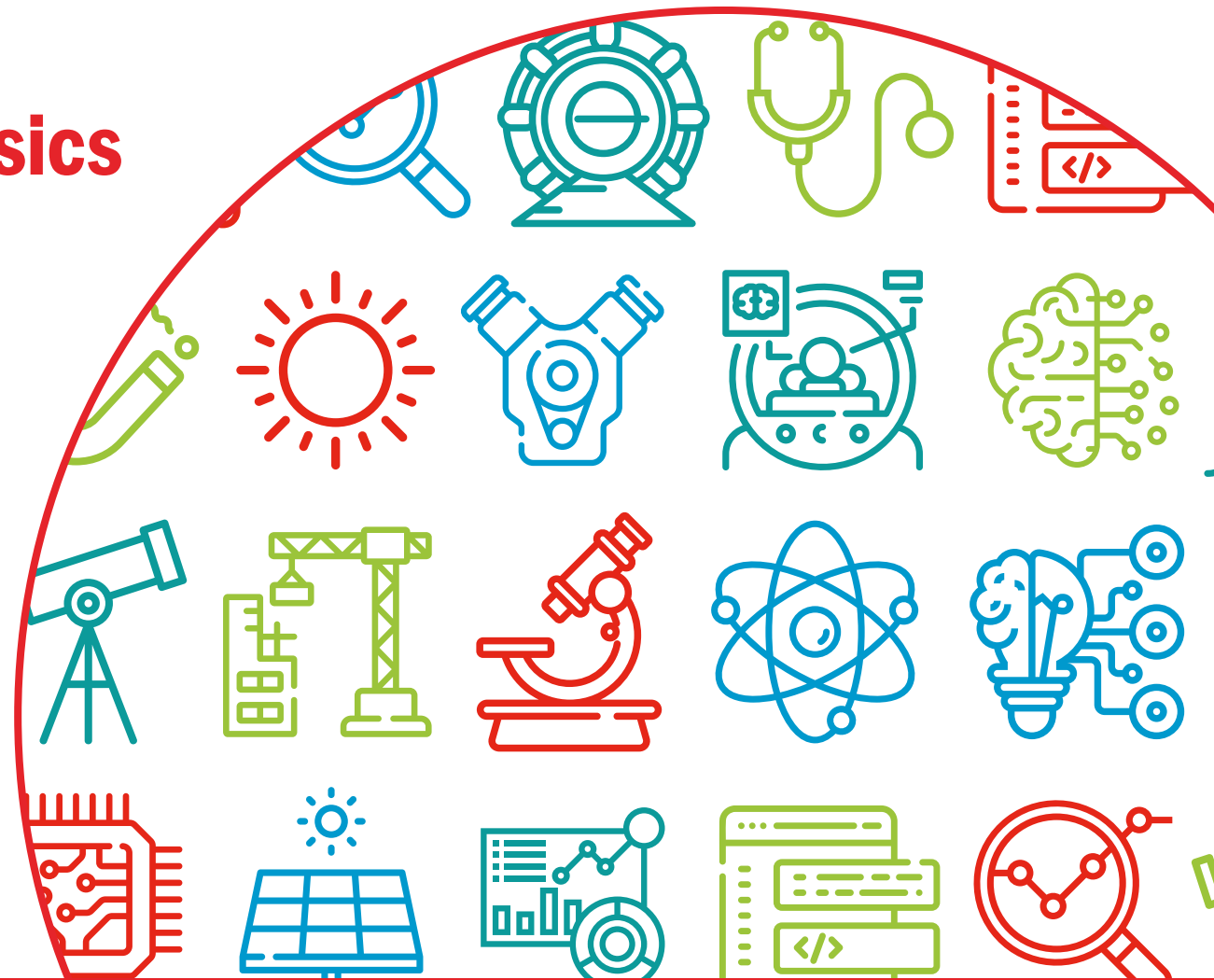


The contribution of physics to the English economy

Executive summary



Physics is a foundation stone of the English economy and the industries which use physics are both important and highly productive. Physics-based industries (PBIs) employ more than 2.3 million full time equivalent (FTE) employees nationwide, and contribute 10% of national gross domestic product (GDP). Labour productivity in the sector sits at £81,300 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?

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.

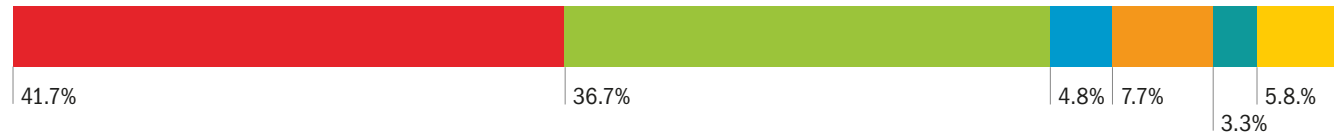
The largest parts of the physics sector are physics manufacturing (which includes, but is not limited to, the production of a wide range of goods, from fibre optic cables to aircraft and medical equipment to support civil and defence objectives) and physics science and technology, which includes, but 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: **2,338**



Number of enterprises (thousands)

Total: **305.4**



Gross value added - GVA (£bn)

Total: **190.2**

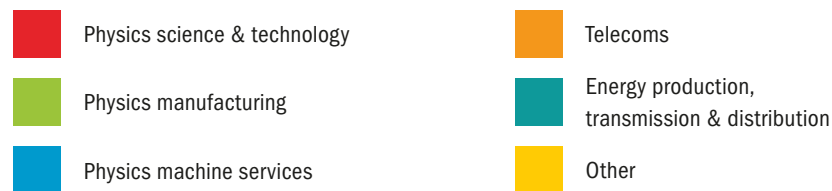


Turnover (£bn)

Total: **533**



Industry



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

In 2019...

GVA contribution £190bn

The physics sector directly generated £190bn gross value added (GVA), 10% of total English gross domestic product (GDP).

National breakdown

- English PBIs contributed £190bn in GVA - 10% of total English GDP.
- Scottish PBIs contributed £28bn in GVA - 17% of total Scottish 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.

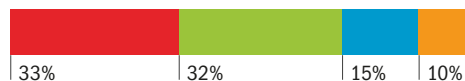
UK Total: **£229bn** - 11%



Spotlight on industry

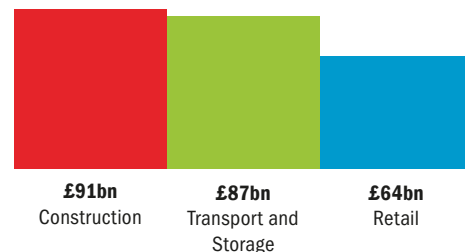
The English PBI sector is largely made up of four high performing industries:

- Physics Manufacturing contributed £63bn in GVA (33% of total PBI GVA)
- Physics Science & Technology contributed £60bn in GVA (32% of total PBI GVA)
- Telecoms contributed £29bn in GVA (15% of total PBI GVA)
- Energy Production, Transmission & Distribution contributed £17bn in GVA (10% of total PBI GVA)



Sectoral comparison

The physics sector generated more than double the annual GVA of the Construction (£91bn) and Transport & Storage (£87bn) sectors, and around three times that of the Retail (£64bn) sector.



Turnover

£533bn

The physics sector generated £533bn in turnover.

National breakdown

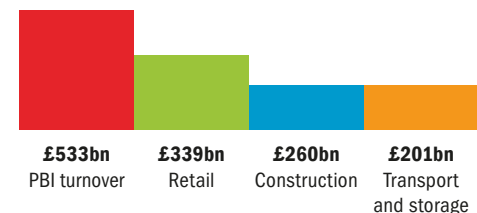
- English PBIs generated £533bn in turnover.
- Scottish PBIs generated £64bn in turnover.
- Welsh PBIs generated £26.7bn in turnover.
- Northern Irish PBIs generated £10bn in turnover.



UK Total: **£634bn**

Sectoral comparison

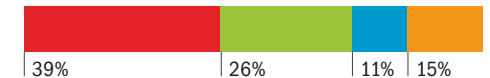
- PBI turnover (£533bn) is more than double the values of the Construction (£260bn) and Transport and Storage Sectors (£201bn).
- PBIs generate around £200bn more in turnover than the Retail sector (£339bn).



Spotlight on industry

In terms of turnover:

- Physics Manufacturing generated £209bn (39% of total PBI turnover)
- Science and Technology generated £138bn (26% of total PBI turnover)
- Telecoms generated £59bn (11% of total PBI turnover)
- Energy Production, Transmission and Distribution generated £82bn (15% of total PBI turnover)



Labour Productivity

Labour productivity sat at £81,300 per worker, per year.

This figure sits below that in Scotland, but higher than the other nations:

- Scotland - £129,000 per worker, per year
- England - £81,300
- Northern Ireland - £71,966
- Wales - £64,828

The physics sector has a large number of enterprises

In 2019...

There were 305,000 physics enterprises operating in England – 13% of all English enterprises.

The physics sector is dominated by science and technology enterprises, which make up 72% of all English PBI businesses (226,000).

This is followed by physics manufacturing, which makes up just 18% of all PBI enterprises despite contributing one third (33%) of all English PBI GVA.

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



The size of physics sector enterprises is similar to the wider English average.

By comparison, in the wider English economy:

- 89.5% of firms are micro enterprises.
- 9% are small.
- The remaining 2% are medium or large.



Northern Ireland had a total of **5,285** businesses in the physics sector (7% of all Northern Irish enterprises)

Wales had a total of **12,170** businesses in the physics sector (12% of all Welsh enterprises)

Scotland had a total of **27,235** businesses in the physics sector (15% of all Scottish enterprises)

England had a total of **305,445** businesses in the physics sector (13% of all English enterprises)



The physics sector is a significant employer in England

In 2019...

Total employment

2.33m FTEs

The sector directly employed more than **2.33 million FTEs**. This accounted for **10% of total English employment**.



National breakdown

These figures are consistent with the other UK nations:

- 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

£41,990

Average employee compensation.



Sectoral comparison

This is a strong figure compared to the retail sector (£20,000), and is similar to the Transport and Storage sector (£36,000).

National breakdown

Employee compensation in England is stronger than in Wales and Northern Ireland:

- 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.



The physics sector grew across the decade

Between 2010 and 2019...

GVA

23% ↑↑

GVA contributed by English PBIs rose by 23%. This is consistent with growth in Wales, and much higher than seen in Scotland:

- The GVA generated by English PBIs grew by 23%
- The GVA generated by Scottish PBIs grew by 0.5%
- The GVA generated by Welsh PBIs grew by 20%
- The GVA generated by Northern Irish PBIs grew by 47%



Turnover

28% ↑↑

English PBIs experienced turnover growth of 28%, from £417bn in 2010. This is in line with the UK-wide PBI turnover growth rate (24%).



Labour productivity

9% ↑↑

Labour productivity increased by 9% across the decade from £75,000 to £81,300.



Number of enterprises

45% ↑↑

The number of physics enterprises grew by 45%.



Employment

14% ↑↑

Employment in the physics sector grew by 14%.



Compensation of employees

£98bn

Compensation of employees (COE) grew by 32% across the decade, from £74bn to **£98bn**.

This was a much higher growth rate compared to employment, meaning that average employee compensation increased by 16% (from £36,103 to £41,990).



Compared to other nations

- 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).



The physics sector has different strengths across the English regions

Physics enterprises are most numerous in London and the South East, and these regions have the largest number of physics staff, turnover and GVA contribution. They have remained dominant across the 2010s, collectively accounting for two fifths of English PBIs and representing two fifths of English GVA by 2019. Across the decade, London was the most most productive English region, with an average productivity figure of £118,000 GVA per FTE worker.

Despite this, the physics sector is strong outside of these regions, with both the Midlands and the North enjoying growth over the decade. GVA in the North West increased by more than 30%, and the West Midlands had a particularly high rise (42.9%) from £13.9 billion to almost £20 billion.

Every region saw its GVA value increase during the period, however regions outside of the Golden Triangle remained below London and the South West in terms of economic output. This illustrates the need for continued investment in the regions targeted in the Levelling Up agenda, to enable the physics sector in these regions to perform at its full potential.

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 to the English economy. For the full findings and methodology, see <https://www.iop.org/sites/default/files/2022-01/Physics-and-the-Economy-England.pdf>.

Regional analysis

*All figures are rounded.

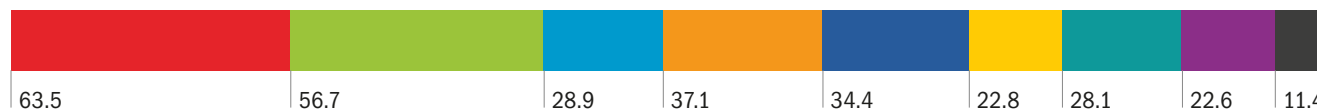
Employment - Full time equivalents (FTEs thousands)

Total: **2,337**



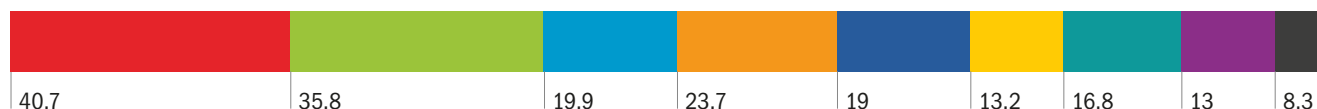
Number of enterprises (thousands)

Total: **305.5**



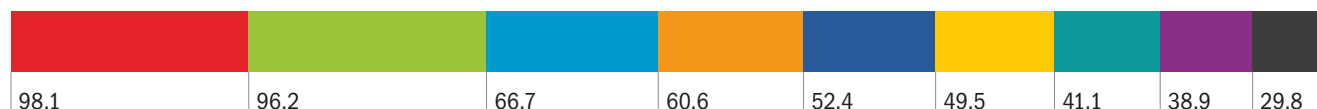
Gross value added - GVA (£bn)

Total: **190.4**

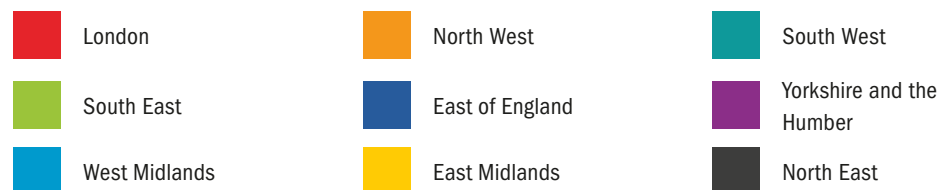


Turnover (£bn)

Total: **533.3**



Region



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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