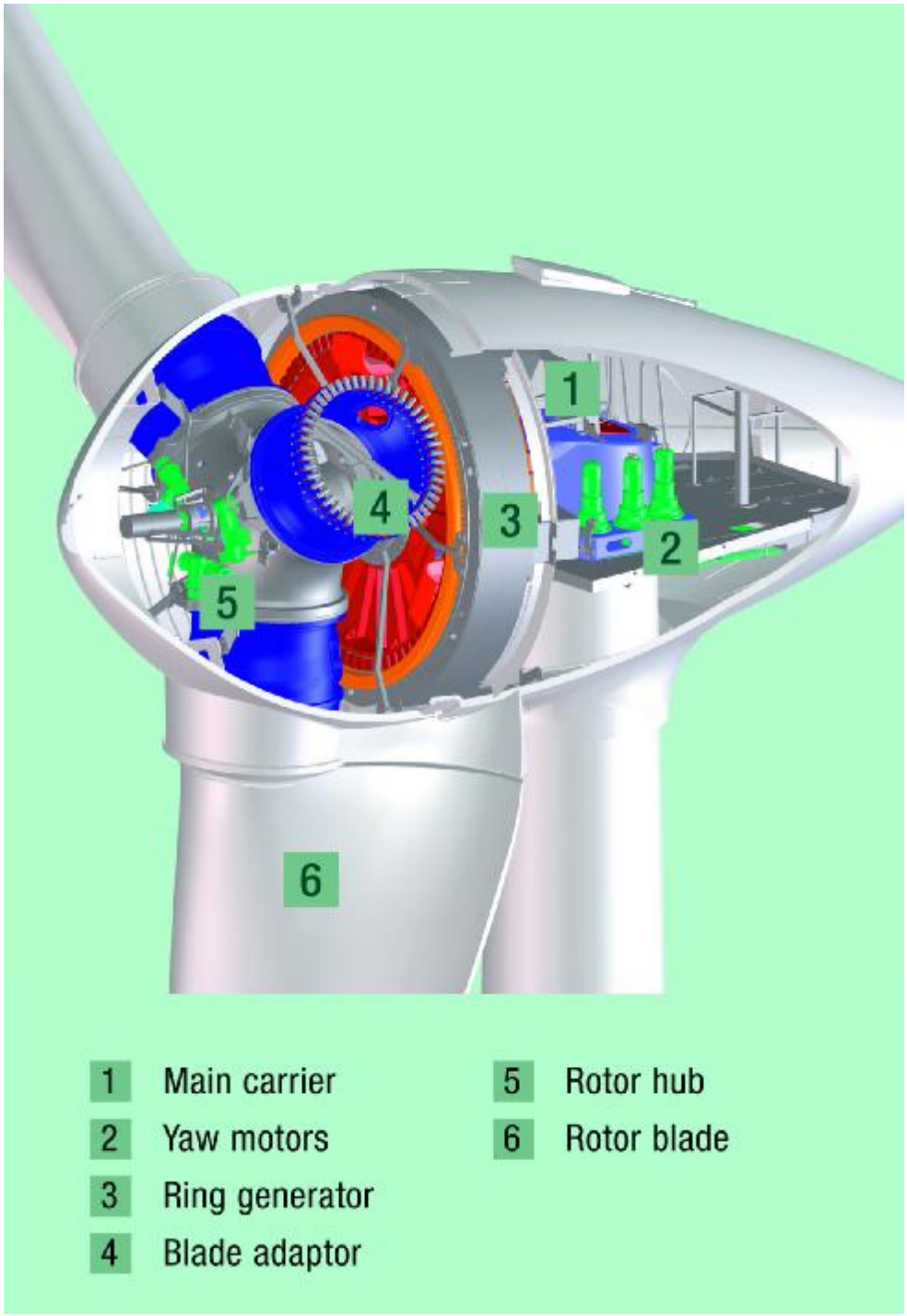


Figure 2: Illustration: Nacelle

1.2 Rotor

The E-82 rotor blades made of glass reinforced plastic (GRP) (epoxy resin) have a major influence on turbine output and its noise emission. Their shape and profile were developed according to the following criteria:

- high power coefficient
- long service life
- low noise emissions
- low loads and
- less material

One special feature to be pointed out is the new rotor blade profile which extends down to the nacelle. This innovative design eliminates the loss of the inner air flow experienced with conventional rotor blades. Together with the streamlined nacelle, the use of prevailing winds is considerably optimised.

The rotor blades of the E-82 were specially designed to operate with variable pitch control and variable speed. Due to this special profile, the blades are not sensitive to turbulence and dirt on the leading edge. On the outside, a top coat protects the rotor blades against environmental factors. The polyurethane-based material employed is highly resistant to abrasion, durable, and highly resistant to chemical factors and solar radiation.

Each of the three rotor blades is adjusted by independent microprocessor-controlled pitch systems. Angle encoders constantly monitor the set angle on each blade and ensure that the three blades are synchronised. This permits quick and accurate adjustment according to the prevailing wind conditions.

1.3 Generator

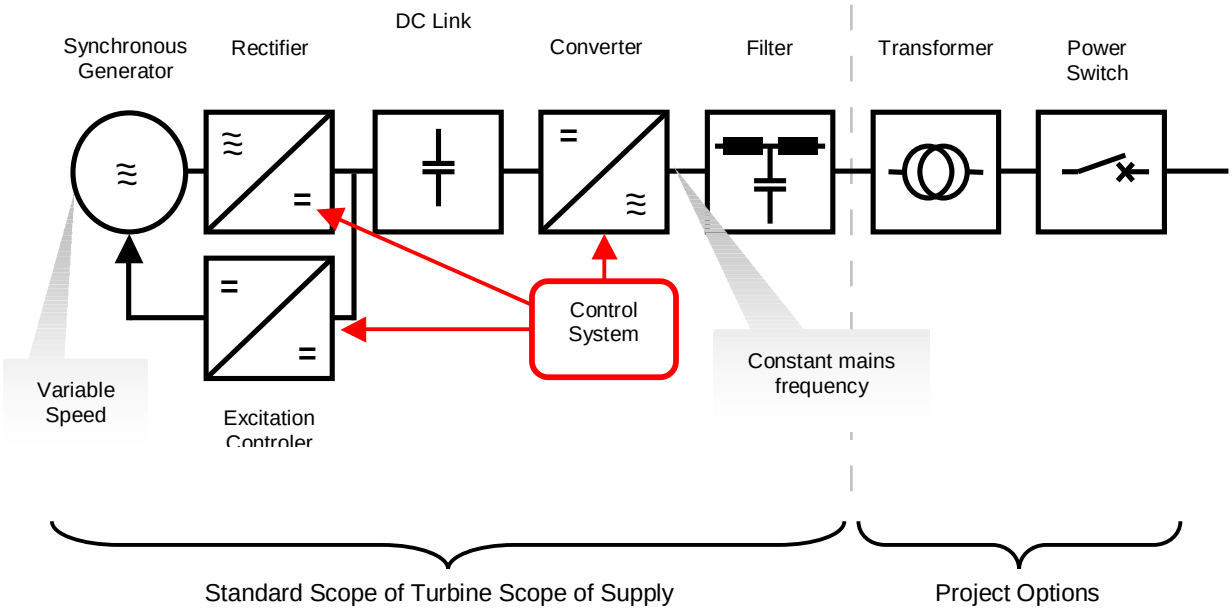
The air flow on the rotor blades drives the rotor which in turn is the direct drive for the E-82 annular generator. The multipole ENERCON generator is based on the direct drive synchronous machine principle.

Due to the low rotational speed and a large generator cross-section, temperature levels are comparatively low during operation and are only subject to minor fluctuations. Slight temperature fluctuations and comparatively few load changes during operation significantly decrease mechanical stress and the associated wear on generator material and insulation. Furthermore, variable speed and the connection to the electrical grid via converters contribute to reducing speed peaks.

1.4 Grid feed unit

The annular generator is coupled with the grid via the ENERCON grid connection unit. The main components in this system are a rectifier, a DC link and modular inverters.

The grid feed unit, generator and pitch unit are all controlled to achieve maximum output and excellent grid compatibility.



Flexible coupling between the annular generator and the grid guarantees ideal output transmission conditions while reducing undesirable reactions between the rotor and the grid in both directions. Sudden changes in wind speeds are controlled in order to maintain stable grid feed. Concurrently possible grid failures have very little effect on the mechanics. The power fed from the E-82 can be exactly regulated between 0 kW to 2000 kW

Depending on the technical configuration, eight or nine identical converter modules are aligned. They feed three-phase current from output on the low voltage side into the grid. Generally, a transformer directly in or near the turbine converts 400V to the desired high voltage.

With this converter technology, the wind energy turbine can be considered as a regulated source of power As long as the voltage at the output terminals is within the permissible range, the converters feed symmetrical, sinusoidal current. The voltage at the output is affected by the feed but it is not actively controlled. If desired, a voltage regulator can be installed at the wind farm's point of common coupling.

Depending on the grid voltage phase angle and generator output, a target value for the current to be fed is generated. Three-phase current is then generated according to this target value with the power available in the DC link. This target value is compared to the actual current flow (actual value) every 100 µs and corrected in the event of deviations. The current fed is sinusoidal and largely free of disruptive harmonic oscillations. A high frequency filter further reduces harmonics. No significant flicker emissions occur. Momentary current peaks are excluded with this converter technology.

The range of operation parallel to the grid is limited by the minimum and maximum grid voltage. Both these values (undervoltage and overvoltage) can be set as the limit value for the E-82.

Furthermore, ENERCON provides turbines as "transmission" versions on request. This means that the wind turbine can ride though voltage dips (grid failures) from one to several seconds instead of immediately disconnecting from the grid. As soon as voltage is re-established maximum possible active power is fed into the grid. During a grid failure, active power is fed into the grid depending on the remaining voltage, the maximum converter current and the actual wind conditions. In addition, the wind turbine can support the grid by feeding reactive current in the event of a grid failure. With this feature ENERCON wind turbines are able to provide wind farms with power plant properties often demanded and at the same time contribute to maintaining stable network operation.

The E-82 is preset to a power factor of $\cos\varphi=1$. It does not require reactive power nor does it deliver reactive power to the grid within the entire power range from 0 to 2000 kW. Only active power is fed into the grid. Any equalization payments for reactive power demanded by some power supply network operators are not necessary.

However, if requested by the power supply network operators, it is also possible to run the turbine with an output factor of $\neq 1$. This enables the wind turbine to contribute to reactive power balance and to maintain the voltage in the grid. The maximum reactive power range varies depending on the turbine configuration. The active power being fed is not affected by reactive power being fed simultaneously.

The range of operation parallel to the grid is also determined by a lower and upper frequency limit value. The range between these frequency limits is much wider than in conventional energy production units thanks to ENERCON's flexible IGBT converter technology. ENERCON wind turbines can be used in grids with a rated frequency of 50 Hz or 60 Hz.

If these voltage or frequency limits cannot be maintained, the E-82 control unit switches off all grid contactors in the inverter. This allows the E-82 to immediately disconnect from the grid on all phases.

1.5 Yaw control

The yaw bearing is mounted directly at the top of the tower with an externally geared ring. The yaw bearing allows the nacelle to rotate, thus facilitating yaw control. Six adjustment drives (yaw gears) engage in the geared ring in order to adjust the nacelle to the wind direction. The yaw bearing also transmits the load of the nacelle to the tower. The main carrier is mounted directly on the yaw bearing.

1.6 Safety system

The safety system guarantees safe turbine operation in accordance with international standards and independent test institutes.

1.6.1 Brake System

Halting ENERCON turbine operation is done completely aerodynamically by pitching the rotor blades into the feathered position. The three independent pitch drives move the rotor blades into the feathered position within seconds (i.e. they are "driven out of the wind"). The speed of the turbine is diminished without applying additional load to the drive train. In order to reduce the rotor speed to a safe level, it would be sufficient to drive only one of the three rotor blades out of the wind.

The rotor is not locked in place even when the WEC is shut down. It idles freely at a very low speed. The rotor and drive train remain practically without load. While idling, fewer loads are placed on the bearings than when the rotor is locked.

The rotor is only completely locked in place for maintenance purposes or when the EMERGENCY STOP button is activated. In this case, an additional brake is employed. It does not engage until the rotor has already been partially braked with the pitch controls. The rotor lock is only used as a final safety mechanism for maintenance purposes.

In the event of an emergency (e.g. if the utility's mains fails), each rotor blade is safely brought into the feathered position via its own back-up pitch unit. The backup power units are monitored and automatically charged to guarantee availability. The backup pitch units, which are electromechanically linked, trigger simultaneous pitch control.

The pitch control system is equipped with parallel power supply in the case of emergencies (mains or backup power unit). Together with three fully independent pitch drives this safety concept more than fulfils the requirements for a fail safe braking system.

1.6.2 Lightning protection system

The ENERCON lightning conductor system in the E-82 efficiently diverts almost all possible lightning strikes with no damage caused to the turbine.

The leading and trailing edges of the rotor blade and the blade tip are equipped with aluminium profiles which are attached to an aluminium ring at the blade connection point. Strikes are safely absorbed by these profiles and the lightning current is conducted via a spark gap and cables into the ground surrounding the foundation.

The rear of the nacelle casing is also fitted with a lightning conductor which diverts the current into the ground.

In the event of a lightning strike or an abnormal increase in voltage (overvoltage), the entire electrical and electronic equipment is protected by built-in energy-absorbing components. All main conductive turbine components are connected to the equipotential busbar with an adequate wire cross-section. Furthermore, overvoltage surge arresters are installed with low impedance grounding at the mains connection point.

The turbine electronics located in metal housing are electrically isolated. The remote monitoring system is protected by a special protection module for data interfaces.

1.6.3 Sensor System

A comprehensive monitoring system guarantees turbine safety. All safety related functions (e.g. rotor speed, temperature, loads, oscillations) are monitored by electronic media. If the electronics fail, a mechanical safety function takes over. If one of the sensors registers a serious fault, the turbine shuts down immediately.

1.7 Control system

The E-82 control system is based on a microprocessor system developed by ENERCON. Sensors query all turbine components and data such as wind direction and wind speed and adjust the operating mode of the E-82 accordingly.

When wind speeds suitable for turbine operation are measured over three consecutive minutes, the automatic startup process is initiated. Once the lower speed range limit is reached, power output is fed to the grid. Elevated making current does not occur at start-up since the grid connection is performed through the DC Link and the converter.

During operation at partial load, speed and rotor blade angle are continuously adjusted to the changing wind conditions. Power is controlled through generator excitation. If rated wind speed is exceeded, the blade angle is adjusted to maintain rated speed.

When the storm control system (optional) is deactivated, the turbine stops as soon as an average wind speed of 25 m/s in the 10-mnute-mean or a peak value of 30 m/s is exceeded. The turbine restarts when the wind speed constantly remains below the shutdown wind speed. The rotor is permitted to idle freely at a very low speed even in the shutdown mode.

Yaw control begins even before the start-up speed has been reached. The wind vane constantly takes wind direction measurements. If the deviation between the direction of the rotor axis and the measured wind direction is too great, the yaw adjustment drives correct the nacelle position. The deviation angle and the time it takes for the nacelle position to be corrected vary depending on the wind speed.

Whether the turbine is stopped manually or via the turbine controls, the blade is pitched into the feathered position to reduce the actual contact surface of the wind flow on the blade. The turbine gradually slows down to idle mode.

2 CONTROL SYSTEM

2.1 Response to safety relevant sensor messages

Turbine response to messages received from individual sensors is explained in the following sections. If a safety relevant sensor responds, the turbine initiates an automatic shutdown. The nature of the shutdown and whether it is followed by a restart depends on the fault in question.

Turbine fault occurrences are displayed on the LCD. Minor faults can be reset by pressing the “Acknowledge fault” button once their cause has been established. Afterwards, the turbine automatically starts up again. Some faults may only be rectified by Service technicians and then deleted. The respective status text flashes on the LCD. These messages are also marked with an asterisk.

Furthermore, sensor reliability is constantly monitored by the control system. If the sensors respond, a fault message is sent via the remote monitoring system. Depending on the sensor, the turbine may continue to operate for a certain amount of time. If certain sensors respond, the turbine has to be stopped immediately and the fault rectified.

2.2 Starting the turbine

Unless expressly stated otherwise, these instructions apply to startup after an automatic shutdown and for operation start up with the start/stop switch.

When the turbine is switched on (main switch on control cabinet to “ON” and start/stop switch is set to start), "Turbine operational" appears on the LCD shortly afterwards (status 0:2), provided the E-82 control system has not detected any faults. Ninety seconds after start-up, the rotor blades are driven out of the feathered position (approx. 90°) and "idle mode" begins. The rotor starts turning slowly. The turbine begins the actual operations startup procedure when the average wind speed is greater than the required startup wind speed for three consecutive minutes.

2.3 Normal operation

Once the E-82 startup procedure is completed, the wind energy converter switches to normal operation. During operation, the wind conditions are continuously determined: rotor speed, generator excitation and output are optimised, the nacelle position is adjusted to the wind direction and all sensor messages are recorded. When outside temperatures are high and if the wind speeds are also elevated, the generator fan is switched on.

2.3.1 Operation at partial load

During operation at partial load, the speed and power output are continuously adjusted to the changing wind conditions. In the upper partial load range, the rotor blades are pitched a few degrees to avoid flow interruption (stall effect).

As wind speed increases, the rotor speed and power output increase.

2.3.2 Automatic control mode

When the wind speed exceeds the rated wind speed, the blade angle is adjusted to maintain the rotor speed at / or around its rated value and to limit the use of the wind's power ("automatic control mode"). The required blade angle adjustment is determined by evaluating speed and acceleration measurement data which is then transmitted to the pitch drives. This maintains power output at its rated value.

2.4 Idle mode

If the turbine is shut down (e.g. due to lack of wind or faults), the rotor blades are normally positioned at a 60° angle in relation to the operating position. The turbine then rotates at a slow speed. If this speed (approx. 3 U/min) is exceeded the rotor blades are pitched further into the feathered position (approx. 90°). This operating mode is called "idling". Idling reduces load and enables the turbine to be restarted in the shortest possible time. The reason for turbine shutdown or idle mode is indicated by the status message.

2.5 Stopping the turbine

The E-82 can be stopped by manually activating the start/stop switch and the EMERGENCY STOP button. The control system stops the turbine in the event of faults or unsuitable wind conditions (see Figure 3).

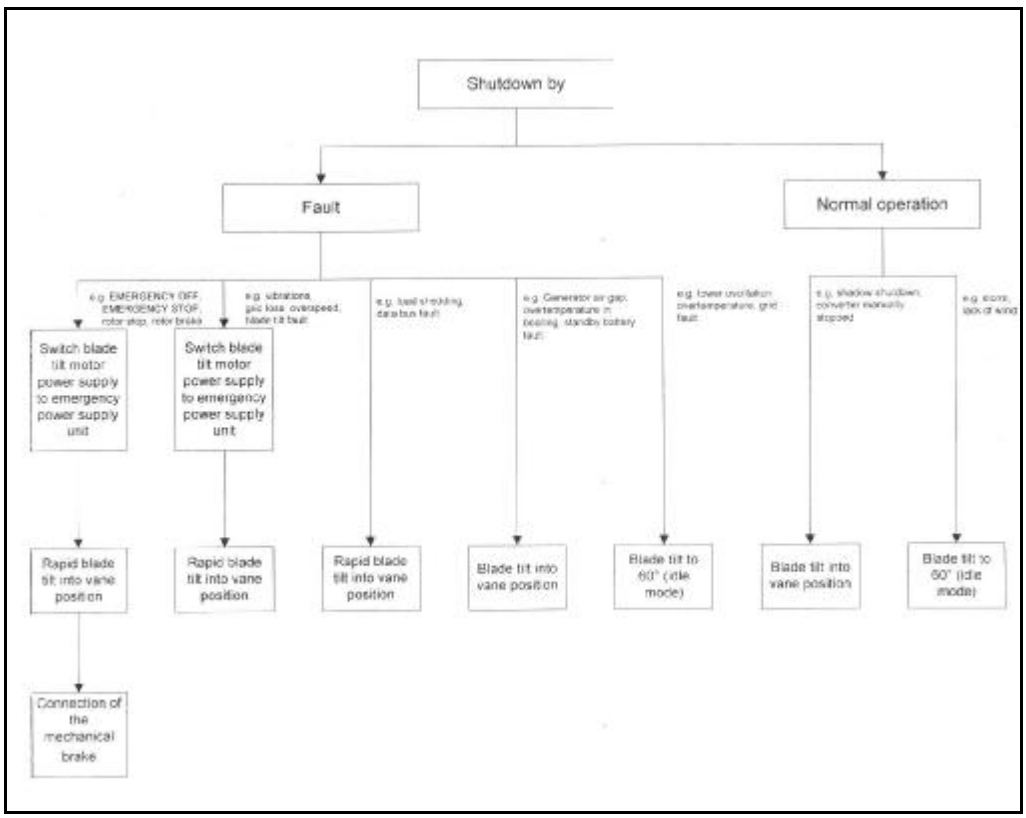


Figure 3: Shutdown procedures for the E-82

2.5.1 Automatic shutdown

In automatic mode, ENERCON wind energy converters are only brought to a standstill aerodynamically by pitching the rotor blades. Pitching the rotor blades reduces the aerodynamic lift force which slows the rotor down. The pitch control devices can drive the rotor blades out of the wind (i.e. into the feathered position) within seconds.

The turbine also stops automatically when certain faults or operating events occur or under certain wind conditions. Some faults cause rapid shutdown to occur. This happens via the rotor blades' backup power units. Other faults result in a normal shutdown.

Automatic restart may be possible depending on the type of fault. In each case the converters are electrically isolated from the grid during shutdown.

2.5.2 Manual stop

The E-82 can be stopped via the start/stop switch on the control cabinet. The control system then pitches the rotor blades out of the wind and the turbine slows to a halt. The brake is not activated and yaw control remains in operation so that the E-82 can continue to optimally adjust to the wind.

2.5.3 Manual shutdown in emergency situations

If individuals or turbine parts are at risk, the turbine can be stopped by pressing the EMERGENCY STOP button. An EMERGENCY STOP button is located on the control cabinet. Pressing it will induce immediate emergency braking on the rotor with rapid pitch control via the emergency pitch and brake units. At the same time the mechanical brakes are activated. All components continue to be supplied with power.

The buttons are latched and have to be pulled back to their original position once the emergency has passed and the turbine is to be restarted.

If the main switch on the control cabinet is set to the OFF position, all turbine components, except for tower and control cabinet lighting and individual light switches and sockets, are switched off. The turbine activates rapid pitch control via the emergency pitch devices. The mechanical brake is not activated when the main switch is used.

2.6 Lack of wind

If the turbine is in operation and the rotor speed drops too low due to lack of wind, the turbine is switched to idle mode by slowly pitching the rotor blades towards the 60° angle. The turbine then restarts automatically when the cut-in wind speed is reached.

If the anemometer freezes due to low temperatures (<3°C), the turbine attempts to start at hourly intervals to test whether the wind speed is sufficient for operation when the wind vane is functioning. If the turbine starts and produces power, it goes into normal operation. However, the correct wind speed does not appear on the display since the frozen sensor cannot provide accurate wind speed data.

2.7 Storm

From the standstill position or idle mode the turbine does not start up at wind speeds over 25 m/s. If an average wind speed of 25 m/s or a top value of 30 m/s is exceeded, the E-82 automatic control mode stops. The turbine also stops if the maximum permissible blade angle is exceeded. A frozen anemometer therefore does not represent a safety risk. In all cases the turbine switches to idle mode.

The E-82 components, such as rotor blades, nacelle, tower and foundations are designed to withstand considerably higher wind speeds.

The turbine starts automatically if the wind speed drops below cut-out wind speed (25 m/s) for 10 consecutive minutes.

When wind speeds surpass 22 m/s the ENERCON Storm Control System does not shut down the turbine abruptly, but rather reduces the power by continuously pitching the rotor blades. The output is only reduced to zero at wind speeds of approx. 28°m/s. This strategy improves electrical behaviour in the grid at the same time increases output.

2.8 Yaw control

The E-82 has a combination wind sensor, which is installed on the top of the nacelle. The combined wind sensor comprises a wind vane, which constantly determines the wind direction, and an anemometer, which measures wind speed.

E-82 yaw control already starts to operate below the cut-in wind speed of 2 m/s. Even if the system shuts down (e.g. due to excessive wind speed), it adjusts according to the wind conditions. The angle and the period of measurement depend on the wind speed and turbine performance.

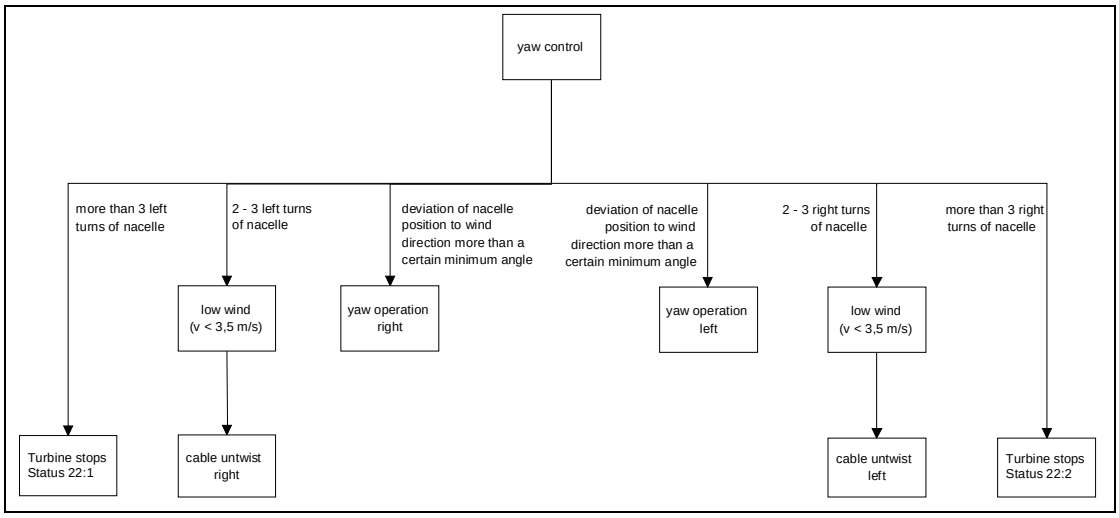


Figure 4: Illustration of yaw control

Yaw procedure is determined by counting the pitch motor rotations and the required pitch time is checked for plausibility. If the control system detects irregularities in yaw control or cable untwisting (See following), shutdown procedure is initiated.

2.8.1 Untwisting power and control cables

The E-82 power and control cables located in the tower pass from the nacelle over a deflection pad and are then fastened to the tower wall. The cables have enough freedom of movement to permit the nacelle to rotate several times in the same direction about its axis. The cables gradually twist. The E-82 control system ensures that the twisted cables are automatically unwound.

Once the cables have been twisted two and three times, the control system uses the next low-wind period to untwist the cables. If, however, high wind conditions continue and the cables have twisted more than 3 turns, the turbine stops and the cables untwist irrespective of wind speed. The cables take about half an hour to untwist. Once the cables have untwisted, the turbine automatically restarts.

The cable twist sensors can be found on the so-called cable twist switch, which in the E-82 is fitted near the access hatch. The sensor is connected via a gearwheel and gearbox to the yaw slewing ring. Changes in the nacelle direction are transmitted to the operation control system.

Furthermore, clockwise and anti-clockwise limit switches transmit whether the permissible limit has been exceeded in either direction (cable twist limit switch clockwise or anti-clockwise). This prevents the tower cables from twisting further. The turbine stops and cannot be restarted automatically.

3 TECHNICAL SPECIFICATIONS:

Turbine type:	**ENERCON E-82**
Rated power:	2000 kW
Rotor diameter:	82 m
Hub height:	78 – 108 m (tower and foundation options)
Turbine concept:	Gearless, variable speed, single blade pitch control
Rotor	
Type:	Upwind rotor with active pitch control
Rotational Direction:	Clockwise
No. of blades:	3
Swept area:	5281 m²
Blade material:	Fibreglass (epoxy resin); integrated lightning protection
Speed:	Variable, 6 – 19,5 rpm
Tip speed:	25 - 80 m/s
Pitch control:	ENERCON blade pitch system, one independent pitching system per rotor blade with allocated emergency supply
Drive train with generator	
Hub:	Rigid
Main bearing:	Dual row tapered / cylindrical roller bearings
Generator:	ENERCON direct-drive synchronous annular generator
Grid power feed:	ENERCON inverter

Braking system	- 3 independent pitch systems with emergency power supply - Rotor brake - Rotor lock
Yaw control:	Active via adjustment gear, load-dependent damping
Cut-in wind speed:	2.5 m/s
Rated wind speed:	12 m/s
Cut-out wind speed:	22 - 28 m/s
Remote monitoring:	ENERCON SCADA