

# Exploring alternatives to the Cumbrian coal mine

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SGR submitted evidence to local planning inquiries and public inquiry opposing coal mine at Whitehaven (SGR, 2021)

(All references listed in final slides)

## Whitehaven coal mine

- Planned extraction of nearly 2.8 million tonnes of coal per year
- All for iron & steel production
  - Most for export? Or all?
- Lifetime of mine: until 2049
- Approx. 500 onsite jobs
- Use of this coal will lead to nearly 9 million tonnes of CO<sub>2</sub> per year
  - Equivalent to about 1.3 million UK citizens



- Coal extraction figures are for 'main production phase'
- Figure for emissions of UK citizens – territorial emissions only, not carbon footprint
- Figures from: West Cumbria Mining Ltd (2021); SGR (2021)

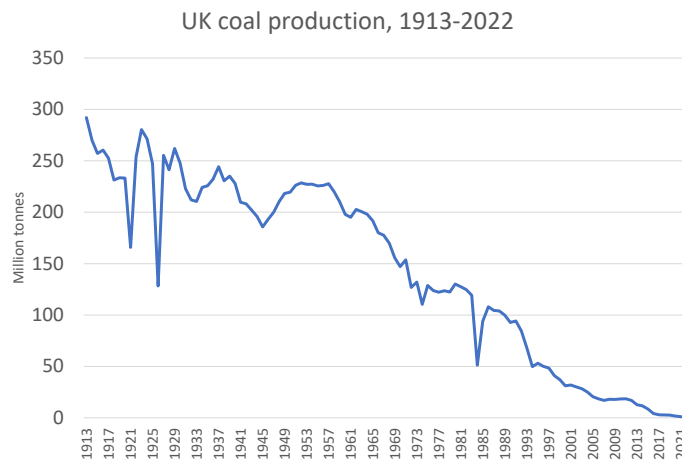
*Image credit: Sue Rickhuss via Pixabay*

UK coal:  
a sector in terminal decline



*Image credit: Sue Rickhuss via Pixabay*

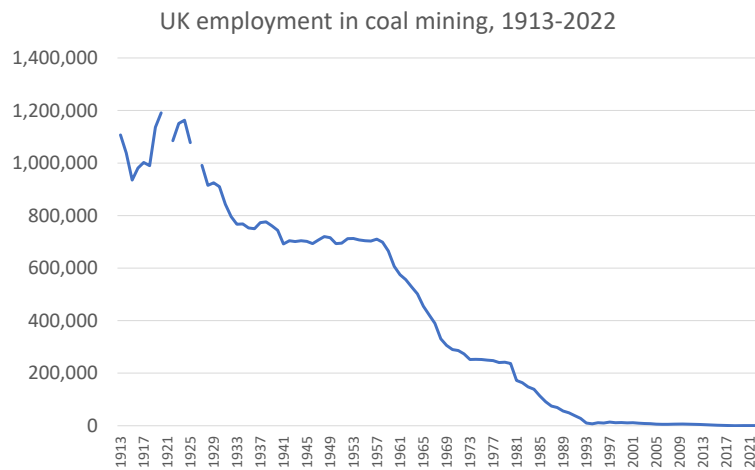
# Declining production



- UK coal production in 2022: **650,000t**
- More than 99% fall since 1913
- Historically, most coal used for electricity

Source: DESNZ (2023)

## Declining jobs



- UK employment in 2022: **480**
- Figures are 'full-time equivalent' / 'direct' jobs

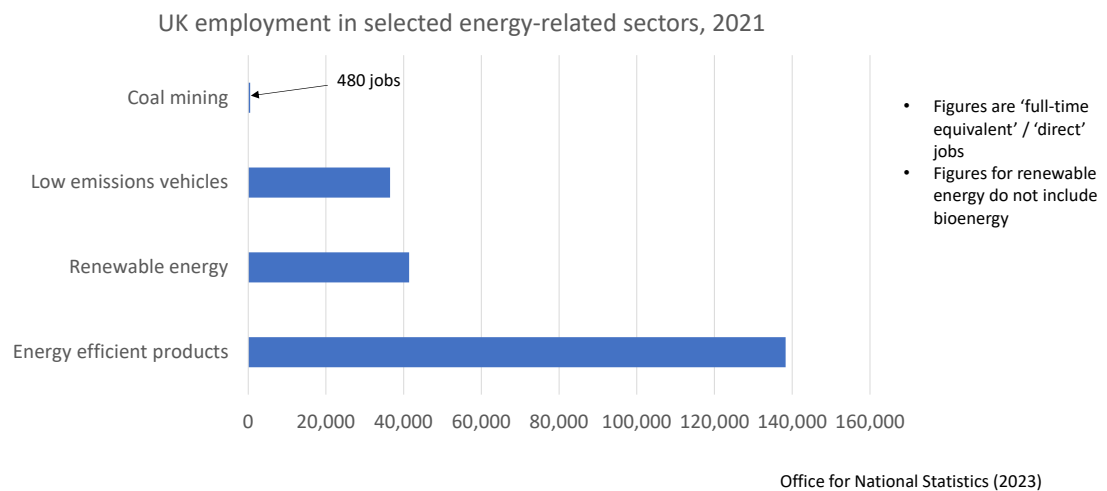
Source: DESNZ (2023)

## UK coal decline: an 'unjust transition'

- UK: world leader in growth in industrial coal use – then world leader in exit from industrial coal use – but...
- Strong cultural attachment to industry which provided significant employment for 200+ years
- Steep falls
  - 1957-1970 – employment fell by 410,000
  - 1979-1993 – employment fell by 232,000 (96% fall)
- 'Unjust transition'
  - Little support for workers made redundant
  - Whole communities faced hardship
  - Bitter industrial disputes – especially in 1980s with Thatcher govt

- Data from: DESNZ (2023)

## UK jobs: coal v low carbon sectors



- In total, the Office for National Statistics (2023), estimated the total employment level of the low carbon and renewable energy sectors to be 247,400 jobs in 2021 (full-time equivalent, direct)

## The iron & steel industry and decarbonisation



- There are many sources which provide basic information on the iron and steel industry, and its technologies. Much of the information in this section is derived from RUSI (2023), with other sources mentioned where relevant.

*Image details/ credit: Port Talbot blast furnace by Grubb at English Wikipedia - Transferred from en.wikipedia to Commons, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=20431866>*

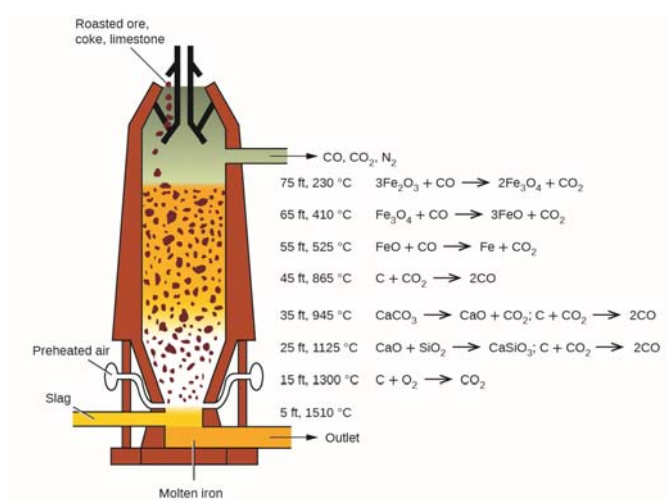


## Iron & steel industry: some basics

- Major user of coal
- Major emitter of greenhouse gas emissions
  - 7% of global total
- Significant obstacles to decarbonisation
- Main production routes/ technologies
  1. Blast Furnace and Basic Oxygen Furnace
  2. Electric Arc Furnace
  3. Direct Reduction and Electric Arc Furnace

- 7% of global GHGs - figure is only for direct energy-related emissions - similar to total for 27 EU nations & UK (Our World in Data, 2023)

## Steel production – method 1: Blast Furnace & Basic Oxygen Furnace (BF-BOF)



- Blast Furnace (left) produces iron from iron ore
- Iron commonly fed into Basic Oxygen Furnace to convert it to steel
- Uses **coal** (in the form of coke)
- **High CO<sub>2</sub> emissions**

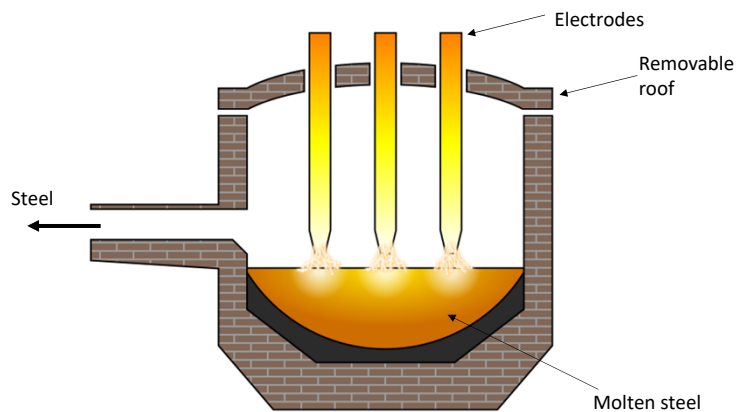
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## BF-BOF: CO<sub>2</sub> / coal reduction options

- Carbon capture (CCUS)
  - Capture CO<sub>2</sub> from exhaust gases and use in industry/ store underground
  - Problems
    - Technology only captures limited fraction of emissions
    - Air pollution: little change to toxic emissions
    - Technology holds limited promise
      - only three projects planned worldwide for iron & steel industry by 2030
- Biomass (from wood)
  - Substitute biomass for coal
  - Problems
    - Sustainability of wood source: may cause deforestation; may not reduce CO<sub>2</sub>
    - Air pollution: little change to toxic emissions

- Only two full-scale CCUS projects – and one pilot project – planned worldwide for iron & steel industry by 2030 (Lead it, 2023)
- Coal industry favours CCUS as it would allow coal use to continue

## Steel production – method 2: Electric Arc Furnace (EAF)



- Electric Arc Furnace (left) produces steel from iron & scrap steel – but not iron ore
- Good for recycling
- High energy efficiency
- **Uses electricity**
- CO<sub>2</sub> emissions dependent on electricity supply

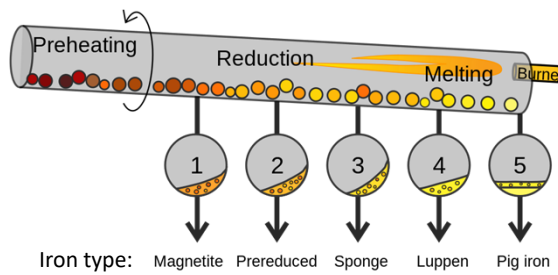
*Image credit: [https://commons.wikimedia.org/wiki/File:Electric\\_Arc\\_Furnace.svg](https://commons.wikimedia.org/wiki/File:Electric_Arc_Furnace.svg)  
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## EAF: CO<sub>2</sub> / coal reduction options

- Minimal coal use in EAF
- CO<sub>2</sub> emissions of electricity supply
  - Can be decarbonised through use of low carbon technologies, e.g. renewable energy
  - Coal has virtually been eliminated from UK electricity supply
- Cannot substitute for all steel production from iron ore
  - Small percentage of global production needs to be made from higher grade iron

- EAF cannot substitute for all steel production from iron ore as small percentage of global production (less than 15%) needs to be made from of higher grade iron (MPI, 2020)

## Steel production – method 3: Direct Reduction (DR) & EAF



- Hot gases passed over iron ore to convert it to iron
- Lower temperature than blast furnace
- Iron then fed into EAF to convert it to steel
- Commonly uses **fossil gas** (natural gas) or **coal** as fuel
- New technologies beginning to be deployed

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## DR-EAF: CO<sub>2</sub> / coal reduction options

- Fuel substitution for DR
  - Coal can be replaced by fossil gas (natural gas)
  - Problems
    - Fossil gas still emits high levels of CO<sub>2</sub> emissions (less than coal)
    - Major suppliers of fossil gas have poor human rights records (e.g. Russia, Iran, China)
  - Coal/ fossil gas can be replaced by hydrogen
  - Hydrogen can be produced from fossil gas ('blue hydrogen') or renewable electricity ('green hydrogen')
  - Problems
    - Blue hydrogen still emits high levels of CO<sub>2</sub> emissions
    - Green hydrogen is at early stage of development – but more promise than CCUS
- EAF CO<sub>2</sub> reduction options in previous slide

## Steel production: what's the best option?

- Recycle much more steel using EAF
  - Decarbonise electricity supply
- Steel from iron ore using DR with green hydrogen
  - Especially high grade types of steel
- Latest estimate for hydrogen DR projects (worldwide)
  - 4 pilot projects by 2025 (3 in Europe)
  - 18 full-scale projects by 2030 (14 in Europe)
  - Green hydrogen planned for over 70% of them
  - Over 50 million tonnes of iron and steel production per year by 2030



- Figures from Green Steel Tracker published by: Lead it (2023)



## UK steel sector

- UK produced 6 million tonnes of steel in 2022
  - 81% from BF-BOF; 19% from EAF
  - Net exports of scrap steel: 8 million tonnes
- Two main steel production sites
  - Tata Steel, Port Talbot, Wales
    - All BF-BOF to be replaced with EAF over 3 years
    - 85% reduction in site's CO<sub>2</sub> emissions
    - £500m subsidy for conversion; £100m job transition fund
  - British Steel, Scunthorpe, NE England
    - BF-BOF continuing with efficiency improvements
    - Move to EAF planned
- Three smaller sites – all EAF
- No green hydrogen DR proposed yet...



- UK industry figures from: World Steel Association (2023)
- Main details on UK industry from: RUSI (2023)
- Details of Port Talbot proposals from: BBC (2023)
- Details of Scunthorpe proposals from: S&P Global (2020)
- Three smaller sites using EAF at Cardiff, Rotherham, and Sheffield

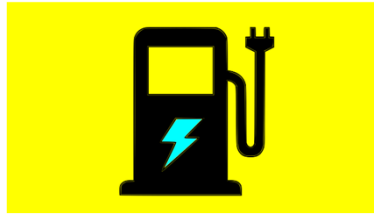
*Image details/ credit: Port Talbot blast furnace by Grubb at English Wikipedia - Transferred from en.wikipedia to Commons, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=20431866>*

## Where does this leave Whitehaven coal mine?

- Demand for coal for UK iron/steel production falling markedly
- Demand for coal for EU iron/steel production also falling markedly due to planned green transition
- Whitehaven coal probably too high in sulphur anyway for UK and EU
  - Expert evidence at public inquiry
- So just adding to global coal supply/ CO<sub>2</sub> emissions

- On sulphur, see: Hazeldine (2021); The Guardian (2022)

## Green jobs in Cumbria



*Image credit: storm-automobile via Pixabay*

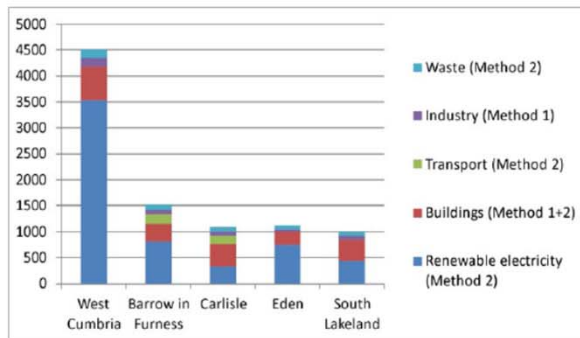
## Potential green jobs for Cumbria: just transition

- Green transition could create thousands of extra jobs in Cumbria
- Buildings
  - Retrofitting homes and businesses with insulation, heat pumps etc
- Transport
  - Improvements to buses, trains, cycle paths, safe walking routes etc
  - Increase in electric vehicle charging points
- Waste
  - Improve rates of reuse, repair and recycling
- Renewable energy
  - Offshore/ onshore wind; solar pv; biogas; hydro; tidal lagoon
- Industry etc

- Industrial options could include – for example – production of office-grade recycled paper, expanding existing paper industry in Cumbria (CAfS, 2021)

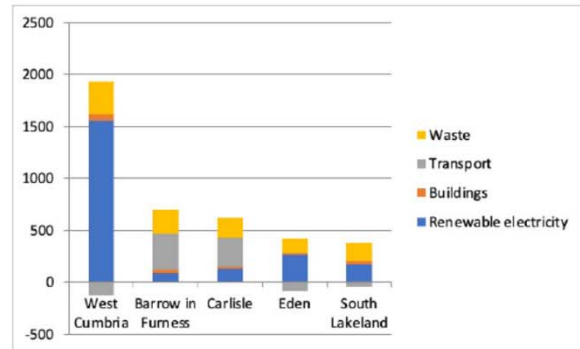
# CAfS report on green jobs in Cumbria

Figure 1: Jobs in the transition period, 2022 to 2037



- Approx 9,000 jobs in transition period
- Local economy reaches zero carbon emissions

Figure 2: Long-term jobs



- Approx. 3,800 long-term jobs
- All jobs figures are 'full-time equivalent' / 'direct'

- Graphs/ figures from: CAfS (2021)
- Green transition requires supportive govt policy and funding – currently, this falls well short.

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