

# Supplementary Material for ‘Policy and Pricing Barriers to Steel Industry Decarbonisation: A UK Case Study’

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## 1. Projected Gas and Carbon Prices

### 1.1. Gas Prices [1]

Gas Price (p/therm)			
	Low	Central	High
2021	33	49	74
2022	33	50	75
2023	34	51	76
2024	35	52	77
2025	36	53	78
2026	37	54	79
2027	37	56	80
2028	38	57	81
2029	39	58	82
2030	40	59	83
2031	41	60	84
2032	41	61	85
2033	42	62	86
2034	43	63	87
2035	43	64	88
2036	43	64	88
2037	43	64	88
2038	43	64	88
2039	43	64	88
2040	43	64	88
2041	43	64	88
2042	43	64	88
2043	43	64	88
2044	43	64	88
2045	43	64	88
2046	43	64	88
2047	43	64	88
2048	43	64	88
2049	43	64	88
2050	43	64	88
2051	43	64	88
2052	43	64	88
2053	43	64	88
2054	43	64	88
2055	43	64	88
2056	43	64	88
2057	43	64	88
2058	43	64	88
2059	43	64	88
2060	43	64	88

### 1.2. Carbon Prices [2]

<b>Traded Carbon Price (£/tCO<sub>2</sub>)</b>			
	<b>Low</b>	<b>Central</b>	<b>High</b>
<b>2021</b>	4	22	40
<b>2022</b>	9	29	50
<b>2023</b>	13	37	60
<b>2024</b>	17	44	70
<b>2025</b>	22	51	81
<b>2026</b>	26	58	91
<b>2027</b>	31	66	101
<b>2028</b>	35	73	111
<b>2029</b>	39	80	121
<b>2030</b>	44	87	131
<b>2031</b>	48	97	145
<b>2032</b>	53	105	158
<b>2033</b>	57	113	170
<b>2034</b>	61	121	182
<b>2035</b>	65	130	195
<b>2036</b>	69	138	207
<b>2037</b>	73	146	219
<b>2038</b>	77	154	232
<b>2039</b>	81	163	244
<b>2040</b>	85	171	256
<b>2041</b>	90	179	269
<b>2042</b>	94	187	281
<b>2043</b>	98	195	293
<b>2044</b>	102	204	306
<b>2045</b>	106	212	318
<b>2046</b>	110	220	330
<b>2047</b>	114	228	343
<b>2048</b>	118	237	355
<b>2049</b>	122	245	367
<b>2050</b>	127	253	380
<b>2051</b>	130	262	394
<b>2052</b>	133	271	409
<b>2053</b>	136	279	423
<b>2054</b>	138	288	438
<b>2055</b>	141	297	452
<b>2056</b>	143	305	467
<b>2057</b>	146	313	481
<b>2058</b>	148	321	495
<b>2059</b>	150	329	508
<b>2060</b>	152	337	522
<b>2061</b>	153	343	533
<b>2062</b>	153	349	544
<b>2063</b>	154	354	554
<b>2064</b>	155	359	564
<b>2065</b>	155	364	573
<b>2066</b>	155	368	582
<b>2067</b>	154	372	590
<b>2068</b>	154	375	597
<b>2069</b>	153	378	603

<b>2070</b>	152	381	609
<b>2071</b>	151	383	615
<b>2072</b>	150	385	620
<b>2073</b>	149	387	625
<b>2074</b>	147	388	629
<b>2075</b>	146	389	632
<b>2076</b>	144	389	635
<b>2077</b>	142	389	637
<b>2078</b>	140	389	638
<b>2079</b>	138	388	639
<b>2080</b>	135	387	638
<b>2081</b>	133	387	640
<b>2082</b>	131	386	640
<b>2083</b>	129	385	640
<b>2084</b>	126	383	640
<b>2085</b>	124	382	640
<b>2086</b>	122	380	638
<b>2087</b>	119	378	636
<b>2088</b>	116	375	634
<b>2089</b>	114	373	632
<b>2090</b>	111	370	629
<b>2091</b>	108	368	627
<b>2092</b>	106	365	625
<b>2093</b>	103	362	621
<b>2094</b>	101	359	618
<b>2095</b>	98	356	614
<b>2096</b>	95	353	610
<b>2097</b>	93	350	607
<b>2098</b>	90	346	602
<b>2099</b>	87	343	598
<b>2100</b>	85	339	593

## 2. Electricity Grid Carbon Intensity [3]

Electricity Grid Carbon Intensity (gCO <sub>2</sub> /kWh)				
	Consumer Transformation	System Transformation	Leading the Way	Steady Progression
2021	107.0	107.4	99.7	111.9
2022	87.1	83.2	77.3	88.4
2023	88.3	84.4	68.9	89.1
2024	77.8	73.1	53.2	88.1
2025	66.7	64.0	51.1	85.6
2026	54.3	59.4	39.2	91.0
2027	53.0	51.1	26.9	98.9
2028	34.8	46.9	17.1	69.5
2029	32.4	32.7	11.3	51.5
2030	19.8	21.6	5.5	41.6
2031	5.7	21.5	2.3	45.0
2032	-2.6	20.0	-0.6	45.6
2033	-15.7	3.9	-18.1	46.0
2034	-20.2	-10.5	-18.0	45.2
2035	-28.3	-15.4	-18.4	40.1
2036	-30.3	-22.2	-19.3	36.9
2037	-34.5	-34.7	-18.4	33.8
2038	-38.8	-38.9	-38.0	33.5
2039	-44.3	-45.2	-43.2	32.3
2040	-43.1	-42.5	-42.1	28.1
2041	-48.7	-39.4	-41.7	28.6
2042	-47.2	-40.0	-41.8	29.6
2043	-49.1	-48.5	-42.1	25.1
2044	-50.4	-48.5	-42.0	24.0
2045	-49.5	-46.9	-43.1	20.6
2046	-57.2	-50.7	-42.6	20.1
2047	-54.7	-55.0	-42.3	20.0
2048	-54.8	-55.0	-41.9	19.3
2049	-53.5	-52.7	-42.8	16.7
2050	-54.2	-54.6	-43.0	14.3

### 3. Emissions Trading Scheme Parameters

#### 3.1. Data Used to Calculate Equivalent Emissions Benchmarks

Product	Benchmark for 2021-2025 (tCO <sub>2</sub> /t)	Production (t/tCS)				
		TGR-BF + CCS	Hlsarna + CCS	H <sub>2</sub> -DRI + EAF (0% scrap)	H <sub>2</sub> -DRI + EAF (50% scrap)	EAF Only (100% scrap)
Hot Metal	<b>1.288</b>	0.9261	0.9261	0	0	0
Coke	<b>0.217</b>	0.37293	0	0	0	0
Sintered Ore / Pellets	<b>0.157</b>	1.17291	0	1.5038	0.738	0
EAF Carbon Steel	<b>0.215</b>	0	0	1	1	1
Lime	<b>0.725</b>	0.03553	0.03553	0.05	0.05	0.05

#### 3.2. Resulting ETS Free Allocations and Compensation for Indirect Emissions

	Carbon Leakage Exposure Factor	Compensation Rate for Indirect Emissions	ETS Free Allocation (tCO <sub>2</sub> /tCS)				
			TGR-BF + CCS	Hlsarna + CCS	H <sub>2</sub> -DRI + EAF (0% scrap)	H <sub>2</sub> -DRI + EAF (50% scrap)	EAF Only (100% scrap)
<b>2021</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2022</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2023</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2024</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2025</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2026</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2027</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2028</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2029</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2030</b>	1.0	0.750	1.48	1.22	0.49	0.37	0.25
<b>2031</b>	0.9	0.675	1.34	1.10	0.44	0.33	0.23
<b>2032</b>	0.8	0.600	1.19	0.97	0.39	0.29	0.20
<b>2033</b>	0.7	0.525	1.04	0.85	0.34	0.26	0.18
<b>2034</b>	0.6	0.450	0.89	0.73	0.29	0.22	0.15
<b>2035</b>	0.5	0.375	0.74	0.61	0.24	0.18	0.13
<b>2036</b>	0.4	0.300	0.59	0.49	0.19	0.15	0.10
<b>2037</b>	0.3	0.225	0.45	0.37	0.15	0.11	0.08
<b>2038</b>	0.2	0.150	0.30	0.24	0.10	0.07	0.05
<b>2039</b>	0.1	0.075	0.15	0.12	0.05	0.04	0.03
<b>2040</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2041</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2042</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2043</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2044</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2045</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2046</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2047</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00

<b>2048</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2049</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00
<b>2050</b>	0.0	0.000	0.00	0.00	0.00	0.00	0.00

#### 4. Carbon Intensity of Steel Production Against Grid Carbon Intensity

<b>Grid Intensity</b>	<b>TGR-BF + CCS</b>	<b>Hlsarna + CCS</b>	<b>H<sub>2</sub>-DRI + EAF (0% scrap)</b>	<b>H<sub>2</sub>-DRI + EAF (50% scrap)</b>	<b>EAF Only (100% scrap)</b>
<b>gCO<sub>2</sub>/kWh</b>	<b>tCO<sub>2</sub>/tCS</b>	<b>tCO<sub>2</sub>/tCS</b>	<b>tCO<sub>2</sub>/tCS</b>	<b>tCO<sub>2</sub>/tCS</b>	<b>tCO<sub>2</sub>/tCS</b>
-500	0.881	0.167	-1.455	-0.796	-0.160
-490	0.884	0.171	-1.425	-0.779	-0.155
-480	0.887	0.174	-1.395	-0.762	-0.151
-470	0.891	0.178	-1.365	-0.745	-0.147
-460	0.894	0.181	-1.334	-0.728	-0.143
-450	0.898	0.184	-1.304	-0.711	-0.138
-440	0.901	0.188	-1.274	-0.694	-0.134
-430	0.905	0.191	-1.244	-0.677	-0.130
-420	0.908	0.195	-1.214	-0.660	-0.126
-410	0.912	0.198	-1.184	-0.643	-0.121
-400	0.915	0.202	-1.153	-0.626	-0.117
-390	0.919	0.205	-1.123	-0.609	-0.113
-380	0.922	0.209	-1.093	-0.592	-0.109
-370	0.925	0.212	-1.063	-0.575	-0.104
-360	0.929	0.215	-1.033	-0.558	-0.100
-350	0.932	0.219	-1.003	-0.541	-0.096
-340	0.936	0.222	-0.972	-0.524	-0.092
-330	0.939	0.226	-0.942	-0.507	-0.087
-320	0.943	0.229	-0.912	-0.490	-0.083
-310	0.946	0.233	-0.882	-0.473	-0.079
-300	0.950	0.236	-0.852	-0.456	-0.075
-290	0.953	0.240	-0.822	-0.439	-0.070
-280	0.956	0.243	-0.792	-0.422	-0.066
-270	0.960	0.247	-0.761	-0.405	-0.062
-260	0.963	0.250	-0.731	-0.388	-0.058
-250	0.967	0.253	-0.701	-0.371	-0.053
-240	0.970	0.257	-0.671	-0.354	-0.049
-230	0.974	0.260	-0.641	-0.337	-0.045
-220	0.977	0.264	-0.611	-0.320	-0.041
-210	0.981	0.267	-0.580	-0.303	-0.036
-200	0.984	0.271	-0.550	-0.286	-0.032
-190	0.987	0.274	-0.520	-0.269	-0.028
-180	0.991	0.278	-0.490	-0.253	-0.024
-170	0.994	0.281	-0.460	-0.236	-0.019
-160	0.998	0.284	-0.430	-0.219	-0.015
-150	1.001	0.288	-0.399	-0.202	-0.011
-140	1.005	0.291	-0.369	-0.185	-0.007
-130	1.008	0.295	-0.339	-0.168	-0.002
-120	1.012	0.298	-0.309	-0.151	0.002



-110	1.015	0.302	-0.279	-0.134	0.006
-100	1.019	0.305	-0.249	-0.117	0.011
-90	1.022	0.309	-0.218	-0.100	0.015
-80	1.025	0.312	-0.188	-0.083	0.019
-70	1.029	0.315	-0.158	-0.066	0.023
-60	1.032	0.319	-0.128	-0.049	0.028
-50	1.036	0.322	-0.098	-0.032	0.032
-40	1.039	0.326	-0.068	-0.015	0.036
-30	1.043	0.329	-0.037	0.002	0.040
-20	1.046	0.333	-0.007	0.019	0.045
-10	1.050	0.336	0.023	0.036	0.049
0	1.053	0.340	0.053	0.053	0.053
10	1.056	0.343	0.083	0.070	0.057
20	1.060	0.347	0.113	0.087	0.062
30	1.063	0.350	0.143	0.104	0.066
40	1.067	0.353	0.174	0.121	0.070
50	1.070	0.357	0.204	0.138	0.074
60	1.074	0.360	0.234	0.155	0.079
70	1.077	0.364	0.264	0.172	0.083
80	1.081	0.367	0.294	0.189	0.087
90	1.084	0.371	0.324	0.206	0.091
100	1.087	0.374	0.355	0.223	0.096
110	1.091	0.378	0.385	0.240	0.100
120	1.094	0.381	0.415	0.257	0.104
130	1.098	0.384	0.445	0.274	0.108
140	1.101	0.388	0.475	0.291	0.113
150	1.105	0.391	0.505	0.308	0.117
160	1.108	0.395	0.536	0.325	0.121
170	1.112	0.398	0.566	0.342	0.125
180	1.115	0.402	0.596	0.359	0.130
190	1.119	0.405	0.626	0.375	0.134
200	1.122	0.409	0.656	0.392	0.138
210	1.125	0.412	0.686	0.409	0.142
220	1.129	0.416	0.717	0.426	0.147
230	1.132	0.419	0.747	0.443	0.151
240	1.136	0.422	0.777	0.460	0.155
250	1.139	0.426	0.807	0.477	0.159
260	1.143	0.429	0.837	0.494	0.164
270	1.146	0.433	0.867	0.511	0.168
280	1.150	0.436	0.898	0.528	0.172
290	1.153	0.440	0.928	0.545	0.176
300	1.156	0.443	0.958	0.562	0.181
310	1.160	0.447	0.988	0.579	0.185
320	1.163	0.450	1.018	0.596	0.189
330	1.167	0.453	1.048	0.613	0.193

340	1.170	0.457	1.078	0.630	0.198
350	1.174	0.460	1.109	0.647	0.202
360	1.177	0.464	1.139	0.664	0.206
370	1.181	0.467	1.169	0.681	0.210
380	1.184	0.471	1.199	0.698	0.215
390	1.187	0.474	1.229	0.715	0.219
400	1.191	0.478	1.259	0.732	0.223
410	1.194	0.481	1.290	0.749	0.227
420	1.198	0.484	1.320	0.766	0.232
430	1.201	0.488	1.350	0.783	0.236
440	1.205	0.491	1.380	0.800	0.240
450	1.208	0.495	1.410	0.817	0.244
460	1.212	0.498	1.440	0.834	0.249
470	1.215	0.502	1.471	0.851	0.253
480	1.219	0.505	1.501	0.868	0.257
490	1.222	0.509	1.531	0.885	0.261
500	1.225	0.512	1.561	0.902	0.266
510	1.229	0.516	1.591	0.919	0.270
520	1.232	0.519	1.621	0.936	0.274
530	1.236	0.522	1.652	0.953	0.278
540	1.239	0.526	1.682	0.970	0.283
550	1.243	0.529	1.712	0.987	0.287
560	1.246	0.533	1.742	1.004	0.291
570	1.250	0.536	1.772	1.020	0.295
580	1.253	0.540	1.802	1.037	0.300
590	1.256	0.543	1.832	1.054	0.304
600	1.260	0.547	1.863	1.071	0.308
610	1.263	0.550	1.893	1.088	0.312
620	1.267	0.553	1.923	1.105	0.317
630	1.270	0.557	1.953	1.122	0.321
640	1.274	0.560	1.983	1.139	0.325
650	1.277	0.564	2.013	1.156	0.329
660	1.281	0.567	2.044	1.173	0.334
670	1.284	0.571	2.074	1.190	0.338
680	1.288	0.574	2.104	1.207	0.342
690	1.291	0.578	2.134	1.224	0.346
700	1.294	0.581	2.164	1.241	0.351
710	1.298	0.584	2.194	1.258	0.355
720	1.301	0.588	2.225	1.275	0.359
730	1.305	0.591	2.255	1.292	0.363
740	1.308	0.595	2.285	1.309	0.368
750	1.312	0.598	2.315	1.326	0.372
760	1.315	0.602	2.345	1.343	0.376
770	1.319	0.605	2.375	1.360	0.380
780	1.322	0.609	2.406	1.377	0.385

<b>790</b>	1.325	0.612	2.436	1.394	0.389
<b>800</b>	1.329	0.616	2.466	1.411	0.393
<b>810</b>	1.332	0.619	2.496	1.428	0.397
<b>820</b>	1.336	0.622	2.526	1.445	0.402
<b>830</b>	1.339	0.626	2.556	1.462	0.406
<b>840</b>	1.343	0.629	2.587	1.479	0.410
<b>850</b>	1.346	0.633	2.617	1.496	0.414
<b>860</b>	1.350	0.636	2.647	1.513	0.419
<b>870</b>	1.353	0.640	2.677	1.530	0.423
<b>880</b>	1.356	0.643	2.707	1.547	0.427
<b>890</b>	1.360	0.647	2.737	1.564	0.431
<b>900</b>	1.363	0.650	2.767	1.581	0.436
<b>910</b>	1.367	0.653	2.798	1.598	0.440
<b>920</b>	1.370	0.657	2.828	1.615	0.444
<b>930</b>	1.374	0.660	2.858	1.632	0.448
<b>940</b>	1.377	0.664	2.888	1.649	0.453
<b>950</b>	1.381	0.667	2.918	1.665	0.457
<b>960</b>	1.384	0.671	2.948	1.682	0.461
<b>970</b>	1.388	0.674	2.979	1.699	0.465
<b>980</b>	1.391	0.678	3.009	1.716	0.470
<b>990</b>	1.394	0.681	3.039	1.733	0.474
<b>1000</b>	1.398	0.685	3.069	1.750	0.478

## 5. Projected Carbon Intensity of Steel Production in the UK

	TGR-BF + CCS				Hlsarna + CCS				H <sub>2</sub> -DRI + EAF (0% scrap)				H <sub>2</sub> -DRI + EAF (50% scrap)				EAF only (100% scrap)			
	CT	ST	LtW	SP	CT	ST	LtW	SP	CT	ST	LtW	SP	CT	ST	LtW	SP	CT	ST	LtW	SP
2021	1.090	1.090	1.087	1.092	0.377	0.377	0.374	0.378	0.376	0.377	0.354	0.390	0.235	0.235	0.222	0.243	0.098	0.099	0.095	0.101
2022	1.083	1.082	1.080	1.083	0.370	0.368	0.366	0.370	0.316	0.304	0.286	0.320	0.201	0.194	0.184	0.203	0.090	0.088	0.086	0.091
2023	1.083	1.082	1.077	1.084	0.370	0.369	0.363	0.370	0.319	0.308	0.261	0.322	0.203	0.196	0.170	0.204	0.091	0.089	0.082	0.091
2024	1.080	1.078	1.071	1.083	0.366	0.365	0.358	0.370	0.288	0.273	0.213	0.319	0.185	0.177	0.143	0.203	0.086	0.084	0.076	0.090
2025	1.076	1.075	1.071	1.083	0.363	0.362	0.357	0.369	0.254	0.246	0.207	0.311	0.166	0.162	0.140	0.198	0.081	0.080	0.075	0.089
2026	1.072	1.073	1.067	1.084	0.358	0.360	0.353	0.371	0.217	0.232	0.171	0.327	0.145	0.154	0.119	0.207	0.076	0.078	0.070	0.092
2027	1.071	1.071	1.062	1.087	0.358	0.357	0.349	0.374	0.213	0.207	0.134	0.351	0.143	0.140	0.099	0.221	0.076	0.075	0.064	0.095
2028	1.065	1.069	1.059	1.077	0.352	0.356	0.346	0.364	0.158	0.195	0.105	0.263	0.112	0.133	0.082	0.171	0.068	0.073	0.060	0.083
2029	1.064	1.064	1.057	1.071	0.351	0.351	0.344	0.357	0.151	0.152	0.087	0.208	0.108	0.109	0.072	0.140	0.067	0.067	0.058	0.075
2030	1.060	1.060	1.055	1.067	0.346	0.347	0.342	0.354	0.113	0.118	0.070	0.179	0.087	0.090	0.062	0.124	0.061	0.062	0.055	0.071
2031	1.055	1.060	1.054	1.069	0.342	0.347	0.340	0.355	0.070	0.118	0.060	0.189	0.063	0.089	0.057	0.129	0.055	0.062	0.054	0.072
2032	1.052	1.060	1.053	1.069	0.339	0.347	0.339	0.355	0.045	0.113	0.051	0.190	0.049	0.087	0.052	0.130	0.052	0.062	0.053	0.072
2033	1.048	1.054	1.047	1.069	0.334	0.341	0.333	0.356	0.006	0.065	-0.002	0.192	0.026	0.060	0.022	0.131	0.046	0.055	0.045	0.073
2034	1.046	1.049	1.047	1.069	0.333	0.336	0.333	0.355	-0.008	0.021	-0.001	0.189	0.019	0.035	0.022	0.130	0.044	0.049	0.045	0.072
2035	1.043	1.048	1.047	1.067	0.330	0.334	0.333	0.353	-0.032	0.006	-0.002	0.174	0.005	0.027	0.022	0.121	0.041	0.046	0.045	0.070
2036	1.043	1.045	1.046	1.066	0.329	0.332	0.333	0.352	-0.038	-0.014	-0.005	0.164	0.002	0.015	0.020	0.116	0.040	0.044	0.045	0.069
2037	1.041	1.041	1.047	1.065	0.328	0.328	0.333	0.351	-0.051	-0.052	-0.002	0.155	-0.006	-0.006	0.022	0.110	0.038	0.038	0.045	0.067
2038	1.040	1.040	1.040	1.065	0.326	0.326	0.327	0.351	-0.064	-0.064	-0.062	0.154	-0.013	-0.013	-0.011	0.110	0.036	0.036	0.037	0.067
2039	1.038	1.037	1.038	1.064	0.324	0.324	0.325	0.351	-0.081	-0.083	-0.077	0.150	-0.022	-0.024	-0.020	0.108	0.034	0.034	0.035	0.067
2040	1.038	1.038	1.038	1.063	0.325	0.325	0.325	0.349	-0.077	-0.075	-0.074	0.138	-0.020	-0.019	-0.018	0.101	0.035	0.035	0.035	0.065
2041	1.036	1.039	1.039	1.063	0.323	0.326	0.325	0.350	-0.094	-0.066	-0.073	0.139	-0.030	-0.014	-0.018	0.102	0.032	0.036	0.035	0.065
2042	1.037	1.039	1.039	1.063	0.323	0.326	0.325	0.350	-0.089	-0.068	-0.073	0.142	-0.027	-0.015	-0.018	0.103	0.033	0.036	0.035	0.066
2043	1.036	1.036	1.038	1.062	0.323	0.323	0.325	0.348	-0.095	-0.093	-0.074	0.129	-0.030	-0.029	-0.018	0.096	0.032	0.032	0.035	0.064
2044	1.036	1.036	1.039	1.061	0.322	0.323	0.325	0.348	-0.099	-0.093	-0.074	0.125	-0.033	-0.029	-0.018	0.094	0.032	0.032	0.035	0.063
2045	1.036	1.037	1.038	1.060	0.323	0.323	0.325	0.347	-0.096	-0.089	-0.077	0.115	-0.031	-0.027	-0.020	0.088	0.032	0.033	0.035	0.062
2046	1.033	1.036	1.038	1.060	0.320	0.322	0.325	0.347	-0.120	-0.100	-0.075	0.114	-0.044	-0.033	-0.019	0.087	0.029	0.031	0.035	0.062
2047	1.034	1.034	1.038	1.060	0.321	0.321	0.325	0.347	-0.112	-0.113	-0.075	0.113	-0.040	-0.040	-0.019	0.087	0.030	0.030	0.035	0.061

<b>2048</b>	1.034	1.034	1.039	1.060	0.321	0.321	0.325	0.346	-0.112	-0.113	-0.073	0.111	-0.040	-0.040	-0.018	0.086	0.030	0.030	0.035	0.061
<b>2049</b>	1.035	1.035	1.038	1.059	0.321	0.321	0.325	0.345	-0.108	-0.106	-0.076	0.103	-0.038	-0.036	-0.020	0.081	0.030	0.031	0.035	0.060
<b>2050</b>	1.034	1.034	1.038	1.058	0.321	0.321	0.325	0.345	-0.110	-0.112	-0.077	0.096	-0.039	-0.040	-0.020	0.077	0.030	0.030	0.035	0.059

**Key to National Grid ESO Future Energy Scenarios [3]:**

CT: Consumer Transformation.

ST: System Transformation.

LtW: Leading the Way.

SP: Steady Progression.

## 6. Levelised Cost of Steel Production Against Electricity Price

Electricity Price £/MWh	TGR-BF + CCS £/tCS	Hlsarna + CCS £/tCS	H <sub>2</sub> -DRI + EAF (0% scrap) £/tCS	H <sub>2</sub> -DRI + EAF (50% scrap) £/tCS	EAF Only (100% scrap) £/tCS
0	442.48	360.08	233.72	241.74	248.66
1	442.82	360.43	236.73	243.44	249.08
2	443.17	360.77	239.75	245.14	249.51
3	443.51	361.12	242.77	246.83	249.93
4	443.86	361.46	245.78	248.53	250.36
5	444.20	361.81	248.80	250.23	250.78
6	444.55	362.15	251.81	251.93	251.21
7	444.89	362.50	254.83	253.62	251.63
8	445.24	362.84	257.85	255.32	252.06
9	445.58	363.19	260.86	257.02	252.48
10	445.93	363.53	263.88	258.71	252.91
11	446.27	363.88	266.89	260.41	253.33
12	446.62	364.22	269.91	262.11	253.76
13	446.96	364.57	272.93	263.80	254.18
14	447.31	364.91	275.94	265.50	254.61
15	447.65	365.26	278.96	267.20	255.03
16	448.00	365.60	281.97	268.90	255.46
17	448.34	365.95	284.99	270.59	255.88
18	448.69	366.29	288.01	272.29	256.31
19	449.03	366.64	291.02	273.99	256.73
20	449.38	366.98	294.04	275.68	257.16
21	449.72	367.33	297.05	277.38	257.58
22	450.07	367.67	300.07	279.08	258.01
23	450.41	368.02	303.09	280.77	258.43
24	450.76	368.36	306.10	282.47	258.86
25	451.10	368.71	309.12	284.17	259.28
26	451.45	369.05	312.13	285.87	259.71
27	451.79	369.40	315.15	287.56	260.13
28	452.14	369.74	318.17	289.26	260.56
29	452.48	370.09	321.18	290.96	260.98
30	452.83	370.43	324.20	292.65	261.41
31	453.17	370.78	327.21	294.35	261.83
32	453.52	371.12	330.23	296.05	262.26
33	453.86	371.47	333.25	297.74	262.68
34	454.21	371.81	336.26	299.44	263.11
35	454.55	372.16	339.28	301.14	263.53
36	454.90	372.50	342.29	302.84	263.96
37	455.24	372.85	345.31	304.53	264.38
38	455.59	373.19	348.33	306.23	264.81
39	455.93	373.54	351.34	307.93	265.23
40	456.28	373.88	354.36	309.62	265.66
41	456.62	374.23	357.37	311.32	266.08
42	456.97	374.57	360.39	313.02	266.51
43	457.31	374.92	363.41	314.71	266.93

44	457.66	375.26	366.42	316.41	267.36
45	458.00	375.61	369.44	318.11	267.78
46	458.35	375.95	372.45	319.81	268.21
47	458.69	376.30	375.47	321.50	268.63
48	459.04	376.64	378.49	323.20	269.06
49	459.38	376.99	381.50	324.90	269.48
50	459.73	377.33	384.52	326.59	269.91
51	460.07	377.68	387.53	328.29	270.33
52	460.42	378.02	390.55	329.99	270.76
53	460.76	378.37	393.57	331.68	271.18
54	461.11	378.71	396.58	333.38	271.61
55	461.45	379.06	399.60	335.08	272.03
56	461.80	379.40	402.61	336.78	272.46
57	462.14	379.75	405.63	338.47	272.88
58	462.49	380.09	408.65	340.17	273.31
59	462.83	380.44	411.66	341.87	273.73
60	463.18	380.78	414.68	343.56	274.16
61	463.52	381.13	417.69	345.26	274.58
62	463.87	381.47	420.71	346.96	275.01
63	464.21	381.82	423.73	348.65	275.43
64	464.56	382.16	426.74	350.35	275.86
65	464.90	382.51	429.76	352.05	276.28
66	465.25	382.85	432.77	353.75	276.71
67	465.59	383.20	435.79	355.44	277.13
68	465.94	383.54	438.81	357.14	277.56
69	466.28	383.89	441.82	358.84	277.98
70	466.63	384.23	444.84	360.53	278.41
71	466.97	384.58	447.85	362.23	278.83
72	467.32	384.92	450.87	363.93	279.26
73	467.66	385.27	453.89	365.62	279.68
74	468.01	385.61	456.90	367.32	280.11
75	468.35	385.96	459.92	369.02	280.53
76	468.70	386.30	462.93	370.72	280.96
77	469.04	386.65	465.95	372.41	281.38
78	469.39	386.99	468.97	374.11	281.81
79	469.73	387.34	471.98	375.81	282.23
80	470.08	387.68	475.00	377.50	282.66
81	470.42	388.03	478.01	379.20	283.08
82	470.77	388.37	481.03	380.90	283.51
83	471.11	388.72	484.05	382.59	283.93
84	471.46	389.06	487.06	384.29	284.36
85	471.80	389.41	490.08	385.99	284.78
86	472.15	389.75	493.09	387.69	285.21
87	472.49	390.10	496.11	389.38	285.63
88	472.84	390.44	499.13	391.08	286.06
89	473.18	390.79	502.14	392.78	286.48
90	473.53	391.13	505.16	394.47	286.91
91	473.87	391.48	508.17	396.17	287.33
92	474.22	391.82	511.19	397.87	287.76
93	474.56	392.17	514.21	399.56	288.18

<b>94</b>	474.91	392.51	517.22	401.26	288.61
<b>95</b>	475.25	392.86	520.24	402.96	289.03
<b>96</b>	475.60	393.20	523.25	404.66	289.46
<b>97</b>	475.94	393.55	526.27	406.35	289.88
<b>98</b>	476.29	393.89	529.29	408.05	290.31
<b>99</b>	476.63	394.24	532.30	409.75	290.73
<b>100</b>	476.98	394.58	535.32	411.44	291.16



## 7. Levelised Cost of Steel Production Against Effective Carbon Price

### 7.1. Electricity Price of £25/MWh

Effective Carbon Price	TGR-BF + CCS	Hlsarna + CCS	H <sub>2</sub> -DRI + EAF (0% scrap)	H <sub>2</sub> -DRI + EAF (50% scrap)	EAF Only (100% scrap)
£/tCO <sub>2</sub>	£/tCS	£/tCS	£/tCS	£/tCS	£/tCS
0	379.31	380.26	326.73	295.31	264.19
5	384.58	381.96	326.99	295.57	264.45
10	389.84	383.66	327.26	295.84	264.72
15	395.11	385.36	327.52	296.10	264.98
20	400.37	387.06	327.79	296.37	265.25
25	405.64	388.76	328.05	296.63	265.51
30	410.90	390.46	328.32	296.90	265.78
35	416.17	392.16	328.58	297.16	266.04
40	421.43	393.86	328.85	297.43	266.31
45	426.70	395.56	329.11	297.69	266.57
50	431.96	397.26	329.38	297.96	266.84
55	437.23	398.96	329.64	298.22	267.10
60	442.49	400.66	329.91	298.49	267.37
65	447.76	402.36	330.17	298.75	267.63
70	453.02	404.06	330.44	299.02	267.90
75	458.29	405.76	330.70	299.28	268.16
80	463.55	407.46	330.97	299.55	268.43
85	468.82	409.16	331.23	299.81	268.69
90	474.08	410.86	331.50	300.08	268.96
95	479.35	412.56	331.76	300.34	269.22
100	484.61	414.26	332.03	300.61	269.49
105	489.88	415.96	332.29	300.87	269.75
110	495.14	417.66	332.56	301.14	270.02
115	500.41	419.36	332.82	301.40	270.28
120	505.67	421.06	333.09	301.67	270.55
125	510.94	422.76	333.35	301.93	270.81
130	516.20	424.46	333.62	302.20	271.08
135	521.47	426.16	333.88	302.46	271.34
140	526.73	427.86	334.15	302.73	271.61
145	532.00	429.56	334.41	302.99	271.87
150	537.26	431.26	334.68	303.26	272.14
155	542.53	432.96	334.94	303.52	272.40
160	547.79	434.66	335.21	303.79	272.67
165	553.06	436.36	335.47	304.05	272.93
170	558.32	438.06	335.74	304.32	273.20
175	563.59	439.76	336.00	304.58	273.46
180	568.85	441.46	336.27	304.85	273.73
185	574.12	443.16	336.53	305.11	273.99
190	579.38	444.86	336.80	305.38	274.26
195	584.65	446.56	337.06	305.64	274.52
200	589.91	448.26	337.33	305.91	274.79

205	595.18	449.96	337.59	306.17	275.05
210	600.44	451.66	337.86	306.44	275.32
215	605.71	453.36	338.12	306.70	275.58
220	610.97	455.06	338.39	306.97	275.85
225	616.24	456.76	338.65	307.23	276.11
230	621.50	458.46	338.92	307.50	276.38
235	626.77	460.16	339.18	307.76	276.64
240	632.03	461.86	339.45	308.03	276.91
245	637.30	463.56	339.71	308.29	277.17
250	642.56	465.26	339.98	308.56	277.44
255	647.83	466.96	340.24	308.82	277.70
260	653.09	468.66	340.51	309.09	277.97
265	658.36	470.36	340.77	309.35	278.23
270	663.62	472.06	341.04	309.62	278.50
275	668.89	473.76	341.30	309.88	278.76
280	674.15	475.46	341.57	310.15	279.03
285	679.42	477.16	341.83	310.41	279.29
290	684.68	478.86	342.10	310.68	279.56
295	689.95	480.56	342.36	310.94	279.82
300	695.21	482.26	342.63	311.21	280.09
305	700.48	483.96	342.89	311.47	280.35
310	705.74	485.66	343.16	311.74	280.62
315	711.01	487.36	343.42	312.00	280.88
320	716.27	489.06	343.69	312.27	281.15
325	721.54	490.76	343.95	312.53	281.41
330	726.80	492.46	344.22	312.80	281.68
335	732.07	494.16	344.48	313.06	281.94
340	737.33	495.86	344.75	313.33	282.21
345	742.60	497.56	345.01	313.59	282.47
350	747.86	499.26	345.28	313.86	282.74
355	753.13	500.96	345.54	314.12	283.00
360	758.39	502.66	345.81	314.39	283.27
365	763.66	504.36	346.07	314.65	283.53
370	768.92	506.06	346.34	314.92	283.80
375	774.19	507.76	346.60	315.18	284.06
380	779.45	509.46	346.87	315.45	284.33
385	784.72	511.16	347.13	315.71	284.59
390	789.98	512.86	347.40	315.98	284.86
395	795.25	514.56	347.66	316.24	285.12
400	800.51	516.26	347.93	316.51	285.39

## 7.2. Electricity Price of £50/MWh

Effective Carbon Price	TGR-BF + CCS	Hlsarna + CCS	H <sub>2</sub> -DRI + EAF (0% scrap)	H <sub>2</sub> -DRI + EAF (50% scrap)	EAF Only (100% scrap)
£/tCO <sub>2</sub>	£/tCS	£/tCS	£/tCS	£/tCS	£/tCS
0	387.94	388.88	402.13	337.73	274.81
5	393.20	390.58	402.39	338.00	275.08
10	398.47	392.28	402.66	338.26	275.34

15	403.73	393.98	402.92	338.53	275.61
20	409.00	395.68	403.19	338.79	275.87
25	414.26	397.38	403.45	339.06	276.14
30	419.53	399.08	403.72	339.32	276.40
35	424.79	400.78	403.98	339.59	276.67
40	430.06	402.48	404.25	339.85	276.93
45	435.32	404.18	404.51	340.12	277.20
50	440.59	405.88	404.78	340.38	277.46
55	445.85	407.58	405.04	340.65	277.73
60	451.12	409.28	405.31	340.91	277.99
65	456.38	410.98	405.57	341.18	278.26
70	461.65	412.68	405.84	341.44	278.52
75	466.91	414.38	406.10	341.71	278.79
80	472.18	416.08	406.37	341.97	279.05
85	477.44	417.78	406.63	342.24	279.32
90	482.71	419.48	406.90	342.50	279.58
95	487.97	421.18	407.16	342.77	279.85
100	493.24	422.88	407.43	343.03	280.11
105	498.50	424.58	407.69	343.30	280.38
110	503.77	426.28	407.96	343.56	280.64
115	509.03	427.98	408.22	343.83	280.91
120	514.30	429.68	408.49	344.09	281.17
125	519.56	431.38	408.75	344.36	281.44
130	524.83	433.08	409.02	344.62	281.70
135	530.09	434.78	409.28	344.89	281.97
140	535.36	436.48	409.55	345.15	282.23
145	540.62	438.18	409.81	345.42	282.50
150	545.89	439.88	410.08	345.68	282.76
155	551.15	441.58	410.34	345.95	283.03
160	556.42	443.28	410.61	346.21	283.29
165	561.68	444.98	410.87	346.48	283.56
170	566.95	446.68	411.14	346.74	283.82
175	572.21	448.38	411.40	347.01	284.09
180	577.48	450.08	411.67	347.27	284.35
185	582.74	451.78	411.93	347.54	284.62
190	588.01	453.48	412.20	347.80	284.88
195	593.27	455.18	412.46	348.07	285.15
200	598.54	456.88	412.73	348.33	285.41
205	603.80	458.58	412.99	348.60	285.68
210	609.07	460.28	413.26	348.86	285.94
215	614.33	461.98	413.52	349.13	286.21
220	619.60	463.68	413.79	349.39	286.47
225	624.86	465.38	414.05	349.66	286.74
230	630.13	467.08	414.32	349.92	287.00
235	635.39	468.78	414.58	350.19	287.27
240	640.66	470.48	414.85	350.45	287.53
245	645.92	472.18	415.11	350.72	287.80
250	651.19	473.88	415.38	350.98	288.06
255	656.45	475.58	415.64	351.25	288.33
260	661.72	477.28	415.91	351.51	288.59

265	666.98	478.98	416.17	351.78	288.86
270	672.25	480.68	416.44	352.04	289.12
275	677.51	482.38	416.70	352.31	289.39
280	682.78	484.08	416.97	352.57	289.65
285	688.04	485.78	417.23	352.84	289.92
290	693.31	487.48	417.50	353.10	290.18
295	698.57	489.18	417.76	353.37	290.45
300	703.84	490.88	418.03	353.63	290.71
305	709.10	492.58	418.29	353.90	290.98
310	714.37	494.28	418.56	354.16	291.24
315	719.63	495.98	418.82	354.43	291.51
320	724.90	497.68	419.09	354.69	291.77
325	730.16	499.38	419.35	354.96	292.04
330	735.43	501.08	419.62	355.22	292.30
335	740.69	502.78	419.88	355.49	292.57
340	745.96	504.48	420.15	355.75	292.83
345	751.22	506.18	420.41	356.02	293.10
350	756.49	507.88	420.68	356.28	293.36
355	761.75	509.58	420.94	356.55	293.63
360	767.02	511.28	421.21	356.81	293.89
365	772.28	512.98	421.47	357.08	294.16
370	777.55	514.68	421.74	357.34	294.42
375	782.81	516.38	422.00	357.61	294.69
380	788.08	518.08	422.27	357.87	294.95
385	793.34	519.78	422.53	358.14	295.22
390	798.61	521.48	422.80	358.40	295.48
395	803.87	523.18	423.06	358.67	295.75
400	809.14	524.88	423.33	358.93	296.01

### 7.3. Electricity Price of £100/MWh

Effective Carbon Price	TGR-BF + CCS	Hlsarna + CCS	H <sub>2</sub> -DRI + EAF (0% scrap)	H <sub>2</sub> -DRI + EAF (50% scrap)	EAF Only (100% scrap)
£/tCO <sub>2</sub>	£/tCS	£/tCS	£/tCS	£/tCS	£/tCS
0	405.19	406.13	552.93	422.58	296.06
5	410.45	407.83	553.19	422.85	296.33
10	415.72	409.53	553.46	423.11	296.59
15	420.98	411.23	553.72	423.38	296.86
20	426.25	412.93	553.99	423.64	297.12
25	431.51	414.63	554.25	423.91	297.39
30	436.78	416.33	554.52	424.17	297.65
35	442.04	418.03	554.78	424.44	297.92
40	447.31	419.73	555.05	424.70	298.18
45	452.57	421.43	555.31	424.97	298.45
50	457.84	423.13	555.58	425.23	298.71
55	463.10	424.83	555.84	425.50	298.98
60	468.37	426.53	556.11	425.76	299.24
65	473.63	428.23	556.37	426.03	299.51
70	478.90	429.93	556.64	426.29	299.77

75	484.16	431.63	556.90	426.56	300.04
80	489.43	433.33	557.17	426.82	300.30
85	494.69	435.03	557.43	427.09	300.57
90	499.96	436.73	557.70	427.35	300.83
95	505.22	438.43	557.96	427.62	301.10
100	510.49	440.13	558.23	427.88	301.36
105	515.75	441.83	558.49	428.15	301.63
110	521.02	443.53	558.76	428.41	301.89
115	526.28	445.23	559.02	428.68	302.16
120	531.55	446.93	559.29	428.94	302.42
125	536.81	448.63	559.55	429.21	302.69
130	542.08	450.33	559.82	429.47	302.95
135	547.34	452.03	560.08	429.74	303.22
140	552.61	453.73	560.35	430.00	303.48
145	557.87	455.43	560.61	430.27	303.75
150	563.14	457.13	560.88	430.53	304.01
155	568.40	458.83	561.14	430.80	304.28
160	573.67	460.53	561.41	431.06	304.54
165	578.93	462.23	561.67	431.33	304.81
170	584.20	463.93	561.94	431.59	305.07
175	589.46	465.63	562.20	431.86	305.34
180	594.73	467.33	562.47	432.12	305.60
185	599.99	469.03	562.73	432.39	305.87
190	605.26	470.73	563.00	432.65	306.13
195	610.52	472.43	563.26	432.92	306.40
200	615.79	474.13	563.53	433.18	306.66
205	621.05	475.83	563.79	433.45	306.93
210	626.32	477.53	564.06	433.71	307.19
215	631.58	479.23	564.32	433.98	307.46
220	636.85	480.93	564.59	434.24	307.72
225	642.11	482.63	564.85	434.51	307.99
230	647.38	484.33	565.12	434.77	308.25
235	652.64	486.03	565.38	435.04	308.52
240	657.91	487.73	565.65	435.30	308.78
245	663.17	489.43	565.91	435.57	309.05
250	668.44	491.13	566.18	435.83	309.31
255	673.70	492.83	566.44	436.10	309.58
260	678.97	494.53	566.71	436.36	309.84
265	684.23	496.23	566.97	436.63	310.11
270	689.50	497.93	567.24	436.89	310.37
275	694.76	499.63	567.50	437.16	310.64
280	700.03	501.33	567.77	437.42	310.90
285	705.29	503.03	568.03	437.69	311.17
290	710.56	504.73	568.30	437.95	311.43
295	715.82	506.43	568.56	438.22	311.70
300	721.09	508.13	568.83	438.48	311.96
305	726.35	509.83	569.09	438.75	312.23
310	731.62	511.53	569.36	439.01	312.49
315	736.88	513.23	569.62	439.28	312.76
320	742.15	514.93	569.89	439.54	313.02

325	747.41	516.63	570.15	439.81	313.29
330	752.68	518.33	570.42	440.07	313.55
335	757.94	520.03	570.68	440.34	313.82
340	763.21	521.73	570.95	440.60	314.08
345	768.47	523.43	571.21	440.87	314.35
350	773.74	525.13	571.48	441.13	314.61
355	779.00	526.83	571.74	441.40	314.88
360	784.27	528.53	572.01	441.66	315.14
365	789.53	530.23	572.27	441.93	315.41
370	794.80	531.93	572.54	442.19	315.67
375	800.06	533.63	572.80	442.46	315.94
380	805.33	535.33	573.07	442.72	316.20
385	810.59	537.03	573.33	442.99	316.47
390	815.86	538.73	573.60	443.25	316.73
395	821.12	540.43	573.86	443.52	317.00
400	826.39	542.13	574.13	443.78	317.26

## References

- [1] Department for Business, Energy & Industrial Strategy. BEIS 2019 Fossil Fuel Price Assumptions. 2020.
- [2] HM Treasury. Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. 2021.
- [3] National Grid ESO. Future Energy Scenarios 2021. 2021.