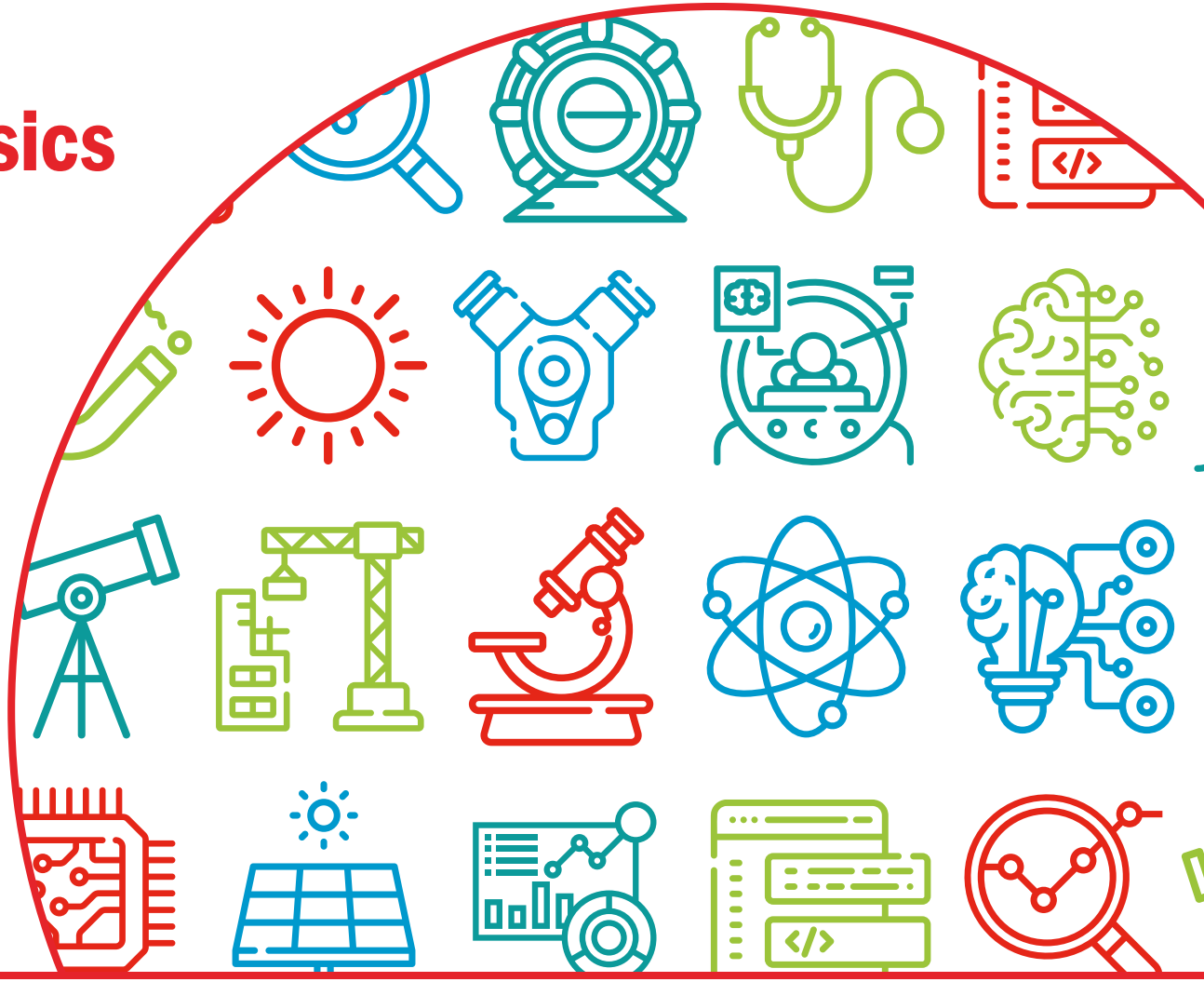
The contribution of physics to the UK economy

Executive summary



IOP Institute of Physics

Physics is a foundation stone for the UK economy and the industries which use physics are both important and highly productive. Physics-based industries (PBIs) employ more than 2.7 million full time equivalent (FTE) employees nationwide, and contribute 11% of national gross domestic product (GDP). Labour productivity in the sector is strong at £84,300 per worker, per year.

A project commissioned by the Institute of Physics (IOP) and conducted by the Centre for Economics and Business Research (CEBR) shows the performance and growth of the sector between 2010-2019. Read the full report at https://www.iop.org/strategy/productivity-programme/physics-and-economy.

What is the physics sector?

Physics-based industries (PBIs) are industries whose enterprises demonstrate...

A) ongoing research and development (R&D) which consistently makes use of physics knowledge (and the R&D activity can be expected to significantly affect the fortunes of businesses within the industry), or

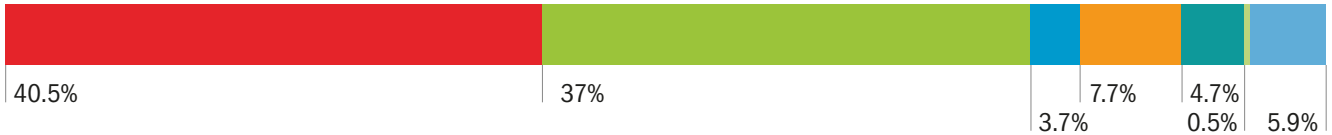
B) those where underlying technology supporting the industry requires significant physics knowledge for continued operation.

The largest parts of the physics sector are Physics Manufacturing (which includes, but is not limited to, the production of a wide range of goods, from fibre optic cables to aircraft and medical equipment to support civil and defence objectives) and Physics Science and Technology, which includes, but is not limited to, technical testing and analysis and practical scientific consultancy. Physics machine services and sales, along with medical equipment sales, represent downstream servicing and sales of the goods physics manufacturing creates. The energy, oil and gas extraction and telecoms industries are major standalone industries with physics at their heart.

In 2019...

*All figures are rounded.

Employment - Full time equivalents (FTEs - thousands) **Total: 2,720**



Number of enterprises **Total: 350.1**

Gross value added - GVA (£bn) **Total: 229bn**

Turnover - (£bn) **Total: 634bn**

Industry

- Physics Science & Technology
- Physics Manufacturing
- Energy Production, Transmission & Distribution
- Telecoms
- Physics Machine Services
- Gas & Oil Extraction
- Other

The physics sector is highly productive and a significant contributor to the UK economy

In 2019...

GVA contribution

The physics sector directly generated £229bn Gross Value Added (GVA), 11% of total UK gross domestic product (GDP). This rose to £563bn when indirect and induced economic contributions are included.

Sectoral comparison

The physics sector generated more than twice the GVA of the Construction (£105bn), Transport and Storage (£98bn), and Retail (£77bn) sectors.

National breakdown

- Scottish PBIs contributed £28bn in GVA – 17% of total Scottish GDP.
- English PBIs contributed £190bn in GVA - 10% of total English GDP.
- Welsh PBIs contributed £7.3bn in GVA – 10% of total Welsh GDP.
- Northern Irish based PBIs contributed £3.5bn in GVA – 7% of total Northern Irish GDP.

Turnover

£634bn

The turnover for the physics sector in 2019.

Sectoral comparison

This figure (£634bn) is more than double that of the Transport and Storage, and Construction sectors, and £2.5 billion greater than Retail.

National breakdown

- English PBIs generated £533bn in turnover.
- Scottish PBIs generated £64bn in turnover.
- Welsh PBIs generated £26.7bn in turnover.
- Northern Irish PBIs generated £10bn in turnover.

Labour productivity

Labour productivity sat at **£84,300**

Across the decade...

GVA contribution

21%

Direct GVA rose by 21%.

This is a higher growth rate than seen in the Retail sector (16%, from £66bn to £77bn), but lower than in the Construction sector (57%, from £67bn to £105bn), and the Transport and Storage sector (51% from £65bn to £98bn).

Turnover

24%

UK PBIs experienced an increase of £123 billion in turnover; a 24% rise across the decade.

Labour productivity

7%

Labour productivity increased by 7% from £79,000 to £84,300.

The physics sector has a large number of enterprises

In 2019...

There were 350,135 physics enterprises operating in the UK.

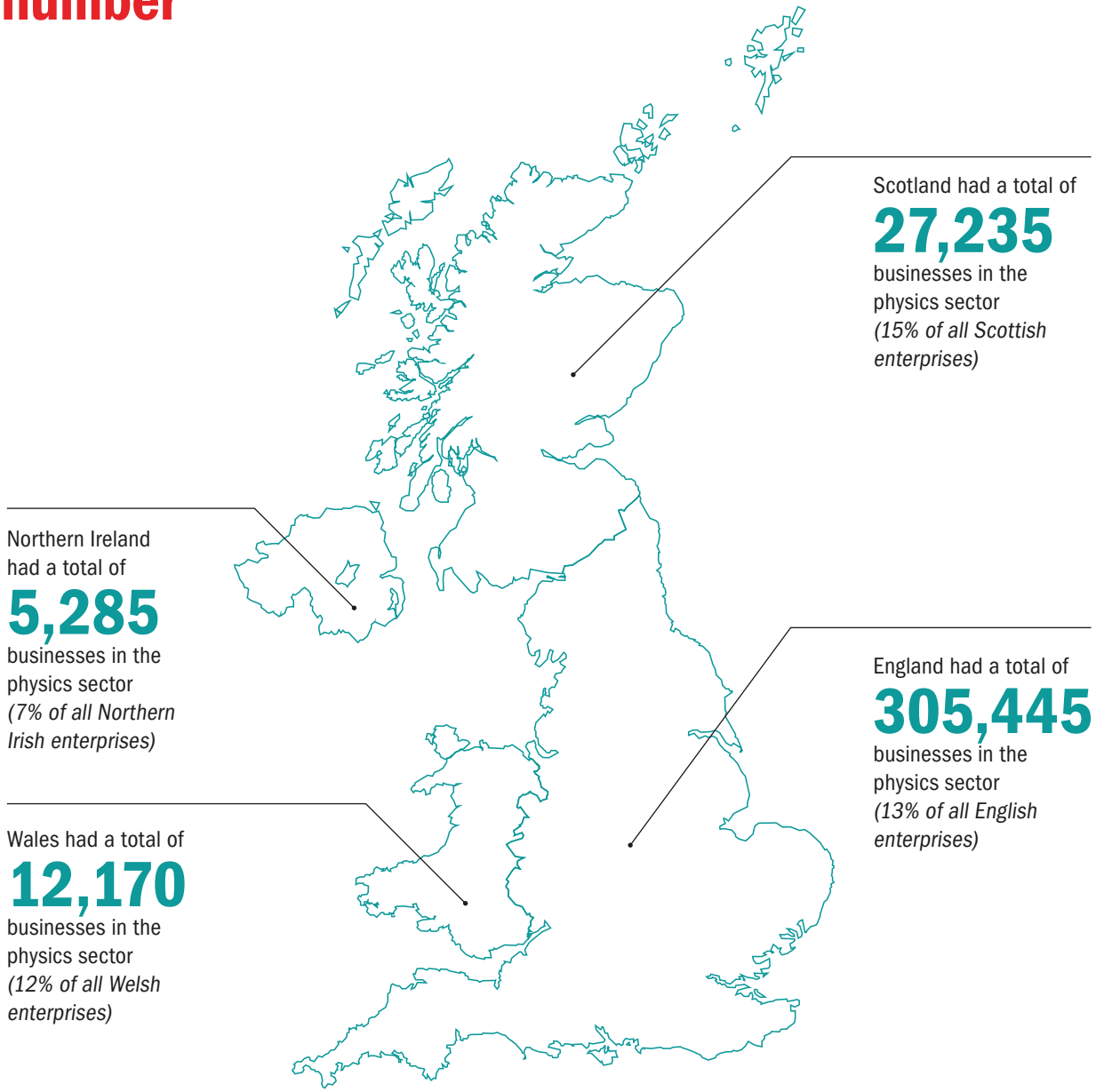
The number of physics enterprises in the UK rose by 46% across the decade.

The majority of physics businesses are SMEs (99%), which employ a maximum of 9 people.

- 92% (322,225) of enterprises were categorised as micro companies.
- 7% (22,990) of enterprises were small (10-49 employees).
- 1% (4,890) were medium (50-249 employees) or large (250+).

The size of physics sector enterprises is similar to the UK average. By comparison, in the wider economy...

- 89% of firms are micro enterprises.
- 9% are small.
- The remaining 2% are medium or large.



The physics sector is a significant employer in the UK

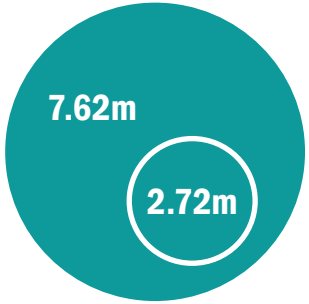
In 2019...

Total employment

The sector directly employed **2.72m** FTEs.

This accounted for **10%** of total UK employment.

This rose to **7.62m** when indirect and induced enterprise's FTEs are counted.



National breakdown

- English PBIs directly employed 2,338m FTEs– 10% of total English employment.
- Scottish PBIs directly employed 220,000 FTEs– 10% of total Scottish employment.
- Welsh PBIs directly employed 113,138 FTEs– 10% of total Welsh employment.
- Northern Irish PBIs directly employed 48,842 FTEs – 7% of total Northern Irish employment.

Compensation of employees

£42,000

Average employee compensation

Sectoral comparison

This is a strong figure compared to other sectors;

£42,000	£36,000	£29,000	£20,000
Physics	Transport and Storage	Construction	Retail

National breakdown

- English PBIs had a total of £98bn employee compensation - £41,990 per FTE worker on average.
- Scottish PBIs had a total £10.4bn employee compensation - £47,000 per FTE worker on average.
- Welsh PBIs had a total of £4.1bn employee compensation - £36,089 per FTE worker on average.
- Northern Irish PBIs had a total of £1.7bn employee compensation - £34,791 per FTE worker on average.

Across the decade...

Total employment

Employment in the physics sector grew by 13%.

13%

Compensation of employees

Compensation of employees (COE) grew by 31% across the decade, from £87 billion to £114 billion.

This was a much higher growth rate compared to employment, meaning that average employee compensation increased by 16% (from £36,200 to £42,000).

31%

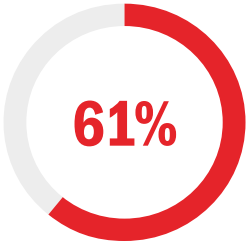
Average English COE/FTE increased from **£36,103** to **£41,990** (16% across the decade).
Average Scottish COE/FTE increased from **£43,000** to **£47,000** (9% across the decade).
Average Welsh COE/FTE increased from **£27,711** to **£36,089** (30% across the decade).
Average Northern Irish COE/FTE increased from **£29,304** to **£34,791** (19% across the decade).

Physics intensive industries undertake a substantial proportion of R&D, performing one third of business conducted R&D

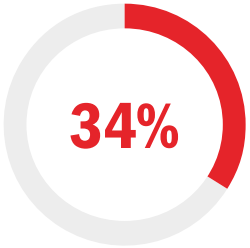
Uplifting R&D in the physics sector by £8.8 billion would see GVA increase by £34.3 billion and turnover by £52 billion.

We looked at two ways of capturing physics R&D spend to give a detailed picture of physics research and development taking place within businesses.

1 Total R&D within the PBIs equalled £15.8 billion (61%, or three fifths of all business-conducted R&D), which includes non-physics R&D taking place within the physics sector.

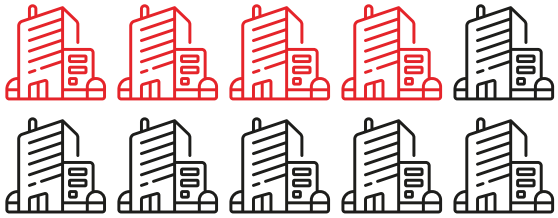


2 R&D taking place in physics-intensive industries, which are the industries where ongoing physics research is most concentrated, equalled £8.9 billion (34%, or one third of business-conducted R&D).



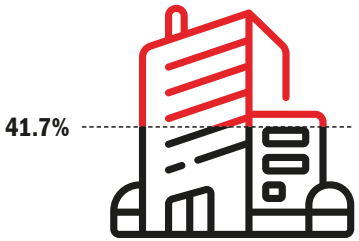
- This means that significant amounts of R&D take place in both PBIs and physics intensive industries, meaning that investment in physics is vital to a thriving R&D ecosystem.
- Of the £4.5 billion increase in R&D in the physics sector over the course of the decade, £3 billion of the increased spend came from physics-intensive industries.
- While R&D spending in the physics sector grew by 40%, R&D spending in physics-intensive industries grew by 76%.

4 out of every 10 of those claiming R&D tax relief were in the physics sector.



Out of just over 59,000 enterprises claiming tax relief

24,580 (41.7%) were in the physics sector



More information and the methodology

The Institute of Physics (IOP) worked with the Centre of Economic and Business Research (CEBR) to quantify the contribution of Physics-Based Industries (PBIs) between 2010-2019 across the UK economy. For the full findings and methodology, see https://www.iop.org/sites/default/files/2021-12/Physics-and-the-Economy-UK.pdf.

The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland. It seeks to raise public awareness and understanding of physics, inspire people to develop their knowledge, understanding and enjoyment of physics and support the development of a diverse and inclusive physics community. As a charity, it has a mission to ensure that physics delivers on its exceptional potential to benefit society.

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