



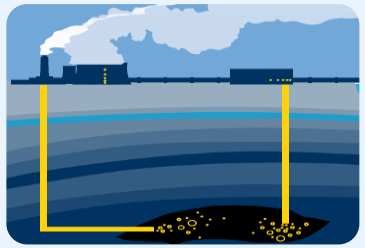



Humber Cluster – update to the 2020 Baseline Local Emissions Assessment

FINAL

HEY Hull and East Yorkshire Local Enterprise Partnership

CATCH

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elementenergy
an ERM Group company

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Introduction

Context

- In 2020, Element Energy led the Phase 1 Baseline Local Emissions Assessment (BLEA), in support of the Humber Industrial Decarbonisation Roadmap (HIDR) by Humber LEP and CATCH. This study is also referred to below as "the 2020 BLEA study".[1]
- Following this and other studies supporting the five work packages within the HIDR phase 1 project, the Humber Cluster Plan has as successfully been awarded funding for its Phase 2 project to deliver its Roadmap and Cluster Plan as part of ISCF's cluster plans competition.
- The 2020 BLEA study focused on the collection of data relevant to the Humber industrial cluster and of three 'business-as-usual' or 'do nothing' scenarios that assess how emissions from the cluster may evolve until 2040 if no deep decarbonisation measure is implemented. Over the coming years, the project will build on the preliminary Phase 1 roadmap work, bringing together industry and public sector bodies in each region in a comprehensive effort to devise a route to net zero emissions.
- This report is an appendix to the 2020 BLEA study and provides an update to the key quantitative analysis previously carried out, now based on 2018 (instead of 2017) data.

Scope of the update

- The updates presented in this report focus on the breakdown of local CO_2 emissions by sector and fuel type, and on business-as-usual scenarios to 2040.
- The focus of the analysis remains on scope 1 emissions from sites within the four local authorities that collectively constitute the Humber.[2] Emissions from the Drax power plant are however also included where relevant since Drax is expected to be an important partner for some of the decarbonisation projects under development.[3]
- The analysis only covers CO_2 emissions relating to fossil fuels.
- Emissions from biomass combustion are treated as carbon neutral in accordance with carbon accounting standards. It is however noted that all sources of CO_2 emissions may be considered as relevant for the sizing and evaluation of decarbonisation projects.
- Detailed information on the methodological approach can be found in the final report from the 2020 BLEA study and is not repeated here.[1]

[1] See final report from the 2020 BLEA study at https://www.humberlep.org/baseline-local-emissions-assessment-compressed/. [2] The four local authorities in the Humber are City of Hull, East Riding of Yorkshire, North Lincolnshire, North East Lincolnshire, referred to as the "Core Humber Cluster" in the previous study. [3] See Zero Carbon Humber and East Coast Cluster for more detail on decarbonisation projects involving Drax

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The Humber industries and power generators emitted 20 $MtCO_2$/yr in 2018

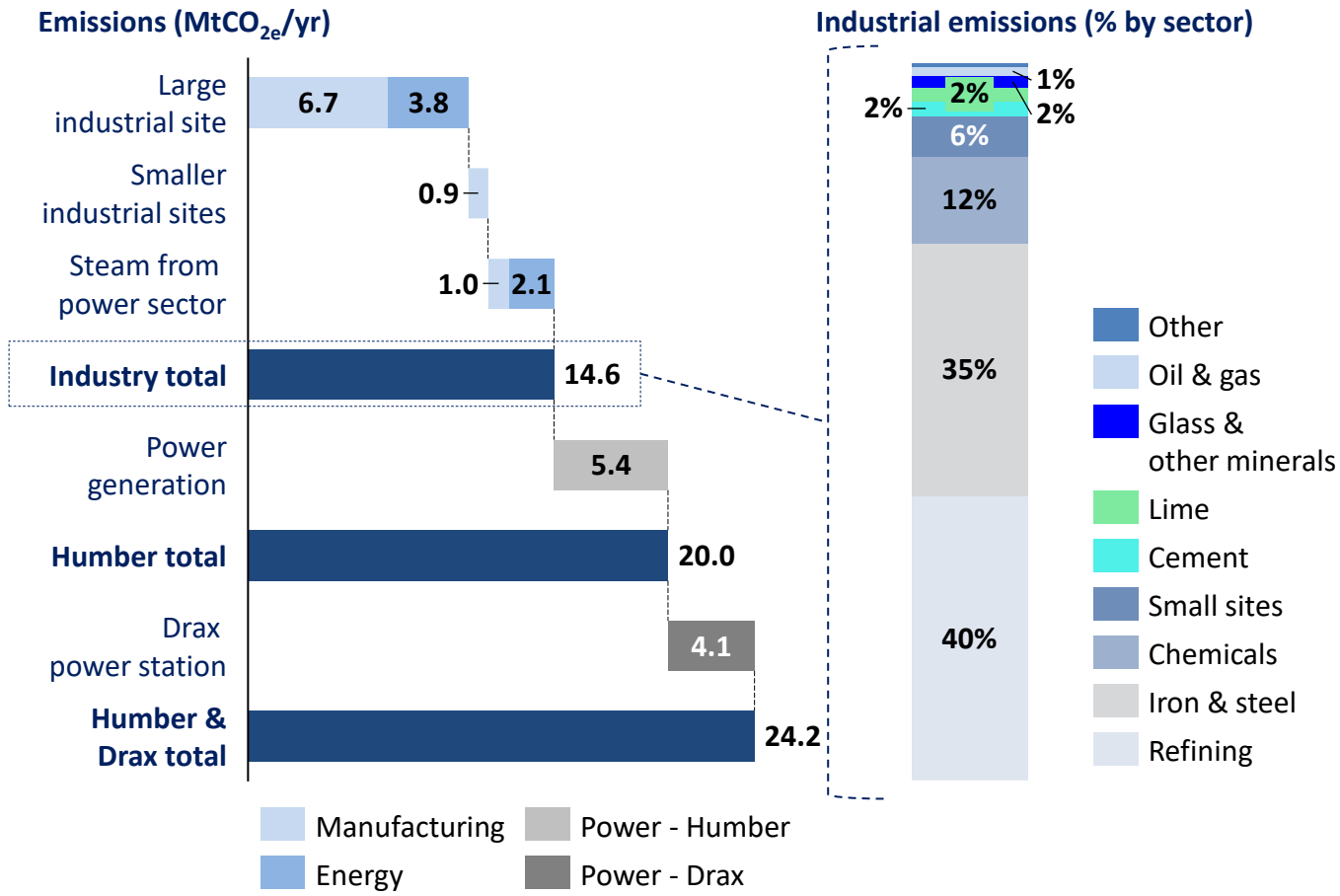
Updated baseline industrial emissions are 14.6 $MtCO_{2e}$/yr, 1.5% lower than reported in the 2020 BLEA study

- The analysis is based on BEIS's dataset on emssions from NAEI large point source, last updated with 2018 data. The 2020 WP1 analysis was instead based on the 2017 data.
- The inclusion of emissions from 6 additional industrial sites in BEIS's dataset is offset by reduced emissions at some of the larger sites within the Humber.[1]
- Emissions from smaller industrial sites are 0.3 $MtCO_{2e}$/yr lower than reported in the 2020 BLEA study; this is due to changes in BEIS's methodology for statistics on emissions by local authority.[2]
- The sectoral breakdown in emissions is virtually unchanged compared to the previous analysis, with the refining and iron & steel sectors responsible for 3/4^{ths} of all industrial emissions.

Emissions from power generators grew by 9% to 5.4 $MtCO_{2e}$/yr

- The change is driven by increased emissions at several power stations including the Immingham CHP plant,[1] which also induced a small increased in estimated industrial emission associated with "steam from power sector".
- The Drax power station adds a further 4.1 $MtCO_{2e}$/yr of fossil CO_2, as well as 13 $MtCO_2$/yr of biogenic CO_2, counted as zero in official reporting as the use of sustainable biomass is considered to be CO_2 neutral at the point of combustion.[3]

Figure 1 – Fossil CO_2 and process from industry and power generation



Biogenic emissions sources like biomass combustion are excluded from this and other charts.

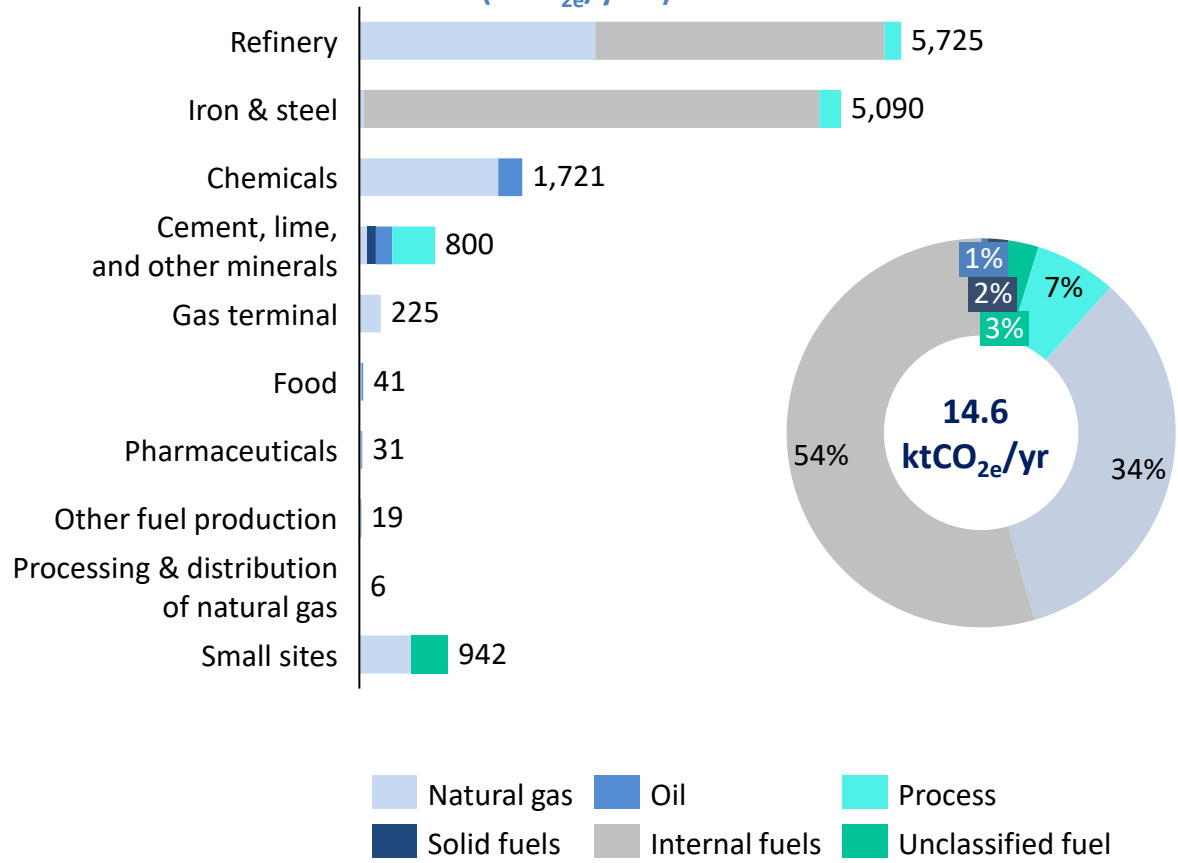
[1] See Appendix: Summary of changes in emissions from Humber sites. Note that these sites are not *per se* new, however they were not included in the previous BEIS publication. [2] See appendix for more detail. [3] See https://www.drax.com/sustainability/carbon-emissions/ accessed on 15/7/2021.

Fossil fuel combustion continues to represent circa 93% of fossil emissions from the Humber industries, with process emissions accounting for the remaining 7%[1]

Emissions from the combustion of fossil fuels are estimated to contribute 93% of all emissions from industries in the Humber

- The emission shares of different fuels are comparable to those estimated in the prior analysis. Minor changes in the relative share of solid fuels and oil are due to a slight review of the methodology, as indicated in appendix.
- The largest share of industrial emissions is associated with internal fuels including:
  - Internal fuels produced in the iron and steel industry (blast furnace gases, coke oven gases, basic oxygen steelmaking gases).
  - Internal fuels produced at the refineries (surplus gases).
  - It is essential to differentiate internal fuels from other purchased fossil fuels since emissions from internal fuels can only be abated with CCS or process change.[2]
- Natural gas is instead by far the most common purchased fossil fuel used across industries in the Humber, with only minor amounts of solid fuels and oil used.

Figure 2 – Industrial emissions by sector and fuel source ($ktCO_{2e}$/year)



[1] This breakdown excludes power generation, which mostly relies on natural gas, except for a small amount of internal fuel used in CHP units linked to the refineries. [2] Internal fuels are discussed in greater detail within the 2020 WP1 report.

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Three business-as-usual or 'do nothing' scenarios were evaluated which foresee emissions reductions of 4-17% by 2040

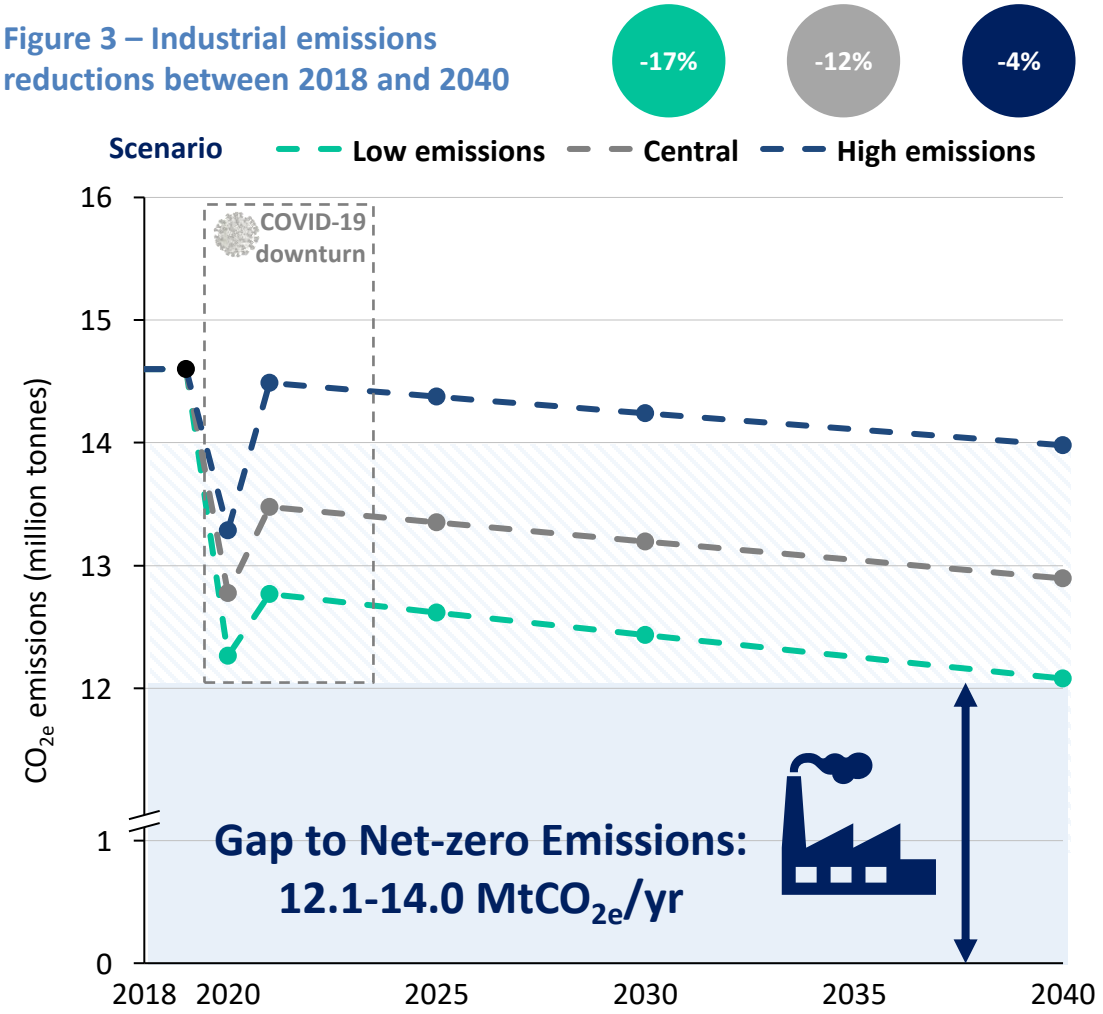
Residual emissions in 2040 are projected to amount to 12-14 $MtCO_{2e}$/yr without strong action on deep decarbonisation

- As indicated in the table below, the scenarios were developed based on the BEIS's sector growth projections and include a few announced site openings and closures.[1]
- While other sites may open or close within the timeline covered by the scenarios, no information on the potential level of emissions associated with these sites is available in the public domain.
- No detailed data is available on the short-term impact of COVID-19 on industrial emissions from the Humber industries. Hence, a range of assumptions was proposed that see 2021 emissions reduce by up to 10% vs 2018 levels.

Table 1 – Differences between the three BAU scenarios

BAU scenario	'High emissions'	'Central'	'Low emissions'
Equivalent BEIS scenario[2]	'High growth'	'Reference'	'Low growth'
Site openings[3]	Altalto by Velocys, Vivergo Fuels	Vivergo Fuels	Vivergo Fuels
Site closures[3]	Novartis, Cemex	Novartis, Cemex	Novartis, Cemex
Emission reductions due to COVID-19 (vs 2018)	0% in 2021	5% in 2021	10% in 2021

Figure 3 – Industrial emissions reductions between 2018 and 2040

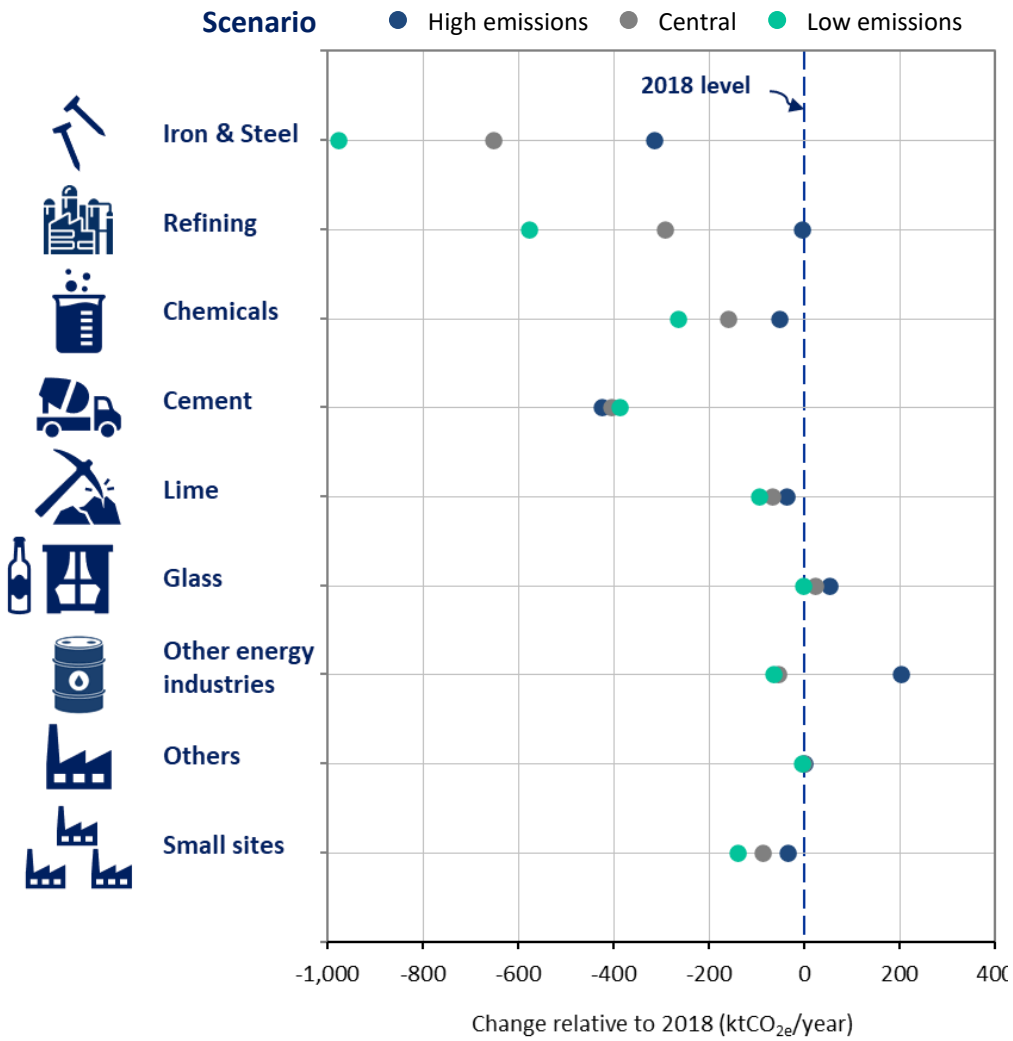


[1] The assumed openings and closures have also been updated from the 2020 WP1 report as outlined in the Appendix: Summary of changes in scenario assumptions. [2] BEIS, Updated Energy & Emissions Projections (Appendix C) 2018. [3] Site openings and closures are assumed to occur in 2021.

The iron & steel, refining and cement sector contribute over 80% of the emissions reductions projected to occur by 2040 under the business-as-usual scenarios

- **The largest emissions reductions originate in 3 sectors:**
  - **Iron & steel** (0.3-1.0 $MtCO_{2e}$/yr reduction), expected to have the lowest growth rate in BEIS' projections.
  - **Refining** (0-0.6 $MtCO_{2e}$/yr reduction), due to the decline in demand for fossil fuels also corresponding to the uptake of electric mobility.
  - **Cement** (reduction of around 0.4 $MtCO_{2e}$/yr), primarily due to the announced closure of the Cemex cement plant.
- Despite the overall reduction in emissions, **the emissions from other sectors could grow** due to:
  - General growth in market demand, as is for instance projected for the **glass** sector in the Central and High emissions scenarios.
  - **New site openings** making significant use of fossil fuels[1] like the Altalto plant by Velocys,[2] recently shortlisted for the Government's Green Fuels, Green Skies competition. The development of blue hydrogen production facilities would likewise be accompanied by increased emissions levels for the "other energy industries" sector.
- It could be noticed that there are significant differences in the absolute variation in emissions projections to 2040 for alternative scenarios between different sectors.
  - For instance, the projected emissions for the iron & steel sector are over 500 $ktCO_{2e}$ higher in the High emissions scenario compared to the Low scenario, whereas the equivalent gap for the glass sector is less than 50 $ktCO_{2e}$.
  - This is due to the much larger magnitude of baseline emissions from the iron & steel sector compared to glass sector, which is combined with different scenarios on the impact of COVID-19 and different CAGR projections for each scenario and sector, resulting in a greater absolute difference in emission projections for the larger emitting sectors.

Sectoral changes in emissions between 2018 and 2040



[1] It should be noted that certain new sites like the Pensana mineral plant may primarily rely on electrical power rather than fossil fuels, and hence do not featuring significant scope 1 emissions. [2] Classified under "Other energy industries" and only assumed to open in the High emissions scenario.

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Conclusions and recommendations (I of II)

- **This study set out to update the baseline for industrial emissions in the Humber.** The analysis highlighted that emissions from industrial sites only reduced by 0.2 $MtCO_{2e}$/yr between 2017 and 2018, reaching **14.6 $MtCO_{2e}$/yr**.
  - Overall emissions in 2018 were 20.0 $MtCO_{2e}$/yr when including power generators in the Humber and 24.2 $MtCO_{2e}$/yr when also including the fossil CO_2 emitted by the Drax power station.
  - The relatively minor change in overall emissions from year to year suggests that the analysis presented here may remain relevant on a regional level for at least a few years. When considering decarbonisation plans on a site-by-site level, it may however be necessary to update the analysis for the individual sites, since much larger variations in emissions can be encountered at this level.
- **An evaluation of how industrial emissions may change over time if no action is taken for decarbonisation** reveals that the Humber industries would potentially continue emitting between **12-14 $MtCO_{2e}$/yr in 2040**. This underlines the need for developing and executing a robust Humber Industrial Cluster Plan (HICP) that could consider a more granular assessment of emissions and the emerging decarbonisation projects in the region as well as any infrastructure and supply chain constraints.
  - It is also noted that while the analysis draws from official growth projections by BEIS, it does not account for potential expansion plans by individual sites or for future emissions sources not relating to announced plant openings (e.g., future blue hydrogen production facilities). In this case, overall emissions might even grow between now and 2040.
  - Potential future site closures may conversely reduce emissions significantly below the level estimated in this study, especially if affecting large emitters.
  - The analysis of fuel use was based on UK-wide statistics by BEIS and hence provides a useful starting point for the evaluation of the available pathways for decarbonisation. It is recommended that **site-specific data** is requested from individual emitters for use in the development of detailed decarbonisation pathways. Such information should cover at a minimum: appliance type and lifetime, fuel use, flue gas stream composition, and energy infrastructure capacity (e.g., electricity grid).

Conclusions and recommendations (II of II)

- While multiple decarbonisation technologies may be deployed in cluster, it is recognised that **CCS is likely to play a significant role** due to the high level of emissions from internal fuels and industrial processes. This will necessitate suitably sized CO_2 transport and storage infrastructure in the proximity.
- **Deep decarbonisation of the Humber relies on the reduction of emissions from a handful of very large emitters**, especially those in the iron & steel and refining sectors. Decarbonisation efforts should be prioritised accordingly to achieve substantial and rapid emissions reductions.
- **The analysis should be considered in the context of decarbonisation plans from other emitters in the wider region**.
  - This may unlock opportunities for the more efficient deployment of enabling infrastructure and accelerate the decarbonisation of the UK as a whole.
  - This analysis identified the Drax power station as being a significant emitter of biogenic CO_2. Further analysis could consider the potential of capturing and storing these biogenic emissions to deliver negative emissions to support the achievement of a UK-wide net zero target.
  - The development of ports able to accept CO_2 shipping imports may further expand the Humber cluster potential to support wider decarbonisation efforts.

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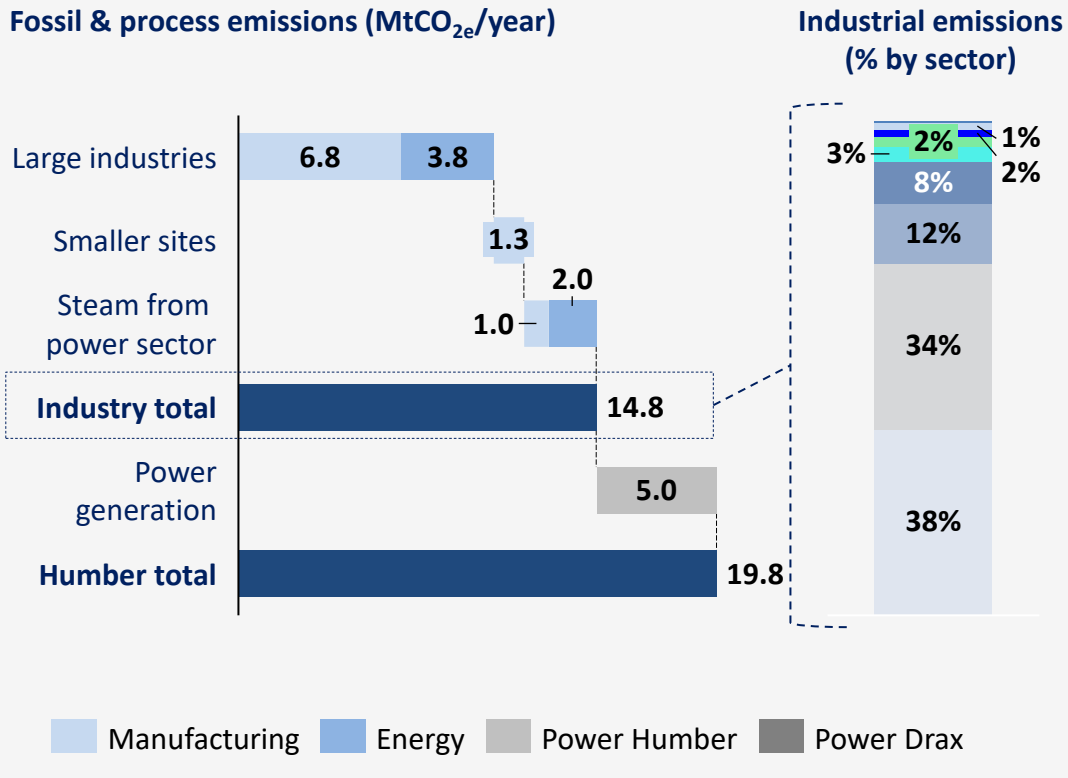
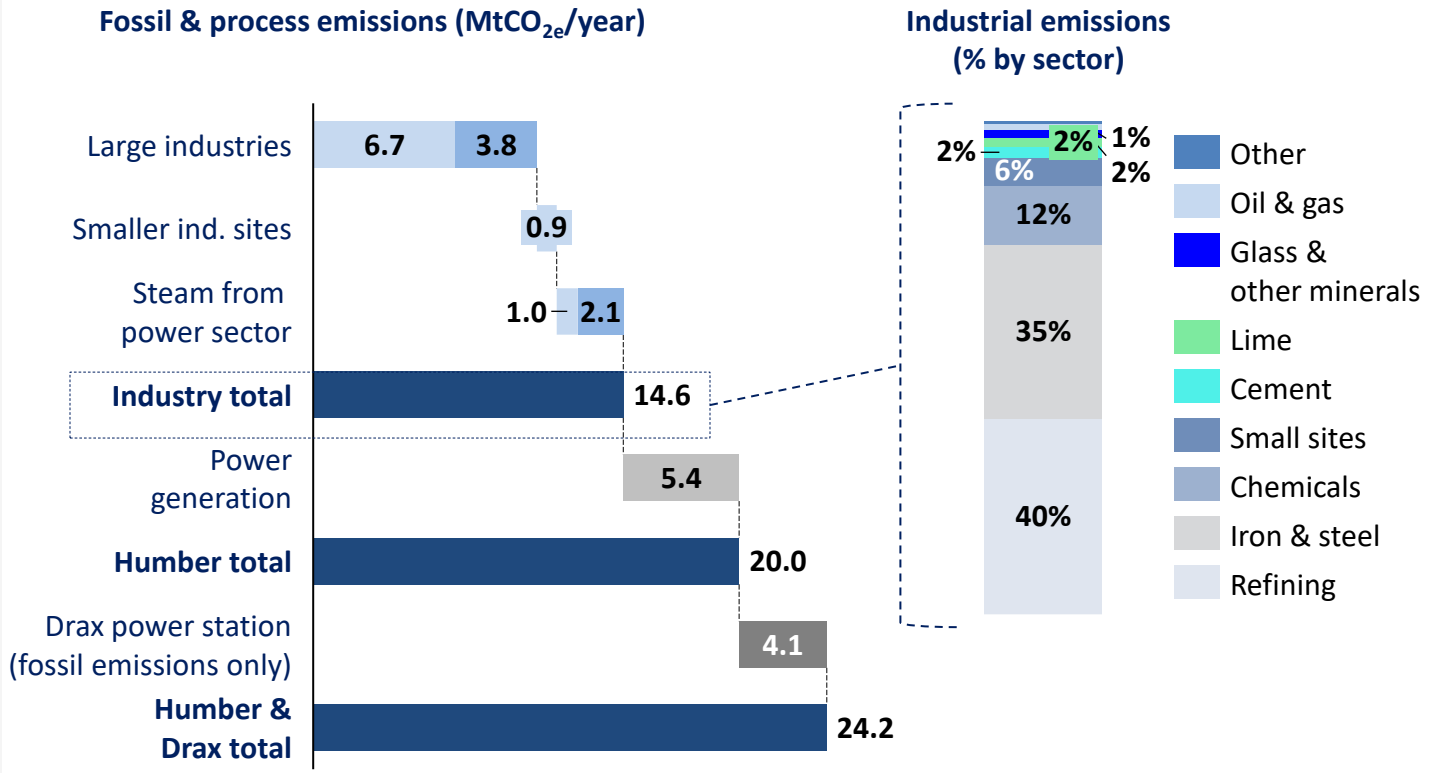
Emissions from the Humber industries and power generators increased by 1% to 20 $MtCO_2$/yr

Previous study





Summary of changes to inputs[1]

- BEIS methodology for statistics on emissions by local authority means now only industrial sites (not commercial) are included. "Smaller sites" emissions hence reduce by just over 0.3 $MtCO_{2e}$/yr.
- Emissions from Drax now included.
- 6 new sites added accounting for 0.1 $MtCO_{2e}$/yr.

Summary of changes to the results[1]

- Emissions from large industries virtually unchanged, despite relatively small changes to individual sites. Sectoral breakdown also remains similar to that in 2017.
- Emissions from power generation (excluding Drax) increased by 0.4 $MtCO_{2e}$/yr between 2017 and 2018.
- Steam from power sector slightly increased (+3%, due to 8% increase in emissions from VPI Immingham CHP, net of 3% decrease in emissions from Triton Power CHP).

[1] More detailed information on site-level changes in emissions is provided below (see: Summary of changes in emissions from Humber sites).

Summary of changes in emissions from Humber sites[1]

Summary of changes in emissions from Humber sites[1]

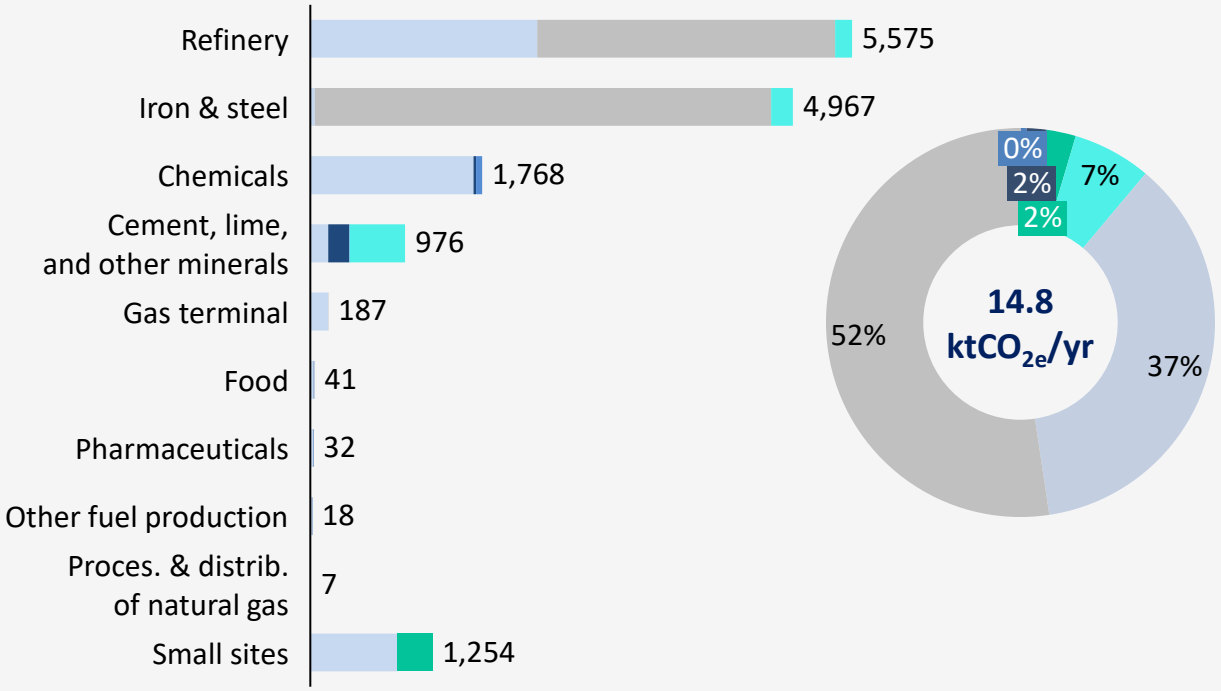
Site	Operator		Emissions (ktCO2/yr) 2017	2018	Increment
Large sites previously included					
Immingham	VPI Immingham LLP	Power generation	3,109	3,369	260
South Humber	EP SHB Ltd	Power generation	1,117	1,344	227
South Ferriby	CEMEX UK Cement Ltd	Cement, lime, and other minerals	465	299	- 166
Keadby	Keadby Generation Ltd	Power generation	907	1,025	119
Scunthorpe / Appleby	British Steel Ltd	Iron & steel	4,952	5,070	118
Saltend	Saltend Cogeneration Company Ltd	Power generation	2,809	2,731	- 78
All other sites	Various	Various	5,191	5,260	70
Total from large sites previously included			**18,549**	**19,100**	**551**
New large sites					
Easington	Gassco AS UK Branch	Gas terminal	-	32	32
Creyke Beck Peaking Plant	Creyke Beck Power Ltd	Power generation	-	29	29
Easington	Centrica Storage Ltd	Gas terminal	-	21	21
Saltend Chemicals Park	Saltend Chemicals Park Ltd	Chemicals	-	14	14
Hull	Smith & Nephew Medical Ltd	Chemicals	-	5	5
Hull Energy Works	Energy Works (Hull) Ltd	Power generation	-	3	3
Total from new large sites			**-**	**103**	**103**
Small sites				**942**	**- 312**
Industry & commercial			1,254		- 1,254
Industry				942	942
Commercial (excluded)				244	n/a
Total from small sites			**1,254**	**942**	**- 312**
Total from all Humber sites			**19,803**	**20,144**	**341**

[1] Excludes Drax.

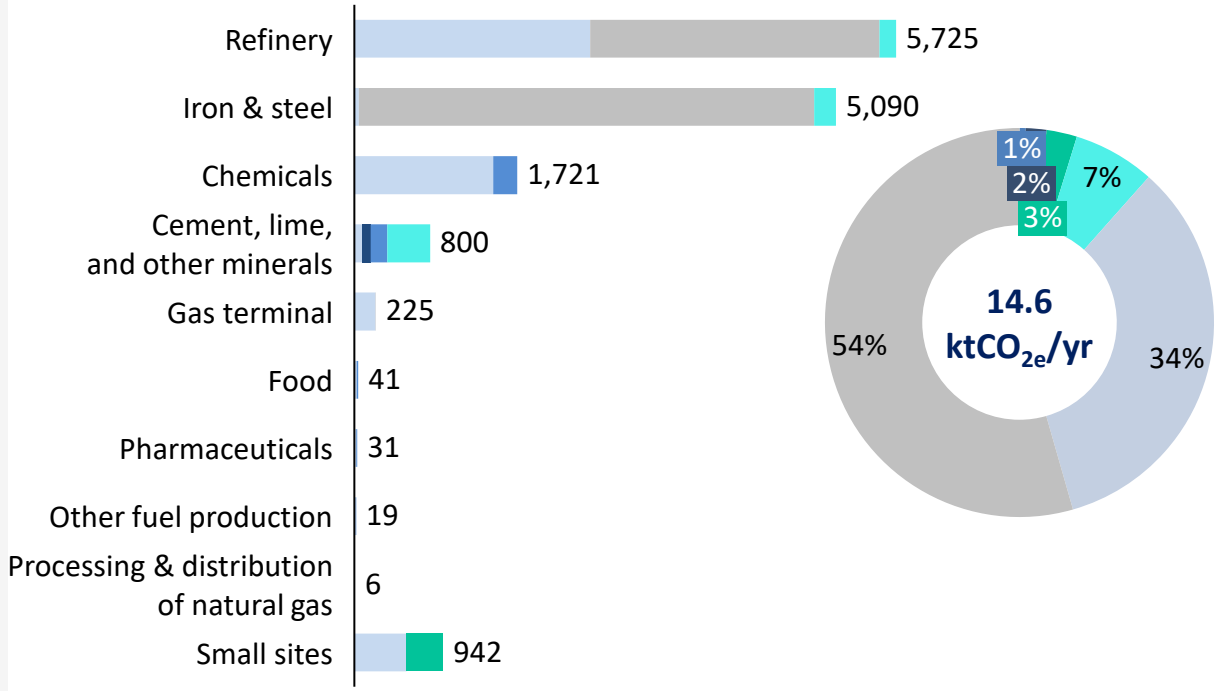
The breakdown of fuel and process contributions is virtually unchanged[1]

Previous study

Total emissions ($ktCO_2$/year) by sector and fuel source



Total emissions ($ktCO_2$/year) by sector and fuel source



Natural gas | Solid fuels | Oil | Internal fuels | Process | Unclassified fuel

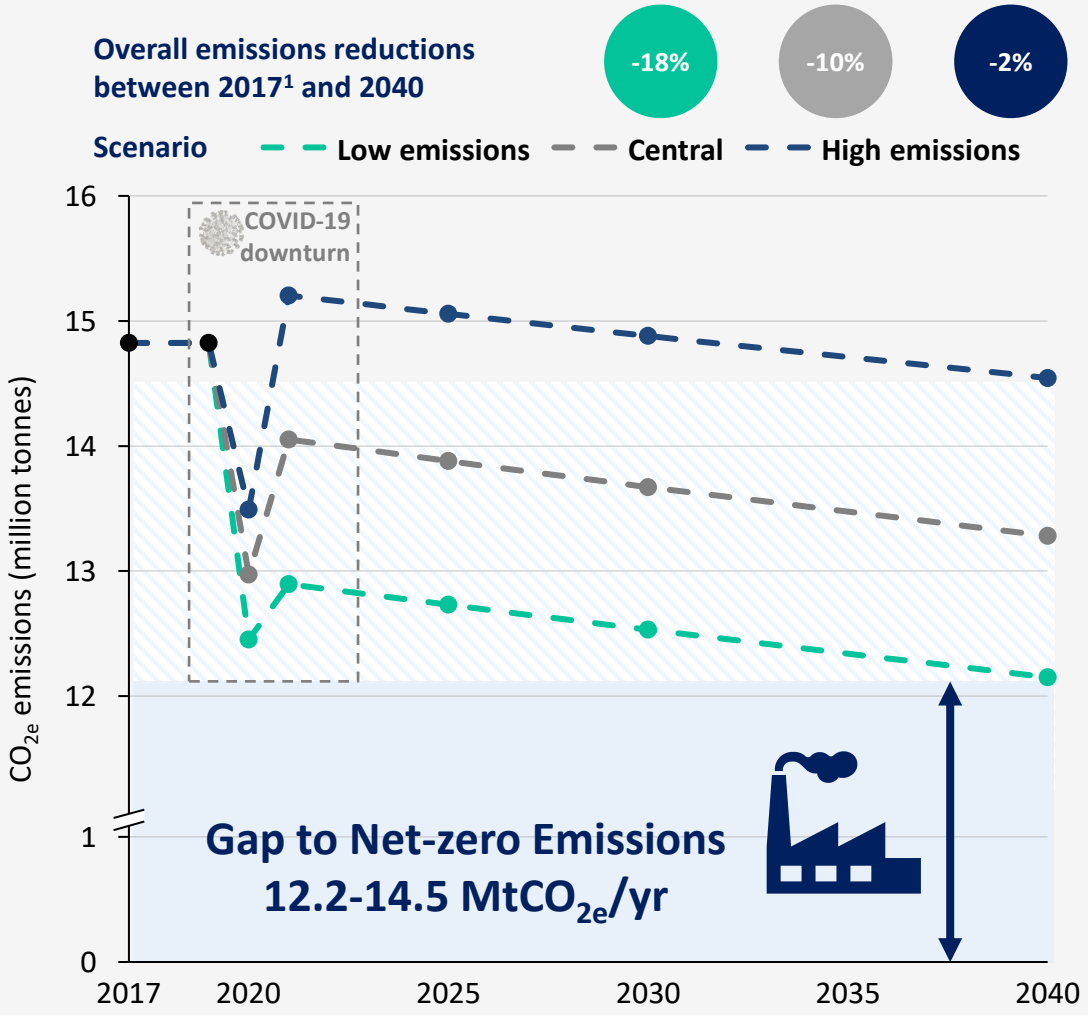
Summary of changes

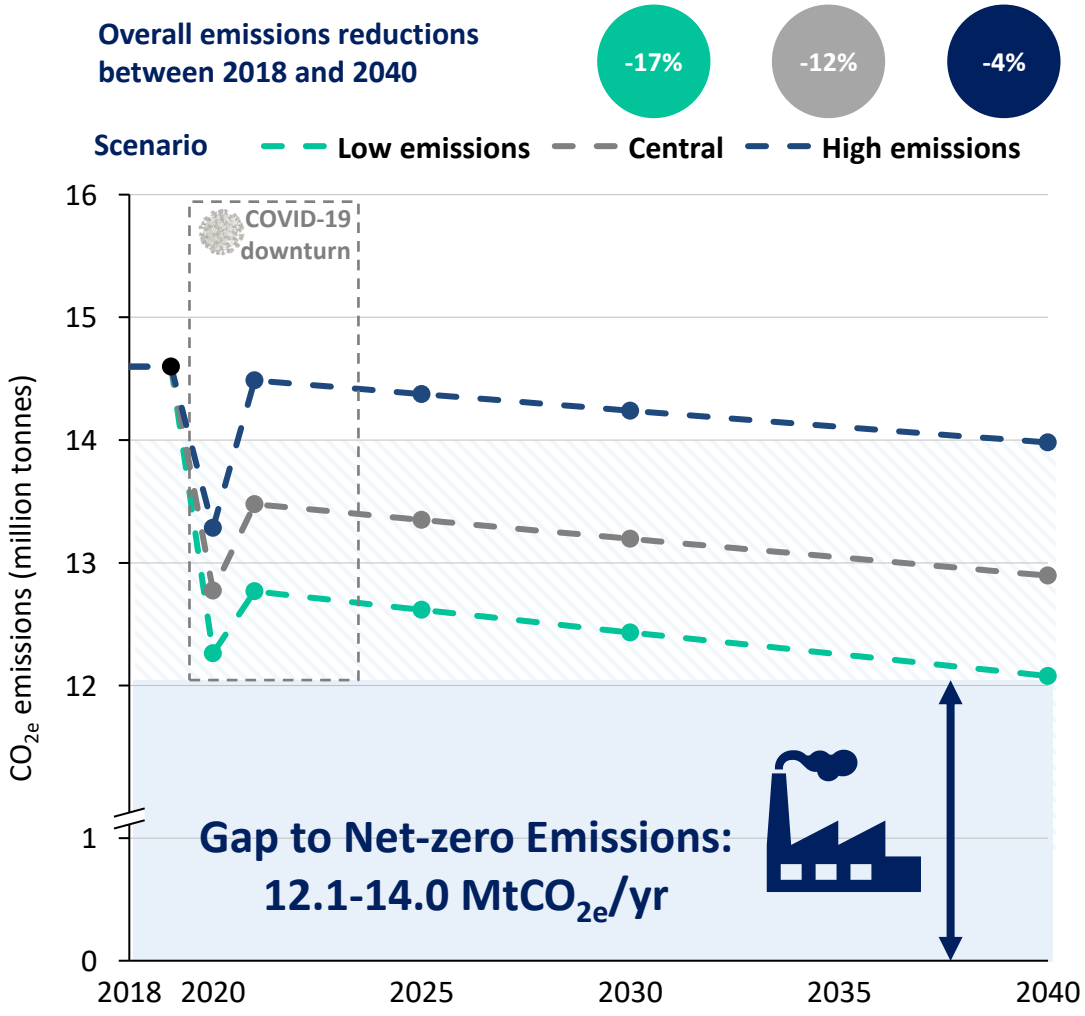
- Changes in the absolute emissions level relate to updates described in the previous two slides.
- We spotted and repaired a small error in the previous version around the use of solid fuels and oil, which shifts <1% of the industrial emissions from solid fuels to oil.

[1] Excludes power generation, which mostly utilises natural gas as well as a small amount of internal fuels.

The business as usual scenarios project slightly lower emissions levels for 2040 in the Central and High emissions scenarios

Previous study





Summary of changes

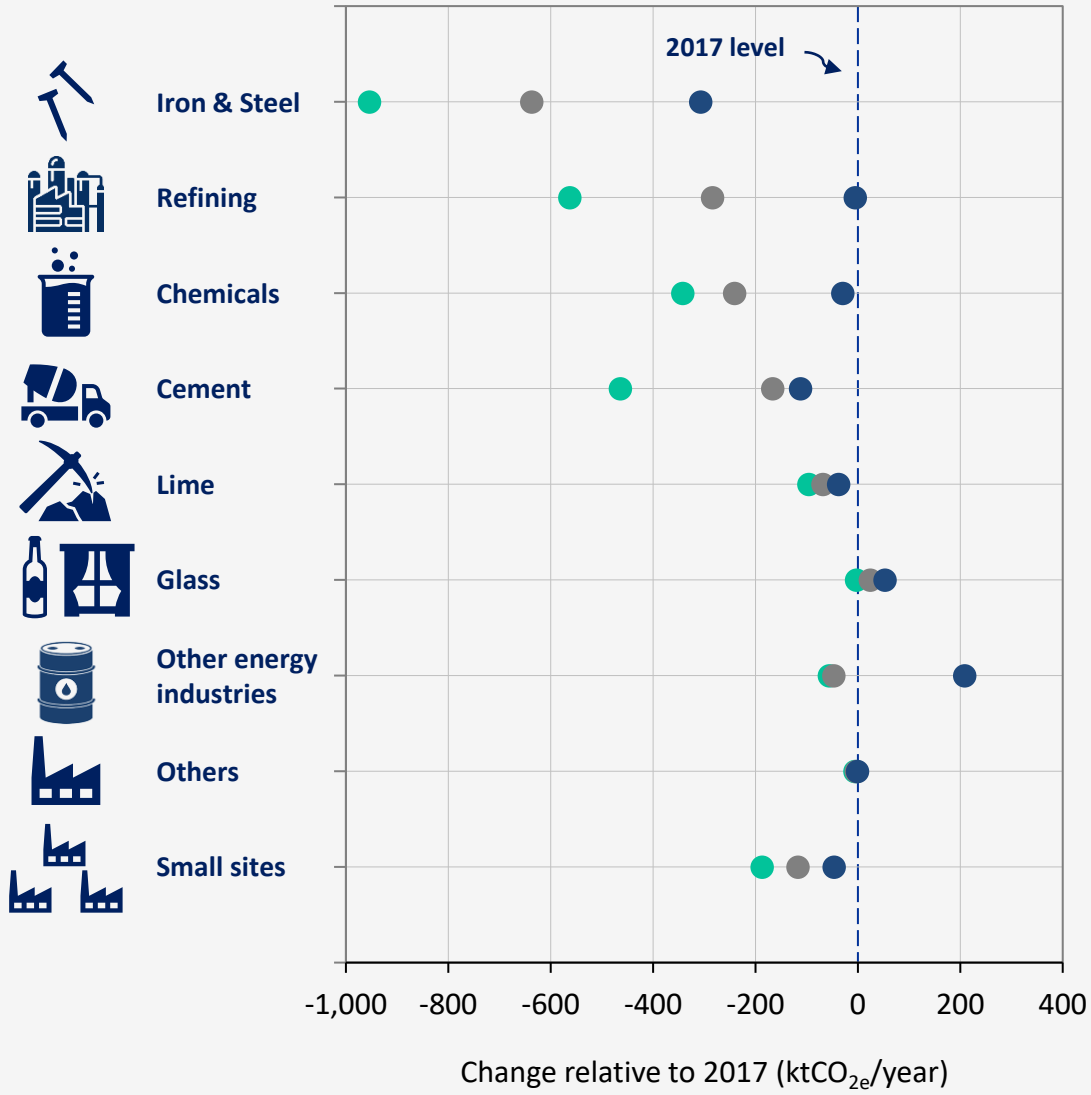
- Updated emissions projections for 2040 are 1% / 3% / 4% lower compared to those calculated in the previous analysis for the same year.
- Closure of Cemex also in the high scenario explains the reduction of emissions between 2021 and 2018. Openings and closures are assumed to happen in 2021.[1]

[1] Hence linear reductions in emissions start in 2021.

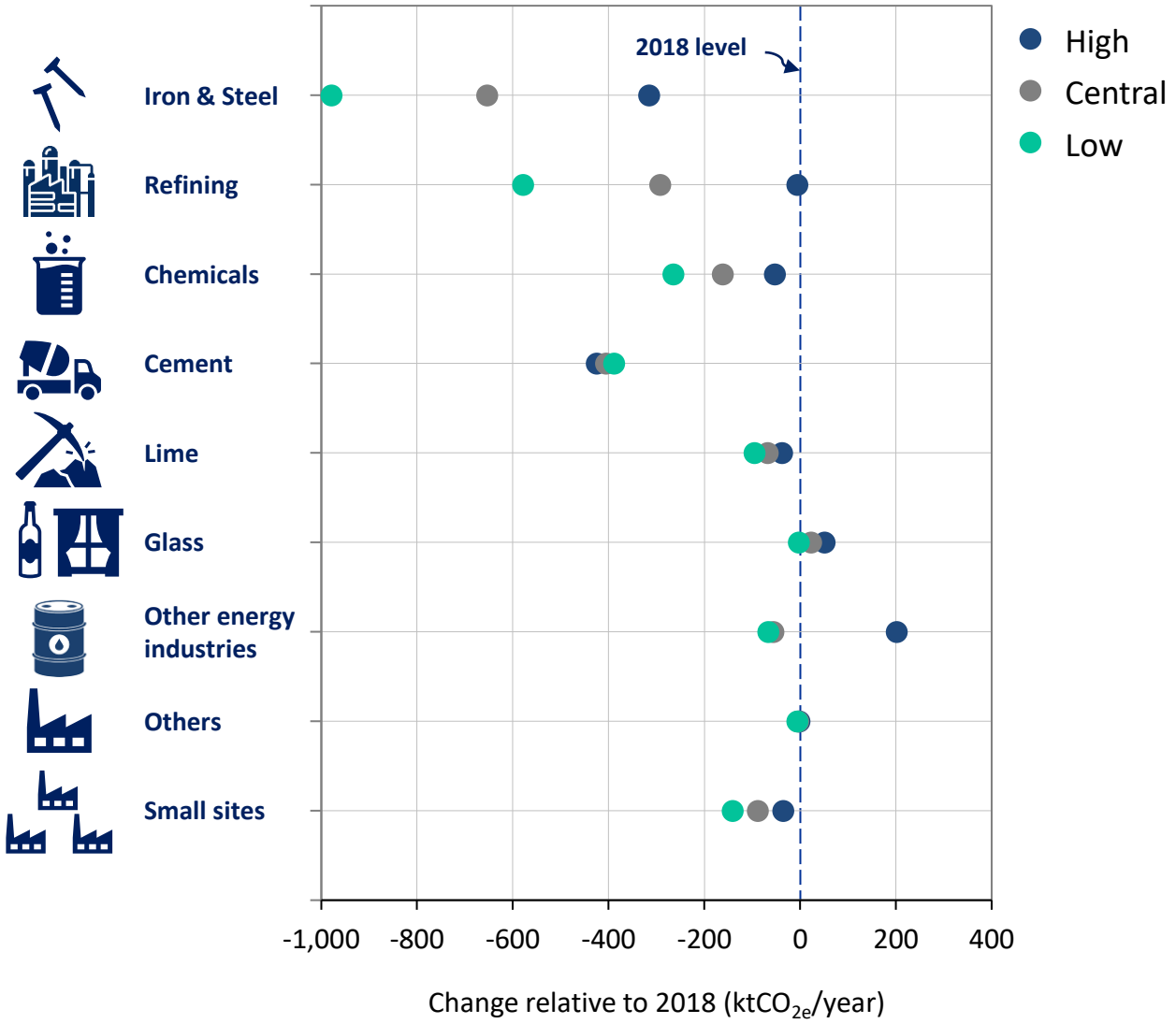
Summary of changes in the comparison of sectoral changes in emissions between baseline year and 2040

Previous study

Sectoral changes in emissions between 2017 and 2040



Sectoral changes in emissions between 2018 and 2040



Summary of changes to business-as-usual scenarios

- Emissions projection changes broadly in line with the previous assessment. Specific changes from the 2018 baseline include:
  - **Vivergo** Fuels now reopens in all scenarios (~85ktCO_2).
  - Large decrease of emissions from cement due to the closure of the **Cemex** plant, which is confirmed for all three scenarios, hence the lower spread in projections.
  - Closure of **Novartis** also confirmed for all scenarios, though it does not significantly impacting emissions from the chemicals sector due to its small size.
- No changes to the assumed short-term impact of COVID-19, still assumed to lead to a 0-10% emissions reduction by 2021, compared to 2018.

Differences between the three BAU scenarios

Previous study

BAU scenario	'High emissions'	'Central'	'Low emissions'
Equivalent BEIS scenario	'High growth'	'Reference'	'Low growth'
Site openings	Altalto by Velocys, Vivergo Fuels	None	None
Site closures	None	None	Novartis, Cemex
Emission reductions due to COVID-19 (vs 2017)	9% in 2020 0% in 2021	12.5% in 2020 5% in 2021	16% in 2020 10% in 2021

BAU scenario	'High emissions'	'Central'	'Low emissions'
Equivalent BEIS scenario	'High growth'	'Reference'	'Low growth'
Site openings	Altalto by Velocys, Vivergo Fuels	Vivergo Fuels	Vivergo Fuels
Site closures	Novartis, Cemex	Novartis, Cemex	Novartis, Cemex
Emission reductions due to COVID-19 (vs 2018)	0% in 2021	5% in 2021	10% in 2021