

Response to the Senedd Finance Committee's inquiry into the Welsh Government draft budget 2023–24 (18 November 2022)

Overview

- i. 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.
- ii. The IOP believes it is imperative the draft budget for 2023–24 includes substantial increases to funding for research, development and innovation (RDI). The IOP previously made this case to the committee for its inquiry into post-EU funding.¹
- iii. The IOP acknowledges the problems created by the replacements for EU structural funds and the on-going uncertainty regarding Horizon Europe. However, there are actions within the Welsh Government's power that should be taken. Many of these actions were included in the IOP's response to the consultation on the draft innovation strategy for Wales.² With regards to funding and the budget, the Welsh Government should push further in implementing recommendations of Professor Graeme Reid's review of government-funded research and innovation:³
 - Funding for the Higher Education Funding Council for Wales (HEFCW):
 - Uplifts to quality-related research (QR) funding.
 - £30m Future of Wales Fund to reward institutions that attract funding into Wales.
 - £25m Research Wales Innovation Fund.
 - Funding for the Welsh Government:
 - £25m St David's Fund for innovation hubs, competitions and within government.
 - Research and innovation office in London.
- iv. The IOP also believes the draft budget should continue to increase funding for the professional learning required to deliver the new Curriculum for Wales (CfW). This would include on-going support for training the physics education workforce, uplifts to teacher training incentives and wider increases for implementation of the working group on Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum.⁴ In particular, clarity would be welcome on funding availability for the Stimulating Physics Network Wales and associated whole-school equity and inclusion project, as well as the Physics Mentoring Project.
- v. The IOP is keen to present and discuss these matters in person with the committee.

1. Research, development and innovation (RDI)

- 1.1 Physics is of substantial benefit to Wales; the Centre for Economics and Business Research found it is worth £7.3bn GVA to the Welsh economy and supports 113,138 jobs—this is equivalent to 10% of both GDP and full-time employment in Wales.⁵ These physics-based businesses increased turnover by 36% and employee pay by 41% in a decade—the fastest rises of the four UK nations and well above the UK average. Despite this success, Wales has had low levels of R&D for

¹ Institute of Physics. 2022. [Response to the Senedd Finance Committee's inquiry into post-EU funding \(13 May 2022\)](#). London: Institute of Physics.

² Institute of Physics. 2022. [IOP response to the Welsh Government's consultation on the draft innovation strategy \(28 September 2022\)](#). London: Institute of Physics.

³ Reid, G. 2018. [Review of Government Funded Research and Innovation in Wales](#). Cardiff: Welsh Government.

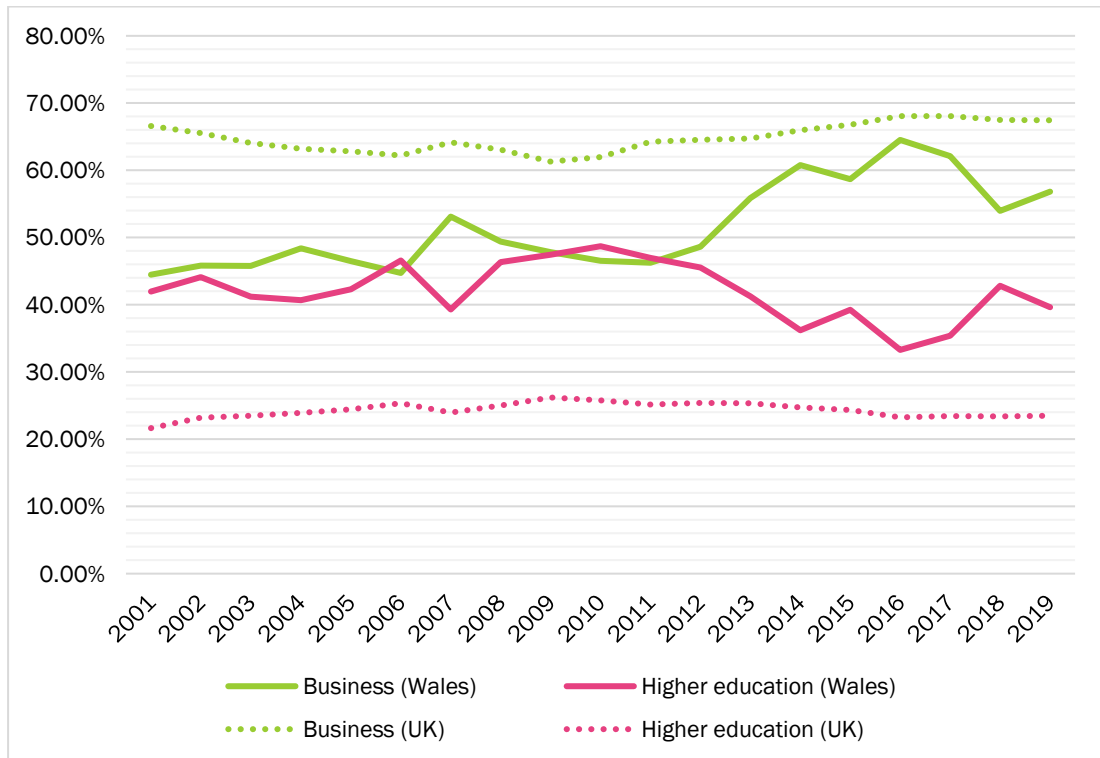
⁴ Welsh Government. 2021. [Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum Working Group: final report](#). Cardiff: Welsh Government.

⁵ Centre for Economic and Business Research. 2021. [Physics and the Economy: Measuring the value of physics-based industries in Wales](#). London: Centre for Economic and Business Research.

decades, has the lowest R&D spending per head of the UK nations and regions of England and is consistently at the bottom of productivity tables.^{6 7 8 9}

- 1.2 According to research from CBI Economics, physics innovators in Wales collaborate more regularly with universities, business partners and peer networks/associations compared to UK colleagues.¹⁰ Similarly, higher education performs a larger share of R&D in Wales compared to higher education’s share for the UK.¹¹ Across the last 20 years, universities have on occasion overtaken the private sector in Wales (a situation unthinkable for the UK as a whole). Clearly, Wales requires more private sector R&D; until this happens, higher education needs to be protected—Wales’s overall levels need to increase, rather than a zero-sum shift.

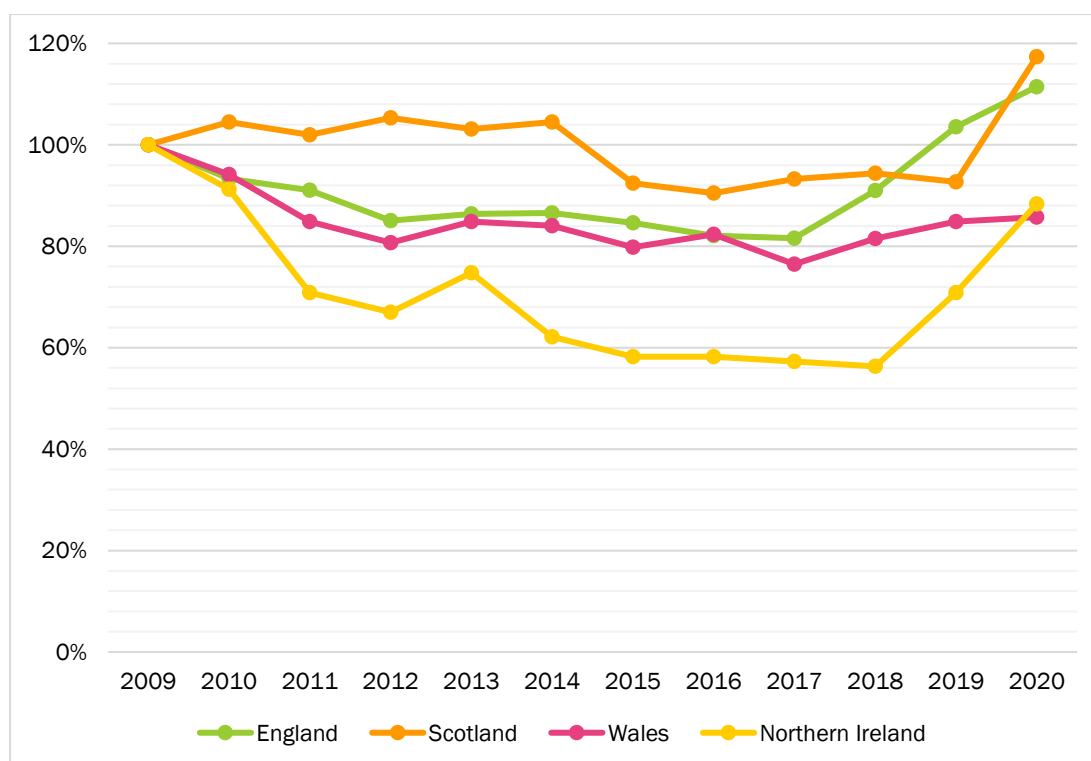
Graph 1: Higher education and private sector share of R&D, 2001–2019



- 1.3 CBI Economics also found physics innovators in Wales feel direct costs are the most substantial challenge to RDI, a finding more pronounced in Wales compared to UK. The innovators were, compared to UK counterparts, more dependent on financial support from the Welsh and UK governments and the EU. Even though the COVID-19 pandemic had a more disruptive impact on physics RDI in Wales, innovators were optimistic RDI spending would increase in the next five years *if conditions were right*.
- 1.4 Despite higher education doing more of the ‘heavy lifting’, HEFCW’s allocations for research have, at best, flatlined; when adjusted for inflation, Wales is failing to keep pace with other nations. Considering CBI Economics’ findings, the current situation does not augur well. Stagnant allocations for university research, coupled with the with current 10.1% rate of the consumer prices index, will create significant pressure in Wales.¹²

⁶ Henley, A. 2021. [Wales’ Productivity Challenge: Exploring the issues](#). Manchester: Productivity Institute.
⁷ Hutton, G. 2021. [Research Briefing: Research and development spending](#). London: UK Parliament.
⁸ Office for National Statistics. 2021. [Gross domestic expenditure on research and development, by region, UK](#). Newport: Office for National Statistics.
⁹ Office for National Statistics. 2021. [Annual regional labour productivity](#). Newport: Office for National Statistics.
¹⁰ CBI Economics. 2022. [Paradigm shift: Unlocking the power of physics innovation for a new industrial era](#). London: Institute of Physics.
¹¹ StatsWales. 2021. [Research and development expenditure in Wales by expenditure type and year](#). Cardiff: Welsh Government.
¹² Office for National Statistics. 2022. [Consumer price inflation, UK: September 2022](#). Newport: Office for National Statistics.

Graph 2: R&D allocations from core funder, 2009–20 (constant prices, where 2009=100%)



- 1.5 HEFCW will soon be folded into the new Commission for Tertiary Education and Research (CTER). The Tertiary Education & Research (Wales) Act included the provision that CTER should safeguard “continuous improvement in the quality of research and innovation carried out by relevant persons, and the competitiveness of that research and innovation compared to research and innovation carried out by other persons”.¹³ Funding increases, which will help make that provision a reality, should not be postponed until CTER is in full operation; the situation needs to be addressed now.
- 1.6 The IOP acknowledges the Welsh Government does not control all public funding for RDI, with UKRI, the Advanced Research and Invention Agency and replacements for EU funding reserved to Westminster.^{14 15} The IOP has put on record its criticisms of replacements for EU regional development funding as a *de facto* cut to science and innovation in Wales, also calling for greater involvement from Wales in the running and structures of UKRI (this was rejected most recently in Sir David Grant’s review of UKRI).^{16 17 18}
- 1.7 But this inquiry relates to the powers directly within the Welsh Government’s remit. The last public review of Welsh Government-funded RDI, led by Professor Graeme Reid, proposed uplifts to existing streams and the creation of new funding pots. Reid proposed two set of funding allocations: one if the Welsh Government controlled replacement funds and one if it did not. As stands, the Welsh Government has still fallen short of the latter.
- 1.8 The Centre for Innovation Policy Research produced a report on the state of the RDI landscape in Wales, with the report being presented to the Welsh Government’s Innovation Advisory Council for Wales in 2021.¹⁹ It noted the problems with the current quasi-implementation of Reid. The Welsh

¹³ [Tertiary Education and Research \(Wales\) Act 2022](#). asc. 1.

¹⁴ [Government of Wales Act 2006](#). c. 32.

¹⁵ [United Kingdom Internal Market Act 2020](#). c. 27.

¹⁶ Institute of Physics. 2022. [Response to the Senedd Finance Committee’s inquiry into post-EU funding \(13 May 2022\)](#). London: Institute of Physics.

¹⁷ Institute of Physics. 2022. [IOP Response to the Nurse Review](#). London: Institute of Physics.

¹⁸ UK Government. 2022. [Independent review of UK Research and Innovation \(UKRI\): final report and recommendations](#). London: UK Government.

¹⁹ Delbridge, R., Henderson, D. and Morgan, K. 2021. [Scoping the future of Innovation Policy in Wales](#). Cardiff: Centre for Innovation Policy Research.

Government's position is that it will only implement all of Reid with uplifts to its budget as part of a post-EU settlement.²⁰ ***This is not consistent with the recommendations from Reid, and the IOP believes Reid's original proposals should be implemented in full and at pace.***

1.9 The Welsh Government's draft innovation strategy has been issued for consultation and responses are now being reviewed.²¹ The strategy did not appear to include any new funding commitments, which would be a serious flaw. The draft budget should include funding to allow for several clear actions that are required:

- Full implementation of the Reid review recommendations.
- Further uplift to QR to compensate for the below inflation allocations in the last decade.²²
- Welsh Government recognizing the impact of full economic costs (FEC) not being recovered on all publicly funded research grants (an absence of FEC is known to create additional pressures in places, like Wales, already lagging for RDI activity).^{23 24}

1.10 The strategy lists what the Welsh Government wants from innovation and what it would like to see UKRI recipients to do with grant funding. But, if the money is from UKRI, then UKRI and the UK Government will decide what happens with it. ***For the Welsh Government to have an innovation strategy with deliverables, it will need to institute its own funding, increase existing streams and incentivise UKRI grant capture.***

1.11 As it stands, the UK Government has a target of increasing public R&D spend by 40% outside England's greater southeast by 2030, pivoting investment zones towards universities, maintaining its aim of R&D spending reaching 2.4% of GDP and protecting R&D budgets until 2025 (albeit in cash rather than real terms).^{25 26} Similarly, the Irish government has reaffirmed its own target of 2.5% GNP.²⁷ The Welsh Government cannot set an equivalent target, as it does not have the same fiscal powers as the other governments. However, one of its five priorities for RDI vowed to:

“Ensure Wales has a fair share of available research, development and innovation funding and we will work to secure funding levels at least equivalent to those we received historically, via the European Union. We will also work to address historic underfunding from both competitive and non-competitive UK investment sources.”²⁸

1.12 Wales was insufficiently RDI-active before Brexit; returning to those levels is unlikely to meet the challenges we face. Indeed, Welsh universities warned publicly this summer about the pressures that are arising from flatlined QR budgets.²⁹ Like the IOP, they also warned about the shortfall that will be incurred via the design of EU replacement funds.³⁰

2. Education and Welsh language

2.1 The IOP is working closely with the Welsh Government on a range of government-funded projects intended to increase the number of physics teachers and ensure current physics teachers have the best possible support. This includes the Stimulating Physics Network Wales and associated whole-school equity and inclusion project, as well as the Physics Mentoring Project.³¹ Audit Wales

²⁰ Welsh Government. 2019. [Wales: Protecting research and innovation after EU exit](#). Cardiff: Welsh Government.

²¹ Welsh Government. 2022. [Innovation strategy for Wales](#). Cardiff: Welsh Government.

²² Institute of Physics. 2022. [Physics: investing in our future](#). London: Institute of Physics.

²³ Institute of Physics. 2022. [IOP Response to the Nurse Review](#). London: Institute of Physics.

²⁴ Chaytor, S., Gottlieb, G. and Reid, G. 2021. [Regional policy and R&D: evidence, experiments and expectations](#). Oxford: Higher Education Policy Institute.

²⁵ UK Government. 2022. [Levelling Up the United Kingdom](#). London: UK Government.

²⁶ UK Government. 2022. [Autumn Statement 2022: documents](#). London: UK Government.

²⁷ Government of Ireland. 2022. [Impact 2030: Ireland's Research and Innovation Strategy](#). Dublin: Government of Ireland.

²⁸ Drakeford, M. 2021. [Written Statement: Five priorities for research, development and innovation](#). Cardiff: Welsh Government.

²⁹ McIntyre, F. 2022. [Flatlined QR funding in Wales prompts concern](#). London: Research Professional.

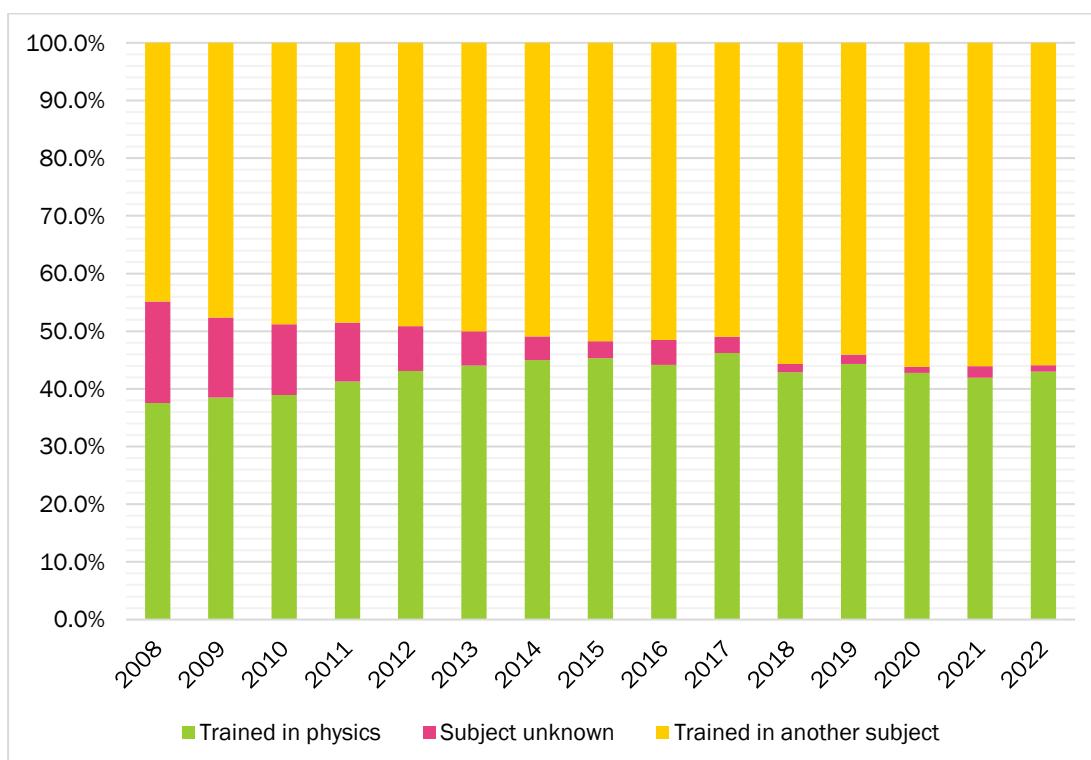
³⁰ Inge, S. 2022. [Shared Prosperity Fund guidance omits R&D and universities](#). London: Research Professional.

³¹ Physics Mentoring Project. 2022. [Our Aims](#). Cardiff: Physics Mentoring Project.

has pointed to the need to maintain sufficient investment in professional learning to deliver CfW.³² This is consistent with lessons to be learned from Scotland’s Curriculum for Excellence.³³

- 2.2 IOP’s projects are funded on an annual basis and face regular funding cliff-edges. Such projects are what the physics teaching community needs and wants, as clarified by a 2020 study from the IOP (for which the Welsh Government was an observer).³⁴ ***The IOP would welcome the draft budget clarifying projects’ potential continuation and, preferably, multi-annual funding.***
- 2.3 Such projects are, in part, a response to the known shortage of physics-trained teachers, a problem Wales shares with the rest of the UK. In 2022, only 43% of those teaching physics in secondary schools were trained in the subject.³⁵ Available data indicates no majority trained in the subject since 2013, with potentially no majority since records started.³⁶

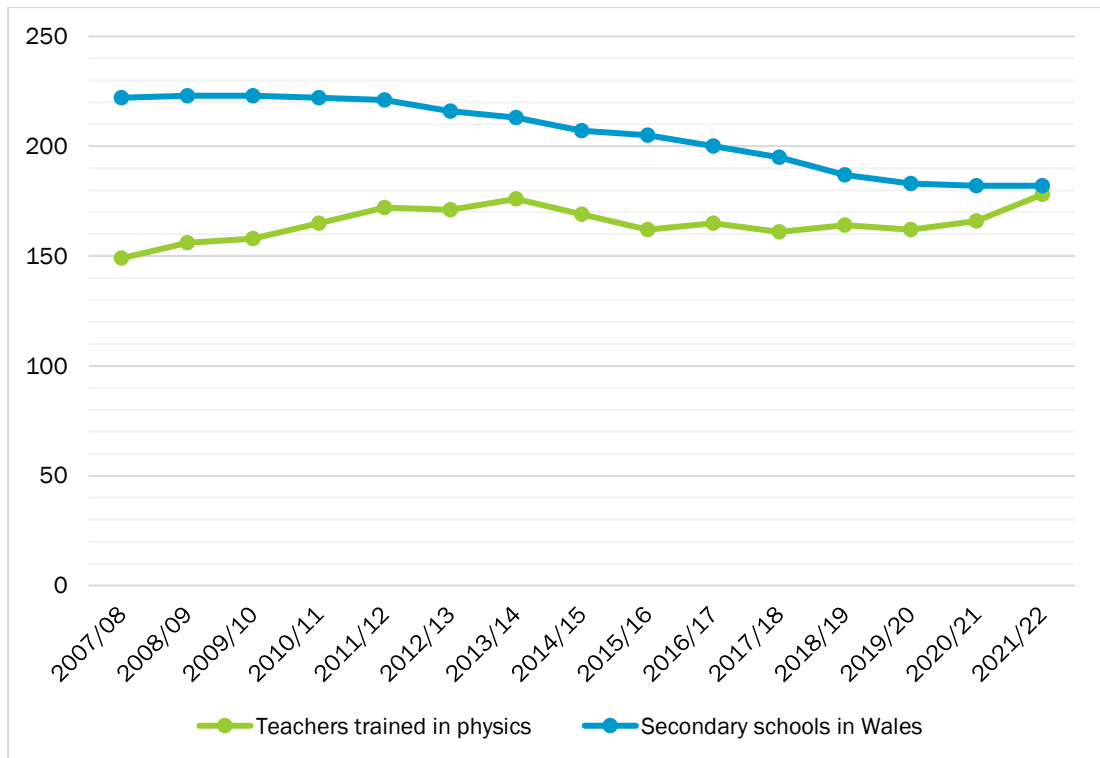
Graph 3: Percentage of physics teachers in Wales trained in physics, 2008–22



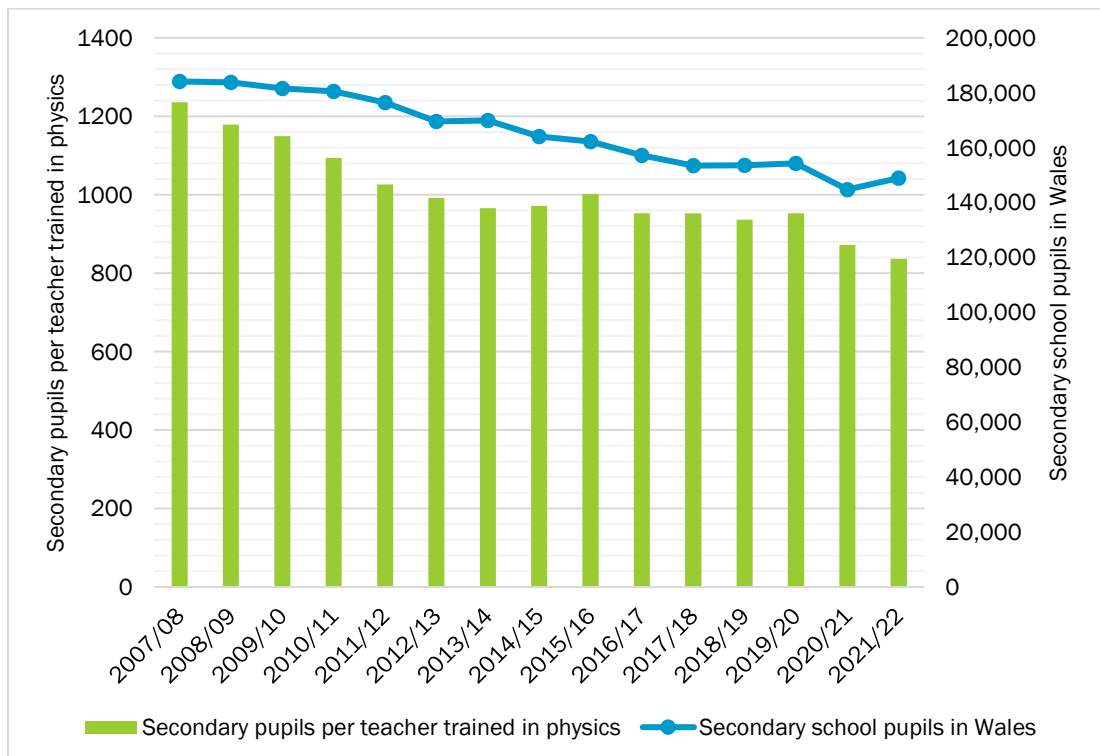
- 2.4 The upshot is that Wales has fewer physics-trained teachers (178) than secondary schools (182). For the latest year, there were 837 secondary school pupils in Wales per teacher trained in physics (note, this is not teachers of physics).³⁷ ³⁸ The gap has narrowed in the last decade, but *the number trained in physics has risen as the proportion of ‘subject known’ has fallen; one cannot be conclusive as to whether there are more physics-trained teachers in the system.*

³² Auditor General for Wales. 2022. [The new Curriculum for Wales](#). Cardiff: Audit Wales.
³³ Muir, K. 2021. [Putting Learners at the Centre: Towards a Future Vision for Scottish Education](#). Edinburgh: Scottish Government.
³⁴ Institute of Physics. 2020. [Subjects Matter](#). London: Institute of Physics.
³⁵ Education Workforce Council. 2022. [Annual Education Workforce Statistics for Wales 2022](#). Cardiff: Education Workforce Council.
³⁶ Education Workforce Council. 2022. [Education workforce statistics](#). Cardiff: Education Workforce Council.
³⁷ StatsWales. 2022. [Schools by local authority, region and type of school](#). Cardiff: Welsh Government.
³⁸ StatsWales. 2022. [Pupils present on census day by local authority and sector](#). Cardiff: Welsh Government.

Graph 4: Teachers trained in physics and secondary schools in Wales, 2008–22



Graph 5: Secondary school pupils per teacher trained in physics in Wales, 2008–22



2.5 The evidence is that the shortage is more pronounced in Welsh-medium education. Welsh Government-commissioned research found science as one of the most difficult subjects for recruitment.³⁹ Research from Bangor University noted, among many key findings, that “student

³⁹ Bryer, N. and Duggan, B. 2019. *Evaluation of Welsh-Medium Provision in Initial Teacher Education*. Cardiff: Welsh Government.

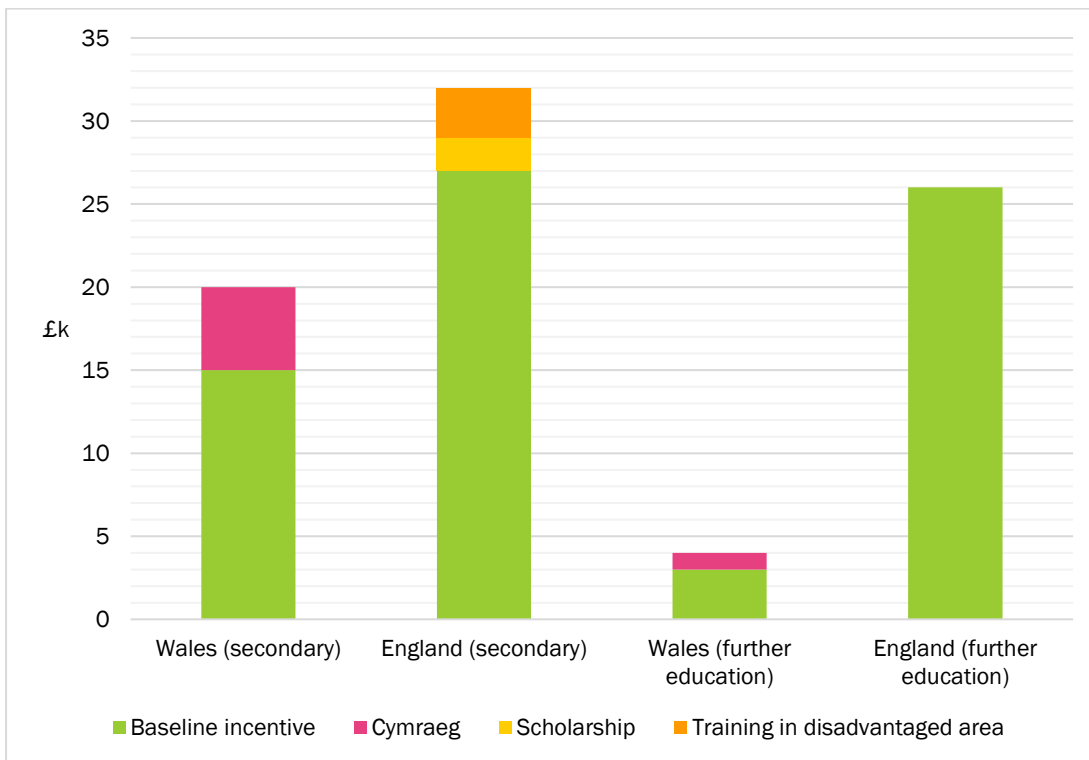
preference is often influenced by teacher bias and this can influence future engagement with Welsh in relation to STEM-related study/work”.⁴⁰

Table 1: ITE physics students and language route (rounded to nearest 5), 2010/11 to 2020/21⁴¹

Language	Year										
	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Welsh	5	5	5	5	*	5	*	*	5	*	5
English	35	35	30	25	25	20	15	15	15	10	35

- 2.6 In line with Cymraeg 2050, the Welsh Government recently issued a 10-year plan for the Welsh-medium education workforce.^{42 43} The plan and associated data analysis acknowledged the shortage and the difficulty Welsh-medium schools face when recruiting science teachers.⁴⁴ The IOP supports the plan and its actions and welcomes the emphasis on longer-term planning. **Any such planning will require consistent funding to offer the best chance of success.**
- 2.6 The discrepancy between Wales and England for initial teacher education (ITE) incentives is pronounced. The financial incentive to train as a secondary physics teacher in Wales is £15,000, extended to £20,000 for those opting for Welsh-medium.^{45 46} In England, the offer is soon to become £27,000, rising to £29,000 for ‘high-calibre’ applicants, with a 3,000 incentive for those choosing to train in the most disadvantaged areas (a separate veterans offer is worth £40,000).⁴⁷ For those opting for further education teaching, the incentive is £3,000 in Wales, extended by £1,000 for those opting for Welsh-medium.⁴⁸ In England, the offer is £26,000.⁴⁹

Graph 6: ITE incentives for physics in Wales and England



⁴⁰ Thomas, E. and Parry, N. M. 2021. *Provision for Welsh-medium STEM subjects: an exploratory study*. Bangor: Bangor University.
⁴¹ StatsWales. 2022. *First years on ITE courses in Wales by subject and year*. Cardiff: Welsh Government.
⁴² Welsh Government. 2021. *Cymraeg 2050: work programme 2021 to 2026*. Cardiff: Welsh Government.
⁴³ Welsh Government. 2022. *Welsh in education workforce plan*. Cardiff: Welsh Government.
⁴⁴ Welsh Government. 2022. *Welsh in education workforce plan: data analysis*. Cardiff: Welsh Government.
⁴⁵ Welsh Government. 2022. *Initial Teacher Education (ITE) Priority Subject Incentive: guidance for students 2022 to 2023*. Cardiff: Welsh Government.
⁴⁶ Welsh Government. 2022. *laith Athrawon Yfory Incentive Scheme: guidance for students*. Cardiff: Welsh Government.
⁴⁷ UK Government. 2022. *Boost for teacher training bursaries by up to £10,000 a year*. London: UK Government.
⁴⁸ Welsh Government. 2022. *Teacher training incentives: PGCE (FE) students*. Cardiff: Welsh Government.
⁴⁹ UK Government. 2022. *FE ITE bursaries funding manual: 2022 to 2023 academic year*. London: UK Government.

- 2.7 Research for the Welsh Government was inconclusive as to whether funding incentives drive recruitment substantially, stating “further research is required to develop an understanding of this issue”.⁵⁰ But it did note “cases where young people were attracted to teach in England because of the incentive difference with Wales [which] raises the question of how prevalent this intention is and how likely it is that those who move to England intend to do so for a fixed period (with a longer-term intention to return to Wales)”.⁵¹ Welsh Government’s aforementioned Welsh-medium research advocated replacing the £5,000 language incentive with £10,000 delivered in instalments across five years (thereby incentivising retention).⁵²
- 2.8 Despite the recommendation to Welsh Government, the IOP is not aware of any further research taking place. However, the IOP can point to findings from England that cash incentives play a role as part of a wider package.⁵³ Concerningly, that research warned “physics is highly unlikely to meet its recruitment target under any package of measures [which] should prompt debate about how the education system can realistically and sustainably staff science departments in schools with a range of specialists”.⁵⁴ Also citing to a Gatsby paper, proposals included:⁵⁵
- Considering the range of training courses offered.
 - Extra subject specialism training for physics (both trainees and existing teachers).
 - Ensuring physics-trained teachers are teaching physics rather than other subjects.
 - Addressing relatively low numbers of students studying physics post-16.
- 2.9 Further studies on cross-border pulls for teacher trainees would be welcome. In lieu of the research, data is available on first year ITE physics students from Wales and location of study.⁵⁶ Between 2010/11 and 2020/21, there were 355 first year ITE physics students from Wales; of that total cohort, 120 (33.8%) went to train in England. *A third of potential physics teachers in Wales have gone to train in England and, with increasing curricular divergence, returning will be difficult.*
- 2.10 It is also worth noting the funding that England’s Department for Education has instituted for teaching internships in chemistry, computing, languages, maths and physics.⁵⁷ The funding is available for school-led partnerships to provide teaching internships for undergraduates studying for a degree in STEM-related subjects and languages. Such schemes already exist in Wales, with Swansea University running an undergraduate module to the same effect. However, schemes in Wales are not in receipt of dedicated funding from the Welsh Government.
- 2.11 ***Not all the above are Welsh Government budgetary matters. However, bursaries, specialist training (see section 2.1 and 2.2) and post-16 participation (see section 2.13 onwards) are. One alone is unlikely to close the teaching gap, which will take many years to close, so should be funded together on a multi-annual basis.***
- 2.13 More broadly, physics suffers from underrepresentation, with a range of communities underserved. Accordingly, the IOP has four policy asks for pre-16 education:
- Revising teachers’ professional standards with an expectation teachers will address injustice in professional practice and actively dismantle discrimination.
 - Ensuring teachers are trained to teach inclusively and tackle injustice, both via initial teacher education and continuing professional learning and development.
 - Directing Estyn to emphasise inclusive teaching and efforts to address injustice.

⁵⁰ Beaufort Research and National Foundation for Educational Research. 2019. [Research Study on the Attractiveness of Teaching and Retention of Teachers](#). Cardiff: Welsh Government.

⁵¹ Ibid.

⁵² Bryer, N. and Duggan, B. 2019. [Evaluation of Welsh-Medium Provision in Initial Teacher Education](#). Cardiff: Welsh Government.

⁵³ Worth, J., Tang, S. and Galvis, M. A. 2022. [Assessing the impact of pay and financial incentives in improving shortage subject teacher supply](#). Slough: National Foundation for Educational Research.

⁵⁴ Ibid.

⁵⁵ Sims, S. 2019. [Increasing the quantity and quality of science teachers in schools: Eight evidence-based principles](#). London: Gatsby.

⁵⁶ StatsWales. 2022. [First Years from Wales on ITE courses in the UK by subject and country of study](#). Cardiff: Welsh Government.

⁵⁷ UK Government. 2022. [Teaching internships programme](#). London: UK Government.

- Mandating whole-school approaches that are informed by ongoing data and evidence collection including students' choices.

2.14 The Welsh Government is making good progress on the above, with many issues acknowledged via the working group on Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum. The Welsh Government accepted all the group's recommendations, which the IOP welcomes.⁵⁸ ***With regards to training, the working group advocated "ringfenced funding within annual professional learning allocations" and it would be positive to see an amount in the draft budget.***⁵⁹

2.15 In light of the above, the IOP would welcome uplifts to the following budget lines (or uplifts indicated previously).

Table 2: Relevant budget lines from 2022–23 budget documents⁶⁰

Ministry	Budget expenditure line	2021–22 (£m)	2022–23 (£m)	2023–24 indicative (£m)	2024–25 indicative (£m)
Education and the Welsh Language	Additional learning needs	9.7	21.1	21.1	21.1
	Curriculum and assessment	7.8	11.0	11.0	11.0
	Curriculum reform	14.1	19.4	19.1	15.7
	Pupil development grant	113.5	133.5	133.5	133.5
	School improvement grant	134.2	171.2	163.2	154.2
	School standards support	1.5	2.8	4.1	5.2
	Teacher development and support	38.9	54.7	55.2	57.2
	Vulnerable groups	1.2	1.2	1.2	1.2
	Welsh in education	13.5	17.8	20.1	24.3
	Welsh language	21.1	22.4	22.4	22.4
Whole-school approach	2.0	5.2	7.4	9.6	
		357.5	460.3	458.3	433

⁵⁸ Institute of Physics. 2022. [IOP Wales welcomes progress on race equality recommendations](#). London: Institute of Physics.

⁵⁹ Welsh Government. 2021. [Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum Working Group](#). Cardiff: Welsh Government.

⁶⁰ Welsh Government. 2022. [Welsh Government budgets](#). Cardiff: Welsh Government.