

CLOUDSiS 1.0 Impact Assessment for the Proposed Habloville Wind Farm

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1 Introduction

1.1 Background

Elements is planning to build the Habloville wind farm, located approximately 14 km south from the Falaise weather radar. Elements has requested a formal CLOUDSiS assessment to quantify the radar impacts of the proposed wind farm, and compare them against the French legislation [1].

1.2 Scope of work

The assessment is carried out in accordance with the approved QinetiQ CLOUDSiS 1.0 method for assessing the impacts on Météo-France weather radars [2]. The assessment activities are described in the QinetiQ statement of work [3].

1.3 Habloville wind farm

Details of the Habloville wind farm were provided by Elements [4][5][6][7]. The proposed wind farm consists of five Nordex N131 turbines, with a hub height of 106 metres above ground level (AGL).

Figure 1-1 shows the turbine layout (white squares), Table 1-1 lists the proposed turbine coordinates in World Geodetic System 1984 (WGS84) latitude and longitude format.

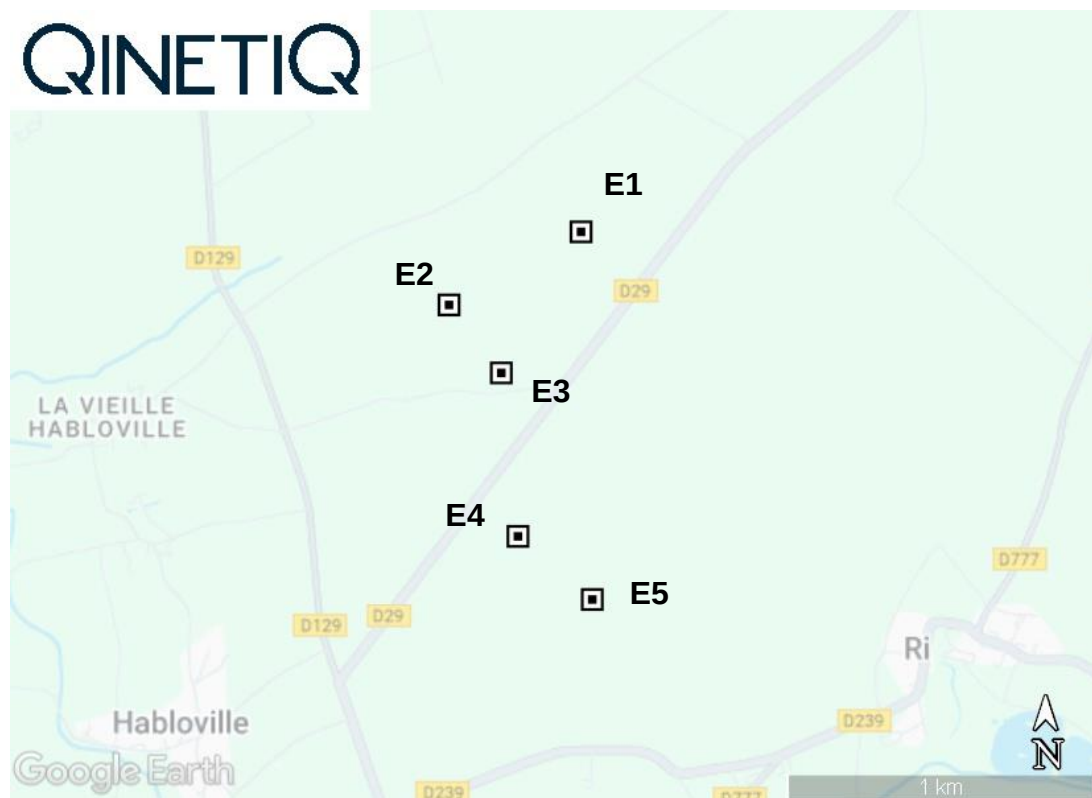


Figure 1-1: Proposed turbine layout (white squares) [7]

Turbine ID	WGS 84 coordinates	
	Latitude (°N)	Longitude (°E)
E1	48.803247	-0.152951
E2	48.801122	-0.158779
E3	48.799147	-0.156471
E4	48.794395	-0.155737
E5	48.792561	-0.152456

Table 1-1: Proposed Habloville turbine coordinates [7]

Table 1-2 shows the main parameters for the N131 turbine type used in the assessment [5][6]. The tower shape used in the assessment (Figure 1-2) was obtained from an engineering datasheet supplied by Elements [6]. Note the bottom section (length = 1.16m) in Figure 1-2 is not in the datasheet, but was added by QinetiQ to achieve the correct hub height; this approach was agreed with Elements [8].

Parameter	Value
Turbine type	Nordex N131
Hub height (metres AGL)	106
Nacelle height (metres)	4
Rotor diameter (metres)	131
Maximum blade tip height (metres AGL)	171.5

Table 1-2: Main turbine parameters for the proposed Habloville wind farm [5][6]

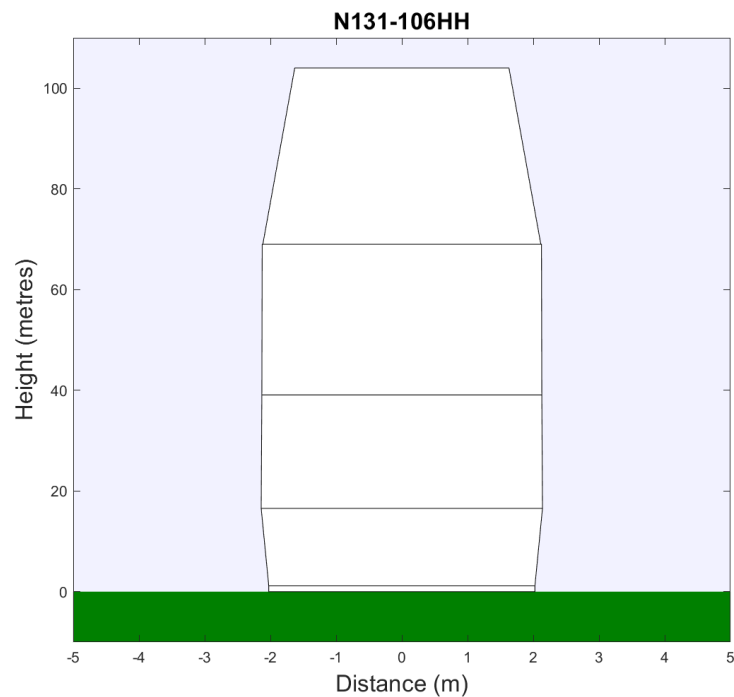


Figure 1-2: Tower shape for the proposed Habloville turbines [6][8]

1.4 Weather radar safeguarding rules

Wind turbines have the potential to impact the operation of weather radars. There are two main impacts [1]:

- occultation (blockage of radar signal, creating a weaker signal in the sector behind the turbines); and
- reflections (unwanted reflections), creating an impact zone of 'fictitious' rainfall in the radar data.

The safeguarding legislation [1] sets out the distances within which an assessment of the potential impact is required. The distances depend on the radar frequency, as summarised in Table 1-3.

Radar frequency	Zone d'éloignement (ZE) radius	Zone de protection zone (ZP) radius
X-band (approximately 10GHz)	10 km	4 km
C-band (approximately 5.6GHz)	20 km	5 km
S-band (approximately 2.8GHz)	30 km	10 km

Table 1-3: Safeguarding distances [1]

Turbines inside the PZ are not permitted. The acceptability of turbines inside the ZE is assessed using Direction Générale de la Prévention des Risques (DGPR) criteria, summarised in Table 1-4.

Criterion	Description	Acceptable condition
C1	Maximum percentage occultation, O, in any sector containing a proposed turbine	$O \leq 10\%$
C2	Maximum dimension, D, of the impact zone created by the proposed wind farm	$D \leq 10 \text{ km}$
C3	Minimum separation, S1, between the proposed wind farm's impact zone, and other wind farm impact zones	$S1 \geq 10 \text{ km}$
C4	Minimum separation, S2, between the proposed wind farm's impact zone, and sensitive sites ^A .	$S2 \geq 10 \text{ km}$
C5	Zone d'impact globale (ZIG) is the total impact zone from all turbines within the CA radius	ZIG is not modified ^B
C6	A turbine is in radar line of sight (LoS) if any part of it is directly visible from the radar	All turbines out of radar LoS

Table 1-4: Safeguarding criteria

The six criteria are used to determine the acceptability of new wind farms^C. The three acceptance conditions are shown in Figure 1-3.

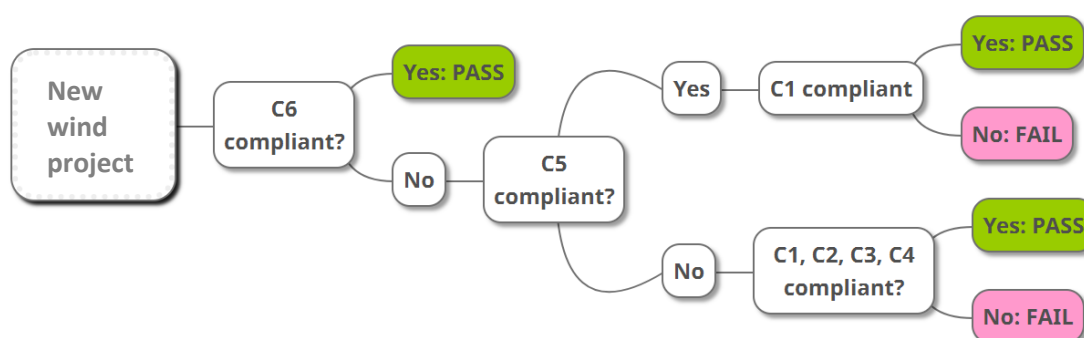


Figure 1-3: Acceptance conditions for new project in the ZE

The acceptance conditions for Habloville are:

- A. The project satisfies C6;
- B. The project satisfies C1 and C5; or
- C. The project satisfies C1, C2, C3, and C4.

1.5

Falaise weather radar

Figure 1-4 shows the proposed Habloville wind farm in relation to the C-band Falaise weather radar and the radar safeguarding zones. Other wind farms within the ZE radius are also shown. Wind farms that are referred to later in the report, are labelled.

Details of all other wind farms were taken from the QinetiQ database [9], except for the Les Hauts Vaudois wind farm, which was provided by Elements [8]. The Elements

^A Sensitive sites are SEVESO-haut establishments, or installations nucléaires de base (INBs)

^B For some projects the impact from a new project falls entirely inside the existing impact zone. In other words, the project does not create any new impact zone areas, and the ZIG is not modified.

^C The criteria are also used for assessing the impacts of repowering projects; as this is a new project, the rules for repowering is not discussed.

definition for Les Hauts Vaudois (5x turbines, in planning) is different to the one in the QinetiQ database (11x turbines, consented). However, Elements has confirmed they have discussed this topic with DREAL, and their definition is the correct one to use for the assessment [8].

QinetiQ is not aware of any sensitive sites within the ZE radius for the Falaise radar.

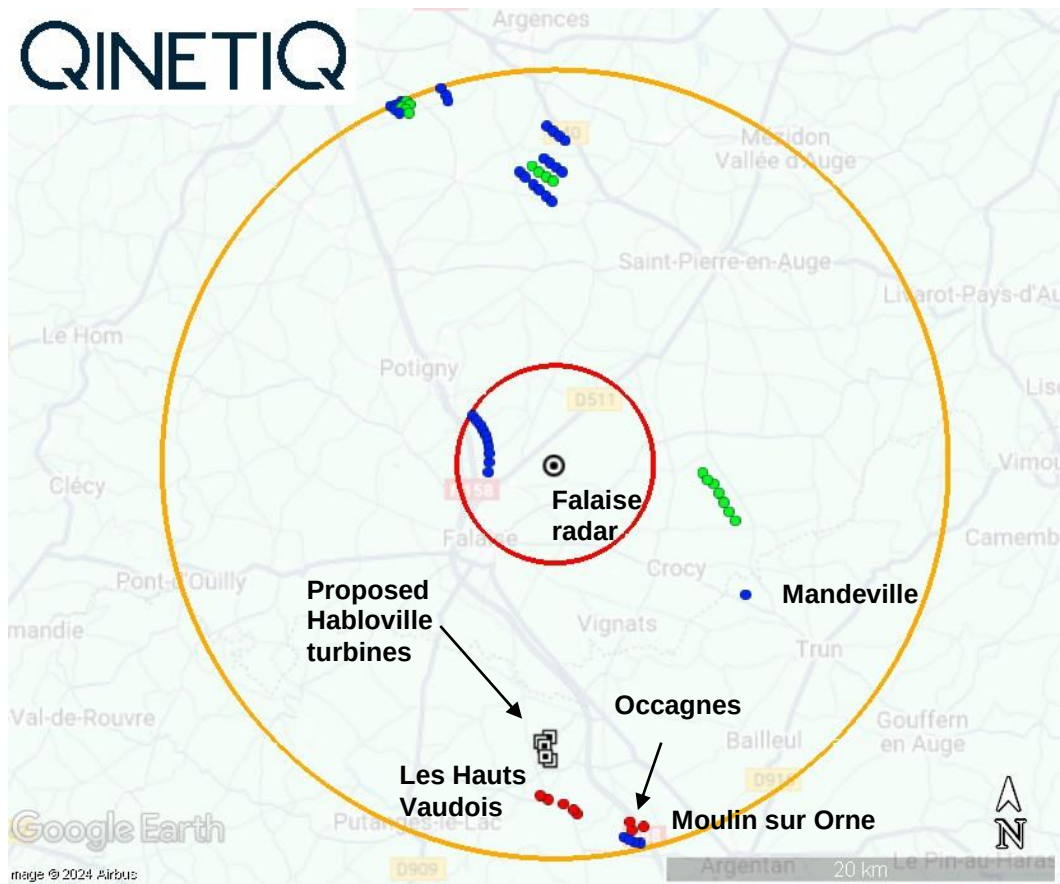


Figure 1-4: Proposed Habloville turbines (white squares) and other wind farms (blue = operational, red = in planning, and green = consented) within the Falaise ZE radius (orange line). White circle icon = Falaise radar; red line = Falaise ZP

2 CLOUDSiS Assessment

2.1 C1: maximum occultation

Figure 2-1 shows the cumulative occultation impact from the proposed turbines and other wind farms within the ZE radius, calculated using the lowest radar scan angle. The maximum occultation is 7.9%. The impact is smaller for the higher scan angles.

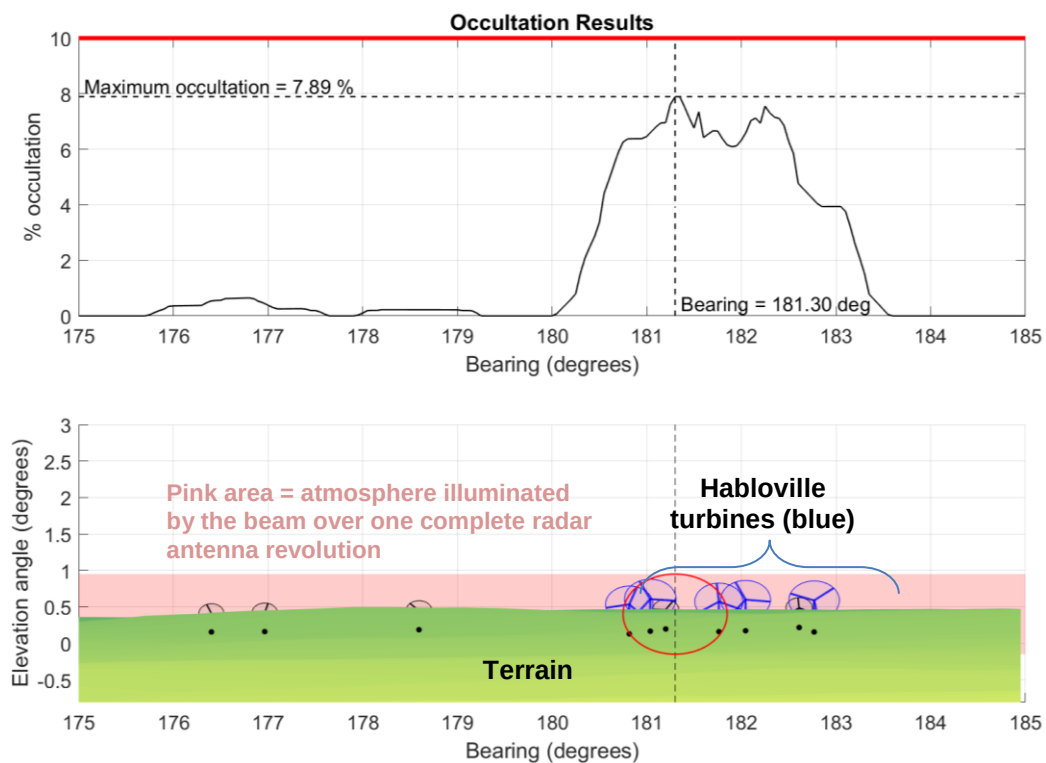


Figure 2-1: Cumulative occultation from Habloville (blue) and other wind farms within the Falaise ZE

2.2 C2: Maximum size of impact zone

Figure 2-2 shows the impact zones^D (pink) from the proposed Habloville wind farm and nearby wind farms, overlaid on a plot of the wind farm composite reflectivity (in dBZ)^E.

The impact zone from Habloville is continuous with the impacts from Les Hauts Vaudois, Occagnes, and Moulin sur Orne. Accordingly, these impact zones will be grouped together^F; this will be referred to as the *Habloville combined impact zone*.

^D Only the parts of the impact zones within the ZE radius are included in the analysis. Any parts of the impact zone outside the ZE should be ignored. This applies to all impact zones shown in the report.

^E Composite reflectivity is the maximum strength of weather radar echoes out of all scan angles, and is usually expressed in logarithmic units, dBZ. In the context of a wind farm assessment, it provides a measure of how large the wind farm reflections will be.

^F Impact zones can be grouped in any way to try to pass the criteria, provided the size of the combined impact zone does not exceed the 10 km limit.

The maximum size of the Habloville combined impact zone, measured along the longest dimensions, is 9.5 km.

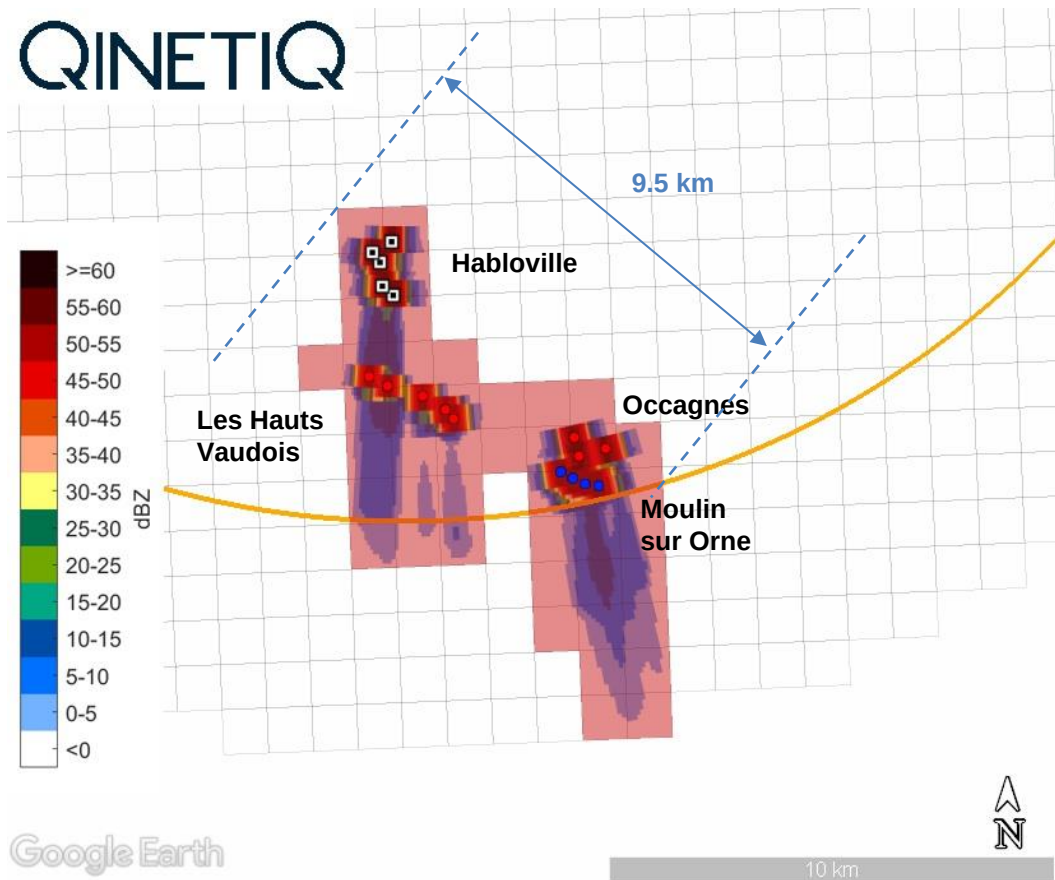


Figure 2-2: Habloville combined impact zone and all other wind farm impact zones within the Falaise ZE radius (orange line). Gridlines = 1 km x 1 km cells

2.3

C3: Minimum separation from other impact zones

Figure 2-3 shows the Habloville combined impact zone and all other wind farm impact zones within the Falaise ZE radius. The minimum interdistance is 10.3 km (Mandeville).

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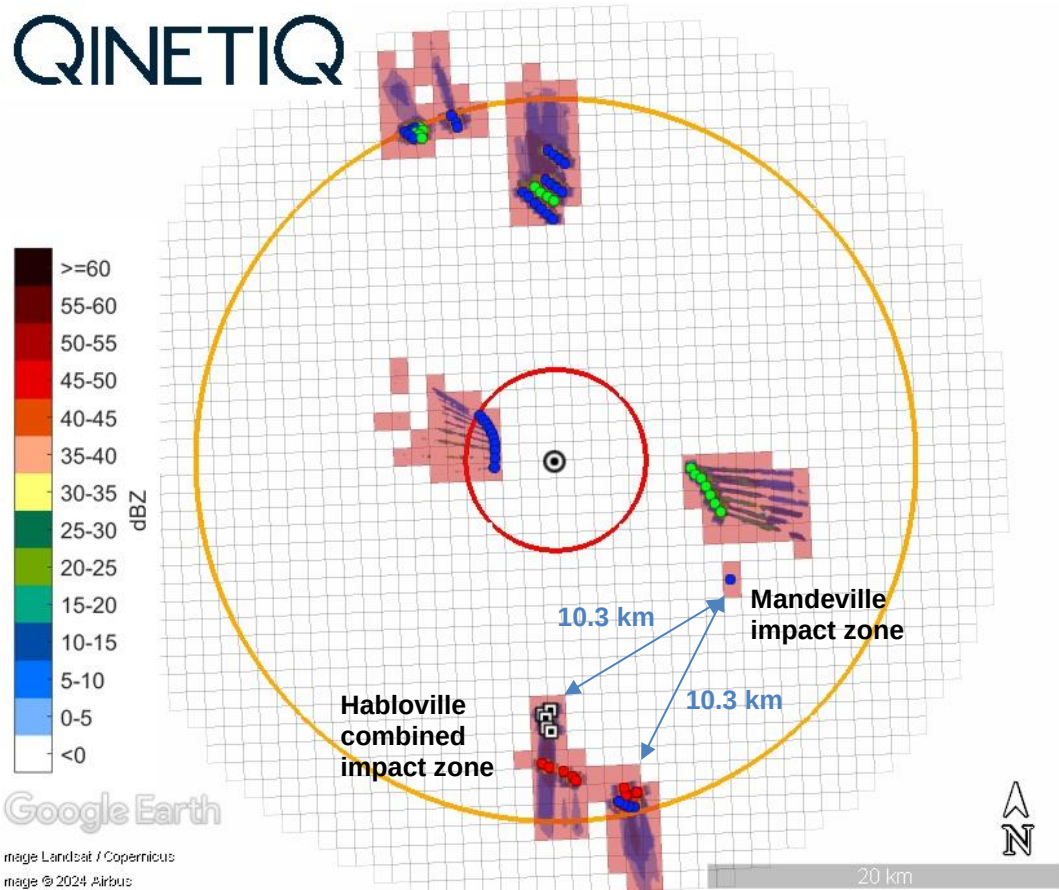


Figure 2-3: Habloville combined impact zone and all other wind farm impact zones within the Falaise ZE radius (orange line). Gridlines = 1 km x 1 km cells; red line = Falaise ZP

2.4 C4: Minimum separation from sensitive sites

There are no sensitive sites with the Falaise ZE radius. C4 is not applicable.

2.5 C5: ZIG

The proposed Habloville creates new impacted cells, therefore, the ZIG is modified.

2.6 C6: LoS visibility

All proposed Habloville turbines are in radar LoS from the Falaise radar.

2.7 Impact metrics

Table 2-1 summarises the impact metrics for the proposed Habloville wind farm.

Criterion	Description	Result
C1	Maximum percentage occultation in any sector containing a proposed turbine	7.9%
C2	Maximum dimension of the ZI created by the proposed wind farm	9.5 km
C3	Minimum separation between the proposed wind farm's ZI, and other wind farm ZIs	10.3 km
C4	Minimum separation between the proposed wind farm's ZI, and sensitive sites	Not applicable (no sensitive sites within ZE radius)
C5	Modification of ZIG	New impacted cells created, ZIG is modified
C6	LoS visibility of all turbines	All turbines are in radar LoS

Table 2-1: Summary of impact metrics for the proposed Habloville wind farm, following the rules for a new wind farm project

2.8 Acceptability

Table 2-2 summarises the acceptance conditions for Habloville (from Section 1.4). A wind farm only needs to pass one condition to be acceptable. The proposed wind farm passes one of the conditions (C), therefore, the impacts on the Falaise weather radar are acceptable.

Acceptance condition	Requirements	Are the requirements met?
A	The project satisfies C6	No
B	The project satisfies C1 and C5	No
C	The project satisfies C1, C2, C3, and C4	Yes

Table 2-2: Summary of acceptance conditions for Habloville

3 Conclusions

Elements is developing the Habloville wind farm (5x Nordex N131-106HH turbines, see Section 1.3). The proposed turbines are within the ZE for the Falaise weather radar, and require an impact assessment.

A CLOUDSiS 1.0 assessment has been carried out to quantify the Falaise radar impacts due to the proposed Habloville wind farm. Following the DGPR acceptance conditions for a new project (see Section 1.4), the impacts on the Falaise weather are acceptable (see Section 2.8).

4 References

- [1] Legifrance, *Arrêté du 10 décembre 2021 modifiant l'arrêté du 26 août 2011 modifié relatif aux installations de production d'électricité utilisant l'énergie mécanique du vent au sein d'une installation soumise à autorisation au titre de la rubrique 2980 de la législation des installations classées pour la protection de l'environnement*, 10 December 2021, TREP2136555A, URL: <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000044516558>
- [2] Legifrance, *"Notice Décision du 03 février 2022 relative à la reconnaissance de la méthode de modélisation des perturbations générées par les aérogénérateurs sur les radars météorologiques CLOUDSiS 1.0 et de la société QinetiQ Ltd chargée de sa mise en oeuvre"*, TREP2201124S, URL: <https://www.bulletin-officiel.developpement-durable.gouv.fr/notice?id=Bulletinofficiel-0032345>
- [3] QinetiQ, *Proposal: Habloville CLOUDSiS assessment*, Contract Reference No. 050224-981 v1, February 2024
- [4] Riffard, M. (Elements), *RE: UC Habloville wind farm project*, email to Ellis, J. (QinetiQ), 2 February 2024
- [5] Riffard, M. (Elements), *RE: UC Habloville wind farm project (981)*, email to Ellis, J. (QinetiQ), 13 February 2024 10:16
- [6] Riffard, M. (Elements), *RE: UC Habloville wind farm project (981)*, email to Ellis, J. (QinetiQ), 13 February 2024 14:20
- [7] Riffard, M. (Elements), *RE: UC Habloville wind farm project (981)*, email to Ellis, J. (QinetiQ), 22 March 2024
- [8] Riffard, M. (Elements), *RE: UC Habloville wind farm project (981)*, email to Ellis, J. (QinetiQ), 14 February 2024 11:22
- [9] QinetiQ, *CLOUDSiS turbine database*, version 217, 17 January 2024