Norwell Solar Farm Steering Group

Application by Elements Green Trent Limited for an Order Granting Development Consent for the Great North Road Solar and Biodiversity Park – project ref. EN010162

Unique Number – [redacted] (Our ref: NSG/10)

Deadline 5. Response to Applicant's submission REP4-060

1 Introduction

1.1 The first purpose of this submission is to briefly revisit the principle of worst case scenario projections, discussed by the Applicant in submission **REP4-060** **"***Responses to ExA's Second Written Questions".* The second is to analyse which scientific evidence previously provided by the Group has gone unchallenged.

1.2 The Examining Authority (ExA) has already alluded to the uncertainty which must surround predicting the future. However, the raison d'etre for this project is grounded in the argument that it will over the next forty years make a positive contribution to reducing climate change. To substantiate that argument, the Applicant makes 40 year projections. The Group make different ones.

2 National Advice

2.1 The ExA will be aware of the content the Planning Inspectorate's Advice Note Nine, which addresses the the Rochdale Envelope approach to NSIPs. They key phrases used in the Note are:-

> ...*"the assessment should be based on cautious 'worst case' approach:"*
>
> *"...ensure that the assessment of the worst case scenario(s) addresses impacts which may not be significant on their own but could become significant when they inter-relate with other impacts alone or cumulatively with impacts from other development"*
>
> *"4.9 If, in the course of preparing an ES, it becomes clear that it will not be possible to specify all the details of the Proposed Development, the ES must explain why and how this has been addressed. The ES will need to establish the relevant parameters for the purposes of the assessment. Where this approach is adopted the assessments in the ES should be undertaken on the*

basis of the relevant design parameters applicable to the characteristics of the Proposed Development included within the DCO. The assessment should establish those parameters likely to result in the maximum adverse effect (the worst case scenario) and be undertaken accordingly to determine significance."

2.2 On page 24 of **REP4-060 ,** the Applicant states the following:-

"the statements by Norwell Solar Farm Steering Group in relation to the battery element being a net contributor of GHG emissions are based on a worst-case approach;"

2.3 The Applicant states on that page however that their adoption of the 365gCO_2/kwh emissions figure remaining unchanged for the next forty years is based on their *"best-estimate approach"* when that figure is already out of date in 2026. National Grid's data shows this to be the case.

2.4 Presumably the use of the factor 207gCO_2/kwh (page 50 in Table A15.1.20 of the lifecycle appendix), used to calculate solar PV carbon savings direct to grid, again for every one of the next 40 years is also their *"best estimate".* This is telling as its use clearly implies that the Applicant estimates that the numerous projects such as this one will have actually have no beneficial impact at all on the decarbonisation of the energy sector. Which one is it to be? One cannot have it both ways.

3 The Worst Case Scenario

3.1 The amount of carbon emissions required to construct, operate and decommission a project is an environmental impact. The Group have previously argued that the Applicant's estimates of required replacement materials are very optimistic and not 'Rochdale compliant'.

3.2 That said, some of the Group's chosen factors have not been either. Up to now, the Group recognises that some of the estimates have now and then been generous. This will now be rectified.

3.3 The adoption of a 50% panel replacement rate is not worst case nor in all likelihood probable. All evidence points to an actual rate of 100%. This is also the rate assumed by the developers at

- The One Earth Solar farm NSIP – EN010159
- The Botley West solar farm project EN010147
- The East Park Energy project EN010141

3.4 Perhaps the most convincing argument that the rate should be 100% is the real world evidence which showed that, as part of the Badran and Dhimish study (see page 8 of the Group's report REP3-113), a likely panel degradation rate for these bifacial panels in this area of this country would be 1.17% per annum.

3.5 This is the second proposed alteration. The Group earlier assumed a 0.7%pa degradation rate. This should be 1.17% as there is empirical evidence to that effect.

3.6 Appendix A recalculates the solar generation with the above 2 new variables applied. Those annual productions figures are then used in Appendix B to arrive at a new total emissions saved figure for panel direct to the grid – 454,230tCO_2.

3.7 As more panels are now being deployed during the project's lifetime, this alters the associated emissions for replacements. A 100% replacement rate adds another 470,625tCO_2

4 Net Emission savings

4.1 There is very little change in the new avoided emissions calculations from the last figures in the Group's report REP3-113 (page 10).The new total is 1,784,674tCO_2 for the Group's scenario and the total based on DESNZ modelling changes to 977,506tCO_2.

4.2 There is a larger change in the projects net emissions when one adds in the extra panels, as shown below.

Group's Future Scenario (Worst Case)

Emission Savings	1,784,874
Production Emissions	4,110,983
Net Emission Savings	**-2,326,109**tCO_2

DESNZ Modelling (Worst Case)

Emission Savings	977,506
Production Emissions	4,110,983
Net Emission Savings	**-3,133,477**tCO_2

5 Outstanding Matters

5.1 In the Group's report REP3-113, several issues were discussed which invited a response from the Applicant. The first was the scientific evidence showing the effect of the depth of discharge on a battery's lifespan. So far, no evidence has been produced by the Applicant to cast any doubt on those findings and the consequential limited lifespan for batteries.

5.2 The second section inviting a response was the report's assertion that 5 critical factors were just copy pastes from the flawed Byers Gill papers. The Applicant has accepted one of them was and it has been shown that at least 2 more had to be. The final two were the replacement rates for panels and batteries.

5.3 The Group estimated the average annual number of overnight charging cycles. Given that it is extremely difficult to imagine overnight demand to be on a par with morning peak demand, it does appear that there will always be a price differential. The Applicant states overnight charging will be governed by market situations. The Group understand that the revenues from the BESS discharges are not governed by the CFD strike price. Morning battery discharges have the potential to be the biggest money earner for the Applicant. The Applicant does not address this issue and the reason may be that with numerous BESS charging overnight, then overnight gas consumption will rise significantly. That undermines green credentials.

5.4 Lastly, there are the findings of the four year study by Badran and Dhimish regarding the performance of bifacial panels in England. It appears these are also going unchallenged with contrary scientific real world evidence.

6 Conclusions

6.1 By adopting three new calculations as above, one is probably nearer a worst case analysis - excess emissions of between 2.3-3.1 million tonnes of CO_2 for the project's lifetime.

6.2 In reality, the totals could be less than these and probably nearer to the Group's figure of 1.8 million tonnes of CO_2. However, it has hopefully been shown that the figures in REP3-113 are not worst case but a more likely end result.

Appendix A
Panel Generation

Year Number	Year	Panels last 27 years	28yrs	29yrs	30yrs	31yrs	Total MWh AC
1	2026	84567	84567	84567	84567	84567	422,834
2	2027	125353	125353	125353	125353	125353	626,764
3	2028	168695	168695	168695	168695	168695	843,477
4	2029	166722	166721	166721	166721	166721	833,607
5	2030	164771	164771	164771	164771	164771	823,854
6	2031	162843	162843	162843	162843	162843	814,214
7	2032	160938	160938	160938	160938	160938	804,688
8	2033	159055	159055	159055	159055	159055	795,273
9	2034	157194	157194	157194	157194	157194	785,969
10	2035	155355	155354	155354	155354	155354	776,773
11	2036	153537	153537	153537	153537	153537	767,685
12	2037	151741	151740	151740	151740	151740	758,703
13	2038	149965	149965	149965	149965	149965	749,826
14	2039	148211	148210	148210	148210	148210	741,053
15	2040	146477	146476	146476	146476	146476	732,383
16	2041	144763	144763	144763	144763	144763	723,814
17	2042	143069	143069	143069	143069	143069	715,345
18	2043	141395	141395	141395	141395	141395	706,975
19	2044	139741	139741	139741	139741	139741	698,704
20	2045	138106	138106	138106	138106	138106	690,529
21	2046	136490	136490	136490	136490	136490	682,450
22	2047	134893	134893	134893	134893	134893	674,465
23	2048	133315	133315	133315	133315	133315	666,574
24	2049	131755	131755	131755	131755	131755	658,775
25	2050	130214	130213	130213	130213	130213	651,067
26	2051	128690	128690	128690	128690	128690	643,450
27	2052	127185	127184	127184	127184	127184	635,922
28	2053	169289	125696	125696	125696	125696	672,074
29	2054	167308	169289	124226	124226	124226	709,274
30	2055	165351	167308	169289	122772	122772	747,492
31	2056	163416	165351	167308	169289	121336	786,700
32	2057	161504	163416	165351	167308	169289	826,869
33	2058	159615	161504	163416	165351	167308	817,194
34	2059	157747	159615	161504	163416	165351	807,633
35	2060	155902	157747	159615	161504	163416	798,184
36	2061	154077	155902	157747	159615	161504	788,845
37	2062	152275	154077	155902	157747	159615	779,615
38	2063	150493	152275	154077	155902	157747	770,494
39	2064	148732	150493	152275	154077	155902	761,479
40	2065	146992	148732	150493	152275	154077	752,570
Total							**29,443,594**

Table notes

The panel degradation rate of 1.17% per annum has been applied, taken from the real world findings for bifacial panels in England as published in *"A comparative study of bifacial versus monofacial PV systems at the UK's largest solar plant" Badran and Dhimish (2024)"* A replacement rate of 100% of the panels is applied starting in 2053.

Appendix B
Emission Avoidance From Panels Direct To Grid

Year Number	Year	Marginal carbon Intensity kgCO2e/kWh	Annual Energy Production (Mwh) AC	Charged to BESS (MwhAC)	Solar Energy to Grid (Mwh) AC	Carbon Avoidance (tonnes CO2e)
1	2026	0.174	422,834	264,829	158,005	27,493
2	2027	0.154	626,764	256,885	369,879	56,961
3	2028	0.133	843,477	249,178	594,299	79,042
4	2029	0.11	833,607	241,703	591,904	65,109
5	2030	0.085	823,854	234,452	589,402	50,099
6	2031	0.0652	814,214	227,418	586,796	38,259
7	2032	0.0501	804,688	220,595	584,093	29,263
8	2033	0.0384	795,273	213,978	581,295	22,322
9	2034	0.0296	785,969	207,558	578,411	17,121
10	2035	0.0226	776,773	264,829	511,944	11,570
11	2036	0.0174	767,685	256,885	510,800	8,888
12	2037	0.0133	758,703	249,178	509,525	6,777
13	2038	0.0102	749,826	241,703	508,123	5,183
14	2039	0.0079	741,053	234,452	506,601	4,002
15	2040	0.006	732,383	227,418	504,965	3,030
16	2041	0.0057	723,814	220,595	503,219	2,868
17	2042	0.0036	715,345	213,978	501,367	1,805
18	2043	0.0028	706,975	207,558	499,417	1,398
19	2044	0.002	698,704	201,332	497,372	995
20	2045	0.0013	690,529	264,829	425,700	553
21	2046	0.0013	682,450	256,885	425,565	553
22	2047	0.0013	674,465	249,178	425,287	553
23	2048	0.0014	666,574	241,703	424,871	595
24	2049	0.0013	658,775	234,452	424,323	552
25	2050	0.0023	651,067	227,418	423,649	974
26	2051	0.0023	643,450	220,595	422,855	973
27	2052	0.0023	635,922	213,978	421,944	970
28	2053	0.0023	672,074	207,558	464,516	1,068
29	2054	0.0023	709,274	201,332	507,942	1,168
30	2055	0.0023	747,492	264,829	482,663	1,110
31	2056	0.0023	786,700	256,885	529,815	1,219
32	2057	0.0023	826,869	249,178	577,691	1,329
33	2058	0.0023	817,194	241,703	575,491	1,324
34	2059	0.0023	807,633	234,452	573,181	1,318
35	2060	0.0023	798,184	227,418	570,766	1,313
36	2061	0.0023	788,845	220,595	568,250	1,307
37	2062	0.0023	779,615	213,978	565,637	1,301
38	2063	0.0023	770,494	207,558	562,936	1,295
39	2064	0.0023	761,479	201,332	560,147	1,288
40	2065	0.0023	752,570	195,292	557,278	1,282
					Total	**454,230**

Table notes

The column 3 emissions factors are the same used by the Group and the Applicant is all similar previous calculations. Column 4 has been taken from Appendix A.