



Solving Skills
One Year On:
Partnerships powering
apprenticeships

Report index

Solving Skills One Year On: Partnerships powering apprenticeships is made up of two sections: A report and case studies.

The report provides top level highlights of all of the case studies. These are grouped under three themes in the section titled *Successfully solving skills*.

The case studies section delves deeper into each of the case study organisations.

Hyperlinks are provided for easy navigation between the two, allowing readers to dip in and out of the case studies pack and return to the report at any point.

- 03 Foreword
- 04 Introduction
- 06 Spotlight on IOP 2023 Apprentice Awards winner – Saskia Burke
- 08 Successfully solving skills: organisations working in partnership to unlock the value of apprenticeships
- 19 Closing remarks
- 20 Case studies index
 - A Combilift
 - B FMB Oxford
 - C National Manufacturing Institute Scotland
 - D South Yorkshire Mayoral Combined Authority
 - E Manufacturing & Engineering Growth & Advancement
 - F North of Tyne Combined Authority
 - G British Airways
 - H ABS Precision Engineering
 - I CMB Engineering

Foreword

Louis Barson, Director of Science,
Innovation and Skills



Physics skills are transformational – they develop our ability to understand the world at a fundamental level, to use that understanding to generate economic growth and tackle our shared challenges, and they change people’s lives by broadening their horizons and ability to contribute.

Apprenticeships play a crucial role at the interface with business-led solutions. that bring about change – as well as representing rewarding career paths for individuals.

When we first commissioned our research into [physics-related apprenticeships](#), we did so to understand some of the barriers limiting the demand and supply of technical talent in physics powered organisations. Skills shortages have affected physics-powered industries’ ability to grow and innovate (read more in IOP’s report: [Paradigm Shift: Unlocking the power of physics innovation for a new industrial era](#). We were also aware that more than half of physics-related jobs don’t require a degree level qualification, almost 1 million jobs in the UK and Ireland.

But this is not widely known by young people considering their post-16 options, and apprenticeships can offer a viable and rewarding pathway into roles across all levels of qualification. This lack of awareness – exacerbated by the other challenges around employer voice, local contexts, financial pressures, and striking challenges around diversity – mean not enough people are successfully engaging with this much-needed career path.

The opportunities for individuals are significant: in this report, we share the story of our 2023 IOP Apprentice Award winner Saskia Burke, to give a lived example of how rewarding physics-related apprenticeships can be. Unfortunately, we also know that significant stereotypes and misconceptions remain that prevent young people from going into physics-related study and careers. We continue to tackle those head-on through our [Limit Less campaign](#) and providing good information about the rewarding career paths physics can lead to through supporting the [Planet Possibility](#) physics careers consortium.

Our [R&D Blueprint](#) shows that physics-powered businesses drive 11% of UK GDP, underpinning productive industries in every part of the UK and Ireland. The IOPs strategy makes the case for the importance of the skills that drive

physics-powered sectors throughout the economy, including areas of our recent focus such as Quantum Technologies, Semiconductors, and the Green Economy (read about our [impact projects](#) and it champions new ways of meeting that need.

So we know a lot about the opportunities, and the barriers. This report is about solutions. It shines a light on the fantastic organisations delivering impactful work to address the barriers and unlock more of the value of apprenticeships. We want to recognise how this effort pays dividends to apprentices, their employers and regional economies – to inspire others to take action.

In the report you’ll see how solutions must be employer driven, industry relevant and regionally tailored – and that local, regional and national government ambitions around employment and the economy play a vital enabling role. The case studies highlight how partnerships are key; organisations most benefiting from apprenticeships have partnerships with their local training providers and other employers within their business networks and geographies. They also hold relationships with schools and engage in their communities.

Across these spheres they champion their apprentices, and apprenticeships overall – and this helps combat negative stereotypes about this rewarding study and career pathway. We hope you will find these stories as inspiring as we have – and will join us to celebrate these organisations and partnerships. Ultimately, we hope that they give ideas on how to be a part of the change we want to see – becoming a partner in unlocking more of the transformational power of physics through apprenticeships.

Definition of physics-powered – broadly describes sectors or organisations that are underpinned by physics as an enabling discipline, including education and research. This encompasses engineering, manufacturing and green energy, including sub-sectors using cutting edge physics-derived technology such as quantum, nuclear and aerospace. Furthermore, whilst we do employ formal analytical methodologies to define physics skills as they relate to knowledge requirements and specific occupational pathways, physics underpins many education and career pathways.

Definition of physics-related apprenticeships – broadly refers to apprenticeships for which physics or physics-related knowledge is a component of the curriculum, or their on-the-job experience in a physics-powered organisation.

Introduction



This report explores the ways in which organisations are working together to tackle the limitations of the apprenticeship systems across the UK and Ireland. Our 2023 [Solving Skills: Powering growth through physics-related apprenticeships](#) report found that several challenges exist for employers to hire apprentices, and for apprentices to choose and stay on this study and career path – despite apprenticeships offering great dividends for both.

In 2023, IOP convened a series of five Solving Skills Summits and heard from over a hundred physics powered employers, education providers and government representatives from across the UK and Ireland. Across these conversations, we found exciting examples of organisations working in regional partnerships to leverage the opportunities that apprenticeships present despite the barriers we identified. Some of these examples are captured in this report, to provide insight and inspiration, but also to recognise and celebrate the efforts of organisations dedicated to apprenticeships.

These case studies spotlight how organisations can play a significant role in increasing local awareness of apprenticeship opportunities regardless of their size or geography - and how local and regional relationships are key. The stories come from a range of organisations, from small businesses to industry networks of 40+ employers; from rural colleges to training provider networks, from local authorities to national institutes.

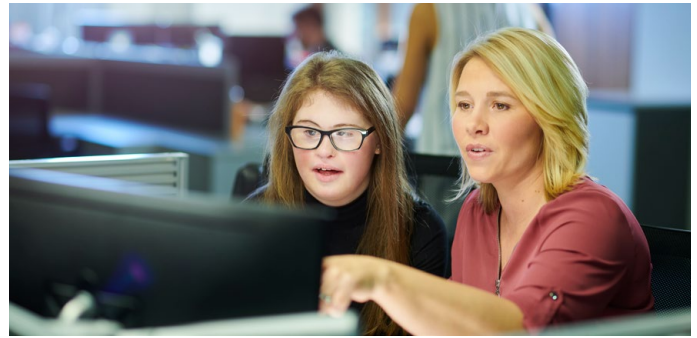
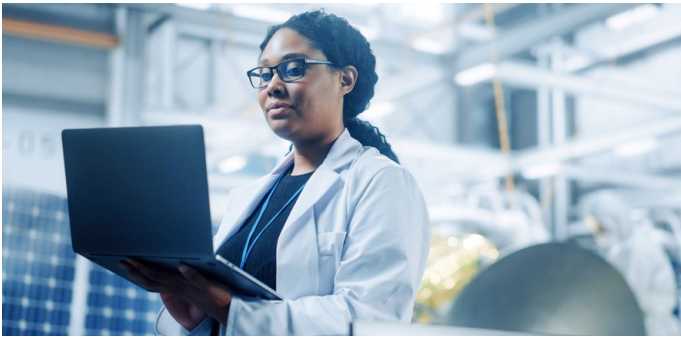
We see how employers work in partnership within their regions to address local skills needs. We share how employers can use apprenticeships to develop their local talent pipeline for international competitiveness, including harnessing talent for specialised skills needs. We share how government investment in the forming of regional partnerships has unlocked access to apprenticeships by smaller businesses, improving the economic and employment outlook of those regions. And we show how organisations are breaking down the stereotypes that hold back young people from pursuing this valuable study and career route.

The stories of best practice shared in this report illustrate how some of the systemic challenges presented by the apprenticeship systems in each nation can be overcome. These barriers must continue to be the focus of the UK and Ireland governments if we are to unlock the true potential of apprenticeships. The calls to action from our 2023 Solving Skills report still stand.

IOP calls to action for UK and Ireland governments

In partnership with stakeholders from across the apprenticeship landscape, governments have an opportunity to address systemic issues that are holding back the growth of STEM apprenticeships as a whole and work towards genuine parity of esteem with other routes. Areas of opportunity are likely to include:

- Ensuring a broad and genuinely representative cross-section of industry is involved in shaping apprenticeships to the benefit of national and regional economies, with a particular emphasis on proactively supporting the engagement of underrepresented SMEs in sectors poised for future growth.
- Ensuring young people in pre-16 education are meaningfully exposed to local employers and technical education providers so that apprenticeships are better understood as a viable route into jobs and have parity with university routes. In England, provider access legislation will need sufficient enforcement, and there is a potential case for equivalent measures in the rest of UK and Ireland.
- Ensuring parity of esteem by reviewing the ways in which technical routes are disadvantaged where there are incentives for schools to promote A levels.
- Tackling the shortage of skilled apprenticeship educators to ensure quality apprenticeship provision and addressing the severe shortage of physics teachers in schools.
- Taking decisive action to break down stereotypes about physics, science and apprenticeships, including making whole school equity plans mandatory in all schools and nurseries.
- Improving data collection on the progression and destination of apprentices, to ensure the systems are genuinely inclusive and open to all, and to inform policy and action.



These calls to action arose from our 2023 [Solving Skills: Powering growth through physics-related apprenticeships](#) report, where we pulled together insights from conversations with and surveys of nearly 300 apprentices, 32 training providers and 39 apprentice employers across the UK and Ireland physics-powered organisations, as well as organisations in the public sector and learned and professional societies.

It found that apprenticeships offer much needed talent and are needed at the forefront of key physics-powered industries, and highlighted that apprentices are committed employees of the organisations that invest in them. Unfortunately, the physics apprenticeships landscape is starkly lacking in diversity and there are systemic, financial and cultural barriers affecting uptake and completion (see Box A for findings).

The solutions begin with employers, who should be front and centre in partnership with other employers, schools and providers, and local or devolved governments. Such coordinated action has the potential to unlock life-changing opportunities for a generation of young people and those seeking upskilling for existing and new careers, help employers tap into a rich vein of talented new employees, and deliver vital skills for future economic growth in the UK and Ireland.

This report makes the case that, although there continue to be challenges in leveraging the apprenticeship opportunities out there, the returns are worth it for employers and the apprentices they invest in. In the following sections of the report, we share the story of our own 2023 Apprentice Award winner illustrating just how meaningful an apprenticeship can be to the individual, their employer and society as a whole. This is followed by case studies of how organisations are tackling the issues that were articulated in our 2023 Solving Skills report.

The organisations we spotlight in the pages that follow have enabled the success of apprenticeships and we look at case studies across the UK and Ireland, under three broad themes. The first theme spotlights how employers have leveraged partnerships with other local employers and training providers to ensure the apprentices they hire hold qualifications that are fit for purpose and offer real value to both employees and employers. The second theme explores how local business

partnerships can improve the access to apprenticeships by smaller employers, and the third shows how employers can stimulate interest in apprenticeships by making them attractive opportunities and by actively championing them in their communities. Section two of this report discusses these organisations and their efforts to maximise the value of apprentices in their regions in greater detail.

Box A. Key findings from Solving Skills: Powering growth through physics-related apprenticeships

- **The voice of employers must be heard: with an increasingly ageing workforce the skills gap is widening, yet we heard there is insufficient employer engagement in apprenticeships, and small and medium-sized enterprises (SMEs) find this most challenging.**
- **Local needs must be met: apprenticeships are driven by local industry needs, yet young people are insufficiently exposed to these opportunities and there is a leaky pipeline (in England and Northern Ireland, more than 40% of apprentices dropped out in 2020).**
- **Financial pressures create barriers: 26% of the apprentices we spoke with expected to have financial issues relating to their apprenticeship. More than 30% had transport issues getting to their employer, with 34% travelling more than 20 miles to their provider.**
- **Diversity is a work in progress: a very small number of physics-related apprentices are women (in Scotland 4%, Wales 6% and England 21%). Stereotypes about apprenticeships leading to 'low status jobs' compound wider stereotypes about the difficulty of physics-related qualifications and the range of careers they can offer.**

Spotlight on IOP 2023 Apprentice Awards winner

Saskia Burke

Our 2023 Solving Skills research uncovered significant challenges for young people to engage with apprenticeships, from travelling long distances to their providers and employers, to financial pressures due to low pay and cost of living. These issues to individuals cumulatively create barriers to their employment in physics-powered organisations that are working to solve global societal and economic challenges.

Here we spotlight [Saskia Burke, the winner of IOP's Apprentice Award 2023](#). Saskia's story shows just how beneficial it is to find out about apprenticeships in good time, to be aware of local opportunities, to have support from parents or carers, to have suitable access to transport, and to have a supportive employer and work environment – all these played some part in her success.

And what she has done with this opportunity will mean far more than the recognition IOP can bestow upon on her – during her apprenticeship, her work contributed to solving real world medical challenges. She was classed as an essential worker because of her contributions to improving the calibration of hospital ventilators. She also participated in work that improved impurity checks for flourine-18 – a cancer diagnosis radiopharmaceutical. Saskia is now a full-time employee at National Physical Laboratory, and is working on climate change modelling, hoping to tackle a globally relevant problem.



Saskia's apprenticeship journey

Although she completed maths, physics and philosophy A levels, Saskia didn't quite see herself going to university. However, she applied because that's what everyone else was doing and she wasn't aware of other options. It was fortunate that, just as she was sitting her exams, her school hosted a visitor that talked about apprenticeships. Saskia recalls this being a pivotal moment

"I was sitting there and thinking, yes, this is what I want to do!"

Her online search for science-based apprenticeships found few options for those with a passion for physics, but she found an opportunity at National Physical Laboratory (NPL), only 15 minutes' drive from where she lived. NPL is the UK's National Metrology Institute, a public sector organisation that provides a measurement infrastructure and enables powerful analysis of data across a multitude of disciplines including aerospace, defence, environment, finance, healthcare, manufacturing and space – to name a few. Saskia was successful in her application, and never looked back.

"I wish more people knew, at the time I was at school, that apprenticeships were an option- which is why I love doing outreach so I can tell everyone about them.

I don't want other kids to miss out on the apprenticeship opportunity because I know how stressful school can be for some people and not knowing that this is an option and forcing themselves through university, for the sake of it, is not right."

Her parents played an important role in helping with her application, but it was their understanding that enabled Saskia to pursue this path:

"They were really supportive because they also could see that university was not the right choice for me. My parents were really glad that I found something that I would be good at and that would suit me."

During her time at NPL, Saskia has been supported to do outreach work, raising the profile of physics-related apprenticeships and career pathways in promotional videos, at in person and digital events inspiring young people into STEM careers. NPL has provided a supportive and engaging environment – apprentices are valued, offered training opportunities and rotations within different departments to expand their experience, and are well supported by staff, who build their capability and autonomy. In addition to support with the apprenticeship itself, NPL offers apprentices the same wider support as its other employees, including being part of networks and support groups, such as one for neurodiversity for example. Saskia was nominated by her employer to feature in the Technician's Gallery at the London Science Museum.



"Saskia has a great future in science, and the apprenticeship will always be the bedrock of that career. She has become a great example of how a young apprentice can be a high achiever, seeking the most out of experiences, and taking pride in helping her cohort to also succeed. Recognising this, her peers awarded her the first Glazebrook Apprentice Award, something presented to the best apprentice of the graduating cohort"

Lucy Caffery, Chair of the NPL Awards committee

Since finishing her apprenticeship, she has stayed at her employer working in nuclear metrology as an Assistant Scientist and has even won funding to run her own research that will contribute to improved climate change modelling, thereby playing a part in the solutions that could ultimately help tackle this global problem.

This success story shows how apprenticeships can play a role in finding solutions for societal problems whilst also tackling the skills gaps that enable physics-powered organisations to thrive.

Successfully solving skills:

organisations working in
partnership to unlock the
value of apprenticeships





Our 2023 report and the extensive stakeholder engagement that followed, including five IOP Solving Skills Summits across UK and Ireland, highlighted the value of partnership amongst employers, and with their local providers of education and training.

In our 2023 [Solving Skills report](#), we called on employers to ensure apprenticeships qualifications meet demand, that they are fit for purpose and address known skills shortages. We also called on smaller employers to form local or regional coalitions to better leverage the value apprenticeships can offer. Lastly, we asked for businesses to engage their local communities to raise awareness of apprenticeships and tackle the limiting stereotypes influencing potential apprentices, and those who influence them.

Over the next few pages, we share examples of how fit for purpose apprenticeships offer real value to two physics-powered organisations: a large employer, Combilift in Monaghan, Ireland, and a small employer FMB Oxford, in England.

We follow this by sharing three examples of how smaller businesses can benefit from local partnerships to better access apprenticeships, boosted by government funded initiatives: the work of the National Manufacturing Institute of Scotland, the South Yorkshire Mayoral Combined Authority in England and Northern Ireland's Manufacturing & Engineering Growth & Advancement small business network.

Finally, we share four case studies illustrating just how employers of all shapes and sizes can powerfully tackle the stereotypes limiting the uptake of apprenticeships in their local communities, raising the esteem and value of apprentices in physics-powered sectors. We share how schools and employers partnered to stimulate local supply and demand of talent in the North East of England, and how apprenticeships can offer attractive career prospects at British Airways in the South. We also hear from two smaller employers whose workforce is made up of previous apprentices, showing just how valuable apprenticeships can be to the sustainability and success of a business: ABS Precision Engineering in Benton, Newcastle upon Tyne and CMB Engineering in Cardiff, Wales.

More detailed information on these case studies is provided in the second section of this report, where we expand on the fantastic work these organisations are doing.

Apprentices in physics-powered sectors have a crucial part to play in tackling skills gaps, and we hope this report further strengthens our calls for action by the UK and Ireland governments to unlock the potential of apprenticeships and champion efforts to tackle the systemic issues that create barriers for engagement with these rewarding career pathways. We hope that these examples will serve as inspiration to decision-makers across the UK and Ireland – showing what can be done to tackle these challenges, and providing concrete examples of best practice that can be transferred into different contexts.

Fit for purpose apprenticeships offer real value to physics- powered employers

1

Alana Kernan, recent apprentice graduate from Combilift and winner of an OEM Apprenticeship Academic Excellence Award.



Our Solving Skills Summits and other conversations with physics-powered organisations, highlighted the challenges of an ageing workforce and a lack of skilled staff threatening employers' ambitions; the skills gap is widening, and the growth of tech and green energy sectors are increasing the pressure. This was particularly acute for small and medium-sized enterprises (SMEs), who struggle to engage with the apprenticeship system due to resource constraints.

However, we also heard how employers, both large and small, can use apprenticeships not only to meet their specific skills needs but also to shape their own pipeline of future talent by working in partnership with local training providers. We share two such success stories here.



FMB Oxford apprentice Angus, working on specialised equipment.

Case study A

Combilift

Large employer developing local talent pipeline for international competitiveness

Combilift, based in In Monaghan, Ireland and holding the world's largest share of multi-directional forklift manufacturing business, led a consortium of industry leaders to partner with a training provider to develop a new three-year Level 6 Original Equipment Manufacturing (OEM) Engineering Apprenticeship. This degree level apprenticeship provides training which maps directly to in-demand job opportunities in the country, opening a talent pipeline that supports Ireland's international competitiveness in the manufacturing sector.

Combilift already offers an internationally recognised Level 5 Engineering Traineeship in OEM which boasts an 85% graduate employment rate. The company was eager to use this budding pipeline of local talent to further develop fit for purpose skills needed by the industry with a higher-level apprenticeship.

“Since the start of the course in 2015 over 100 people have completed the Traineeship and the vast majority are still working with us. Several have gained promotions while others have been sponsored by the company to undertake further study...including the OEM Engineering Apprenticeship Programme.”

Martin McVicar, Managing Director, Combilift

As a large employer in a relatively rural region, Combilift has led a partnership that has added to the career prospects of local people, and the success of the local economy.

[Click here to read more about this case study](#)

Case study B

FMB Oxford

Small business partnering with provider to address highly specialised skills needs

In Oxfordshire, England, an SME with circa 60 employees, FMB Oxford, is strengthening its sustainability by nurturing its own pipeline of talent using apprenticeships. FMB Oxford has built its business model to maximise apprentices' learning on the job – particularly important given its specialised work in manufacturing instruments for particle accelerators.

“It's hard to find the right people with the right skill set in our niche business, so it's often better and easier for us to train them from scratch than to employ more qualified or experienced people”.

Beverley (Bev) O'Farrell, HR Manager

Over the past 15 years, the company has worked closely with its apprenticeship provider the Engineering Trust Training (ETT), helping ETT understand the business and how the on-the-job experience maps onto the course content. This has meant that ETT supports apprentice recruitment by helping source candidates that would be a good fit for FMB Oxford – ensuring that the qualification is fit for purpose and meets the skills needs of this small employer. This approach has been working very successfully, and FMB Oxford has enjoyed a high level of retention of its apprentices; it has hired at least one apprentice a year over the past 15 years and many still work for the business today.

[Click here to read more about this case study](#)

Local business partnership initiatives boost small employer access to apprenticeships

2

Representatives from Es Paradis, Yorkshire Accommodation Bureau and Nikken World at the launch of the South Yorkshire Apprenticeship Hub.



Our 2023 report uncovered that hiring apprentices may be seen as an ‘administrative burden’ by small and medium-sized enterprises (SMEs). SMEs expressed concerns about the productivity loss resulting from training or mentoring apprentices by those who hold core delivery roles in the business. This has stifled the uptake of apprenticeships by SMEs, which represent 99% of all physics-powered business.

SMEs attending our Solving Skills Summits shared how they need help to better understand the value of apprenticeships and navigate the system, and here we offer three case studies of how government investment in tailored regional interventions can unlock SME access to the apprenticeship system.



Headquarters of the National Manufacturing Institute Scotland.

Case study C

National Manufacturing Institute Scotland National institute enables SME access to apprenticeship talent pool

In the outskirts of Glasgow, the National Manufacturing Institute Scotland (NMIS) has received funding from the Scottish government to help SMEs be more easily matched to quality apprentice candidates. NMIS identified that large employers tend to attract sizeable numbers of apprenticeship applications whilst SMEs struggle to find the talent they need. So, it has launched a pilot scheme that will create a database of apprenticeship candidates that were shortlisted but unsuccessful for positions at large employers and connect them to SMEs with apprenticeship vacancies. This is known as the Pre-Approved Talent Scheme (PATS).

PATS aims to enable smaller businesses to source talent whilst benefiting from the resource invested into due diligence completed by the larger employers. It will also signpost applicants to relevant micro-credentials and college courses that would hopefully make them a more successful candidate in the future. 20 SMEs and four large employers have signed up to the pilot, and the results will be available shortly after it closes in March 2024.

[Click here to read more about this case study](#)

Case study D

South Yorkshire Mayoral Combined Authority (MCA)

MCA backs scheme to boost apprenticeship engagement by SMEs

The South Yorkshire Mayoral Combined Authority, the South Yorkshire Colleges Partnership and the South Yorkshire Providers Network, worked together to launch an Apprenticeship Hub, whose objective is to support the region’s SMEs and micro-businesses to hire 300 new apprentices by 2026. There are approximately 200 physics-powered SMEs in the region, across sectors including high precision engineering, clean energy and advanced manufacturing.

This is a regional focus highlighted in the South Yorkshire Local Skills Improvement Plan:

“a range of technical skills are often missing from the current workforce, with a number of industries facing distinct challenges. For example, manufacturing has an ageing workforce and engineering has a low number of women in the industry.”

The Hub will provide tailored support to SMEs by matching the talent needs of employers to suitable apprenticeships and providing support with recruitment. The Hub will also raise the reputation and profile of apprenticeships by working with training providers and schools’ careers advisors to stimulate more interest in uptake.

[Click here to read more about this case study](#)

Case study E

Manufacturing & Engineering Growth & Advancement (MEGA)

SME network increases sector attractiveness for apprenticeship talent

Invest NI and the Mid Ulster Council are sponsoring an industry member network of 43 small and medium-sized enterprises (SMEs) in Mid Ulster, Northern Ireland. MEGA (Manufacturing & Engineering Growth & Advancement) seeks to advance and grow world-class manufacturing and engineering in Northern Ireland by creating a centralised place for all apprenticeship opportunities, creating a stronger pull for talent and stimulating the supply.

“One of the mainstays of manufacturing in the Mid Ulster area is... that companies based here represent almost half of the global manufacturing of crushing, screening, recycling and materials handling equipment. These companies compete fiercely with each other right across the world, nevertheless, their strategic leaders have fully embraced the idea of working collaboratively to address the skills and people shortages we all face...”

We believe that more people need to be exposed to the opportunities that exist on our doorstep within the manufacturing and engineering sectors. Industry in Mid Ulster offers high quality, highly paid careers that are sustainable in the long-term, here at home.”

Darragh Cullen, Managing Director of Edge Innovate and Chair of the MEGA Collaborative Network

To date, MEGA has enabled 87 different apprenticeship pathways and recruited to 270 apprenticeships vacancies, also launching the MEGA Degree Apprenticeship in 2021 in partnership with Ulster University and the Department for the Economy – Northern Ireland’s first ever Degree Apprenticeship in Manufacturing and Engineering.

[Click here to read more about this case study](#)



Keith Richardson, South Yorkshire Apprenticeship Hub Manager, speaking at the launch.



Manufacturing & Engineering Growth & Advancement (MEGA) apprentices standing outside their employer, Mallaghan, in Northern Ireland.

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

3

British Airways apprentices at one of the company's hangars.



Our 2023 report highlighted how young people considering physics-related apprenticeships, may be deterred by misconceptions about them leading to 'low status' jobs. This is compounded by wider stereotypes about who can "do" physics, and a lack of knowledge about the wide range of careers physics can lead to. These misconceptions are widespread in society, and present significant barriers to uptake of physics post-16, particularly for those in underrepresented groups – something that we are tackling through our Limit Less campaign.

Schoolteachers, parents and carers play an important role in shaping perceptions around study and careers

pathways, yet we learned from our conversations across the Solving Skills Summits that they tend to perceive university as a more valued route, and don't feel confident about recommending alternative pathways like apprenticeships.

Given the significant and widening skills gap for physics-powered sectors, employers have an important part to play in tackling the stereotypes that limit potential apprentices from engaging with this rewarding route. The last three case studies of this report highlight how employers are championing apprentices and raising the esteem and attractiveness of apprenticeships in their communities – with great success.



IOP Institute of Physics

Limit Less is the campaign to support young people to change the world and fulfil their potential by doing physics. We want to inspire young people from groups under-represented in the physics community to do physics post-16.

Employers are in danger of missing out on the new generation of talented young people because too many are being discouraged from doing subjects at school that equip them with the vital skills, approaches and mindsets to help them excel in the workplace.

Unfortunately, some young people are put off by the misconceived ideas they are told about what physics is. Others are denied the opportunity to study physics due to the prejudice and stereotypes that they experience because of who they are. Many girls are told that physics is more suited to boys, and both girls and boys are told that physics is not for the likes of them based on their ethnicity, their sexual orientation, their disability and their social background. When young people are deterred from studying physics, they are denied the opportunity to explore how the world works and contribute to shaping their future as informed citizens.

Case study F

North of Tyne Combined Authority

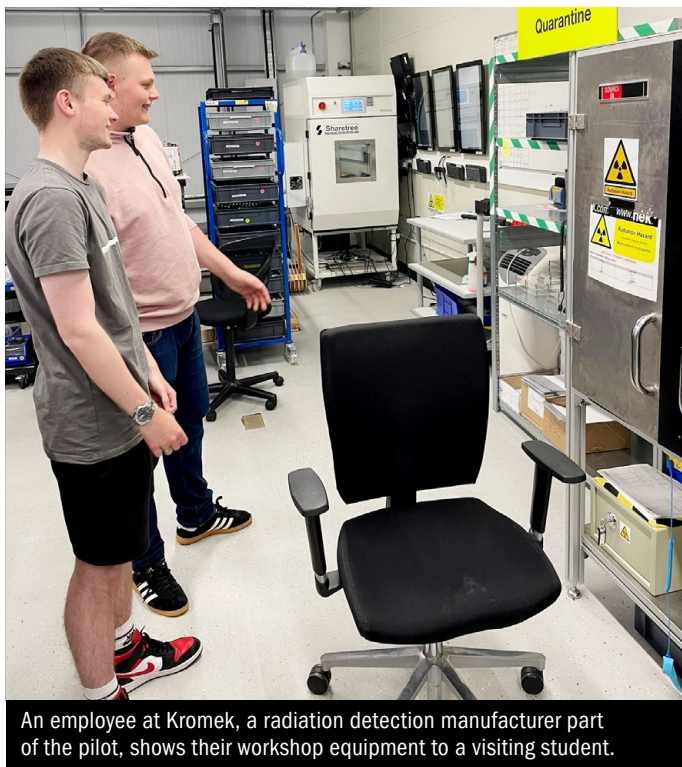
Collaboration between schools and employers stimulates interest in STEM careers

In a bid to tackle skills shortages and acute unemployment, the North of Tyne Combined Authority funded the North East Local Enterprise Partnership (a public, private and education sector partnership) to run a school engagement pilot called *Linking Curriculum to the World of Work*. Recognising that teaching staff often do not have the networks, capacity or tools to engage with industry to create context-based resources, 10 schools were partnered with 19 local employers, involving over 1,500 11-14-year-olds.

Students engaged in curriculum-led learning activities that were co-developed by teachers and industry representatives, in areas of core economic aspirations for the region such as renewable energy. Students also visited employers and were visited by them, including their apprentices.

This had a positive effect on teacher confidence about jobs in STEM sectors: regardless of their specialism the number of teachers feeling confident in talking about STEM opportunities in the region increased from 20% to 100%.

[Click here to read more about this case study](#)



An employee at Kromek, a radiation detection manufacturer part of the pilot, shows their workshop equipment to a visiting student.

Case study G

British Airways

Large employer puts apprenticeships at the heart of its talent pipeline

IOP's 2023 Apprenticeship Employer Award winner British Airways, found that investment in its own pipeline of talent was a necessity for increasing the diversity and sustainability of its business.

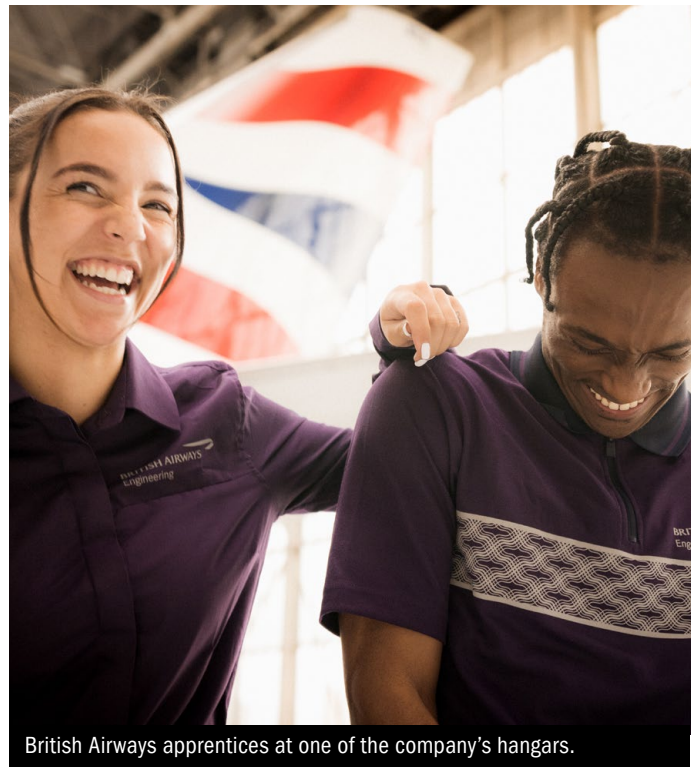
“They grow you, not just as an engineer, they grow you as a person.”

Current British Airways Aircraft Maintenance Apprentice

Starting with its award-winning “Inspire” programme – an aviation and employability focused outreach programme for school and college students – this London-HQ company often uses its own apprentices in outreach and is committed to meeting the government’s diversity in STEM targets. One in five of its apprentices completed a work experience placement at British Airways – it provides purposeful programmes designed to meet specific skills needs that tap into locally available talent.

British Airways makes the role attractive, raising the esteem of apprenticeships; it sponsors the first year’s accommodation and offers competitive pay, discounted travel, generous annual leave and diverse upskilling opportunities. Of the 300 apprentices that started its Aircraft Maintenance Apprenticeship since 2010, more than 80% are still working there.

[Click here to read more about this case study](#)



British Airways apprentices at one of the company’s hangars.



ABS Precision Engineering apprentice at its facility.



A CMB Engineering apprentice and member of staff answering questions at a school careers event.

Case study H

ABS Precision Engineering

Apprenticeships at the heart of a small business

“Engineering is missing a trick. Why not have a more diverse workforce?”

Paul Martin, Production Manager at ABS Precision Engineering

ABS Precision Engineering is a small manufacturing company in the North East of England that has invested in overcoming the stereotypes limiting young people from engaging with apprenticeships. With just under half of its full-time workforce having started out as apprentices with the company themselves, ABS Precision Engineering has built a longstanding culture of support. This includes welcoming parents, carers and potential applicants to its facility, where employees talk about the work and the opportunities that an apprenticeship can offer, supporting informed choices about study and career options.

“I really like working at ABS because the culture here is inclusive, supportive and forward-thinking. I feel like I've been accepted into the workplace and part of 'ABS family'. The learning keeps me challenged and engaged by constantly pushing me just outside my comfort zone so I progress. The training isn't just professional development, but also personal development which I began to realise it's how the company builds the right culture in the workplace.”

Current ABS apprentice

[Click here to read more about this case study](#)

Case study I

CMB Engineering

Employer actively championing apprenticeships in their local community

In Cardiff, Wales, CMB Engineering has long seen the value of apprentices to its business: 10 of the company's 14 business directors started as apprentices themselves, and the company runs a well-established apprenticeship training scheme that is advertised to careers advice teams in local schools and colleges.

CMB Engineering uses its convening power across its business networks to champion apprentices – fundraising for workshop teaching equipment as well as personalised equipment kits. It sponsors its apprentices to compete in regional and national awards, and its apprentices champion the business by sharing their personal stories across CMB Engineering's networks.

[Click here to read more about this case study](#)

Closing remarks

We want to congratulate the organisations that have shared their stories for their efforts in creating opportunities for apprentices to thrive in their organisations, and to raise the profile of this rewarding study and career path in their communities and networks. The second section of this report provides an opportunity to dive deeper into these stories, and as we look to the future, we hope that such good practice will continue across physics-powered organisations in the UK and Ireland.

As can be seen from the variety of case studies in this report, employers of all sizes and geographies can strengthen the sustainability and diversity of their business through apprenticeships. Working in partnership with other local employers and training providers can reduce cost and effort and enable greater access to apprentice talent – helping boost economies at a regional and national scale, as well as the global market competitiveness of our industries. And importantly, apprenticeships also offer impactful career opportunities for apprentices.

However, in order for apprenticeships to play an impactful role in tackling the skills gap holding back the growth of the UK and Ireland's economies, the systemic challenges in the apprenticeship systems of each nation must be addressed. Our calls to action for each of the UK and Ireland governments still stand: Employers need to be in the driving seat, and the solutions tailored to local and regional talent needs. We must focus on increasing the size and diversity of young people choosing this pathway by breaking the stereotypes that limit them.

The IOP continue to champion these asks in their conversations with government. Throughout 2023, we have contributed to several consultations on skills and apprenticeships and presented our case to governments across the UK and Ireland at parliamentary sessions and committees. We have informed the writing of nine Local Skills Improvement Plans across England, and have continued to champion our £2m Challenge Fund-backed initiative, [Planet Possibility](#); a consortium of partners that have already delivered physics careers events and workshops to over 3000 young people from underserved and under-represented communities, with hundreds of teachers attending related professional development sessions and tens of thousands of visitors accessing the careers resources on its website.

How you can help: please share your success stories

This report captures a snapshot of conversations we've had during 2023, but the solutions are still on the horizon. We welcome your success stories, insights and suggestions, and invite you to share them with us via education@iop.org.

Case studies index

We would like to thank the organisations' who contributed to this report, and many others, for sharing their stories of success of apprenticeships across the UK and Ireland. Their stories are only a small sample of organisations helping to break down the barriers to the success of apprenticeships in physics-powered sectors. Whilst there are challenges that continue to limit the role apprenticeships can play in offering rewarding study and career options, and powering growth of the economies across the UK and Ireland, these organisations have committed to overcoming them – a commendable effort worthy of celebration.

The following pages delve deeper into the case studies highlighted in section 1 of this report and follow the same sequence. Each of the headings in this index is hyperlinked to the case study below.

After each case study, you have the option to navigate back to the main report.



1

Fit for purpose apprenticeships offer real value to physics powered employers

p22

Case study A

Large employer developing local talent pipeline for international competitiveness: *Combilift: Monaghan, Ireland*

p24

Case study B

Small business partnering with provider to address highly specialised skills needs: *FMB Oxford: Oxfordshire, England*

2

Local business partnership initiatives boost small employer access to apprenticeships

p26

Case study C

National institute enables SME access to apprenticeship talent pool: *National Manufacturing Institute Scotland: Glasgow, Scotland*

p28

Case study D

MCA backs scheme to boost apprenticeship engagement by SMEs: *South Yorkshire Mayoral Combined Authority: South Yorkshire, England*

p30

Case study E

SME network collaboration increases sector attractiveness for apprenticeship talent: *Manufacturing & Engineering Growth & Advancement (MEGA): Mid Ulster, Northern Ireland*

3

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

p32

Case study F

Collaboration between schools and employers stimulates interest in STEM careers: *North of Tyne Combined Authority: North East England*

p34

Case study G

Large employer puts apprenticeships at the heart of its talent pipeline: *British Airways: London, England*

p36

Case study H

Apprenticeships at the heart of a small business: *ABS Precision Engineering: Benton, England*

p38

Case study I

Employer actively championing apprenticeships across their business networks: *CMB Engineering: Cardiff, Wales*

Case study A: Large employer developing local talent pipeline for international competitiveness

Combilift in Monaghan, Ireland

Martin O'Brien, member of the Apprenticeship Council, holding the Generation Apprenticeship Employer of the Year Award awarded to Combilift in 2020, with company founders standing either side: Robert Moffett on the left and Martin McVicar on the right.



About Combilift:

Combilift is the largest manufacturer of multi-directional, side loading and articulated forklifts in the world, exporting to 85 countries. Established in 1998, it has grown its workforce to more than 700 people, all employed locally in the relatively rural region of Monaghan. In 2020, Combilift won the Generation Apprenticeship Employer of the Year in the large company category.



In an effort to develop engineering talent to meet local job demand in its sector, Combilift led a consortium of industry partners to work with the Cavan and Monaghan Education and Training Board (CMETB). The partnership enabled the development of a three-year Level 6 OEM Engineering Apprenticeship which leads to a variety of roles in the company and industry, supporting the sector's international competitiveness.

The apprenticeship builds on an already internationally recognised Level 5 Engineering traineeship in OEM (Original Equipment Manufacturing), creating an opportunity for higher level training and work opportunities.

The opportunities offered by the OEM apprenticeship are particularly important in the rural locality of Monaghan, a region of circa 65,000 people. The apprenticeship has targets for expanding the diversity of the talent pool, a core aspiration built into the design of the programme.

“The OEM Engineering Apprenticeship is committed to increasing female intake on the programme. Despite much progress, female engineers represent only 12% of the profession in Ireland... Although significant

progress is being made, challenges persist, highlighting the importance of fostering inclusivity and supporting women pursuing careers in engineering. The shortage of females working in engineering roles is a global challenge with Ireland being no exception.”

AnnaMarie Woods, OEM Engineering Apprenticeship Programme Manager, CMETB

One of its recent OEM apprentice graduates, and winner of an OEM Apprenticeship Academic Excellence Award, was quoted as saying:

“Working in the engineering industry for the last 5 years has truly been an eye-opener for me. The stigma that is wrapped around women working in engineering needs to become a thing of the past, there are many brilliant female engineers... Now that I am a graduate of the OEM apprenticeship, I am even more confident in my capabilities as a female engineer and my future is limitless.”

Alana Kernan

[Click here to return to the main report](#)

The physics in the Original Equipment Manufacturing (OEM) sector

The OEM Sector manufactures a range of bespoke equipment using complex electrical, battery, electro-mechanical, hydraulic, pneumatic and electronic technologies. Substantive ideas and principles from physics form the basis for much of an OEM

engineer's work: ideas about forces, fluid flow, circuits, electromagnetism and thermal effects are essential for innovation and design of parts; and they all play a part in implementing and optimising the manufacturing processes.

Fit for purpose apprenticeships offer real value to physics powered employers

Case Study B: Small business partnering with provider to address highly specialised skills needs

FMB Oxford in Oxfordshire, England

FMB Oxford apprentice Lilian, in the workshop.



About FMB Oxford

FMB Oxford is a business with circa 60 employees, manufacturing instruments for photon delivery systems, or particle accelerators, to a predominantly international customer base.

In 2023, it was a finalist and highly commended for its Apprenticeship Employer of the Year nomination at the Oxfordshire Local Enterprise Partnership awards, in the less than 250 employees category. It was nominated by its training provider Engineering Training Trust (ETT).



Despite the challenges for engaging with the apprenticeship system often faced by small to medium-sized enterprises (SMEs), FMB Oxford has found the benefits outweigh the costs. Being a small organisation in a highly specialised field, FMB Oxford is shaping a pipeline of talent to maintain its international competitiveness. Working closely with its training provider Engineering Trust Training (ETT), it has ensured that the relevant apprenticeship qualification is fit for purpose and addresses baseline skills needed by the business, which are further developed in the workplace.

FMB Oxford takes on an apprentice each year, working very closely with ETT. This is a powerful collaboration based on trust, that enhances the quality of apprentice applicants because the provider understands the business, and the business understands the value the apprenticeship can offer. Once they are employed, apprentices are given highly specialist training, go on rotations around the company to learn about different parts of the business, as well as trips abroad to learn more about the company's clients.

“The real benefit of having an apprentice is watching them come in and grow in confidence, knowledge and experience, this not only helps them but the business as well.”

Beverley O’Farrell, HR Manager, FMB Oxford

This investment has resulted in a high rate of conversion of its apprentices into permanent staff. Of the 17 apprentices FMB Oxford employed, all remained with the business for a significant period of time and many still work there. One recently graduated apprentice is now its Quality Coordinator, while others have progressed into senior roles such as Production Manager and Senior Design Engineer. Its apprentices are passionate ambassadors of the company at open days, and of apprenticeships in general: showing how apprenticeships can offer highly specialised and internationally marketable experience.

[Click here to return to the main report](#)

The physics of particle accelerators

A particle accelerator is a device that uses electromagnetic fields to accelerate charged particles, such as protons or electrons, to reach velocities close to the speed of light. These particles are directed into collisions or experiments, allowing scientists to study the fundamental properties of matter. Particle accelerators are used in many fields, including medicine - where they

can be used for cancer treatment or medical imaging. Work in this field relies on principles at the heart of physics-based thinking: apprentices working in this sector would build on their knowledge of assembling apparatus, taking measurements and working through problems using reason and logic.

Local business partnership initiatives boost small employer access to apprenticeships

Case Study C: National institute enables SME access to apprenticeship talent pool

National Manufacturing Institute Scotland (NMIS),
in Glasgow, Scotland

Inside NMIS headquarters, on the outskirts of Glasgow, Scotland.



About NMIS

NMIS brings together industry, academia and the public sector to work on ground-breaking advanced manufacturing research to transform productivity levels, make companies more competitive, and boost the skills of the current and future workforce. NMIS grew out of the University Strathclyde's Advanced Forming Research Centre and includes the Lightweight Manufacturing Centre, Digital Factory, Manufacturing Skills Academy and soon to be opened Digital Process Manufacturing Centre.



With the support of government funding, and working in partnership with Skills Development Scotland, NMIS sought to investigate the barriers for small and medium-sized enterprises (SMEs) recruiting apprentices. It sought to better understand the scale of the problem and potential solutions and held a series of discussions with SMEs and large employers in manufacturing, engineering and renewables industries, as well as academia and governmental agencies.

During these discussions, NMIS identified that larger employers attract greater numbers of apprenticeship applications relative to the number of places available, whilst SMEs can struggle to attract suitable applicants. SMEs were also often not as well-resourced to take on the administrative overhead of apprentice recruitment due to their size.

Furthermore, applicants unsuccessful for an apprenticeship with a large employer may find themselves discouraged from reapplying elsewhere. This was found to increase the loss of talent to other sectors, as well as out of the Scottish education system and ultimately its economy.

As a result, NMIS set up the Pre-Approved Talent Scheme (PATS), a pilot seeking to connect applicants unsuccessful in gaining an apprenticeship place with a large employer with a suitable SME instead. This lessens the administrative overhead for SMEs whilst improving the chances of apprentice applicants finding a suitable placement.

In addition to talent matching for SMEs, support will also be given to the unsuccessful applicants to improve their employability; such as signposting to micro-credentials or college courses if their education or training needs bolstering or facilitating interview practice opportunities if feedback indicated this was a particular concern.

NMIS is working with 20 SMEs and four large employers to pilot the scheme, whose findings will be reported in March 2024.

[Click here to return to the main report](#)

The physics in advanced manufacturing

Advanced manufacturing is a multidisciplinary approach integrating physics with engineering, materials science and computer science. A good foundation in physics enables those working in the sector to understand materials, structures and mechanics, as well as how to work with quantities (acceleration, force, power) and their measurement.

The aerospace sector extensively uses advanced manufacturing for designing and building advanced training and combat aircraft requiring cutting-edge technology. For example, the UK is developing a supersonic stealth fighter – a plane that will need to have an engine that is powerful enough to fly faster than the speed of sound (767 miles per hour), in a structure that can withstand the forces of supersonic flight.

Local business partnership initiatives boost small employer access to apprenticeships

Case study D: MCA backs scheme to boost apprenticeship engagement by SMEs

The South Yorkshire Mayoral Combined Authority, England

Partners celebrating the launch of the Apprenticeship Hub. From left to right: Jack Kidder (Henry Boot), Fliss Miller (South Yorkshire Mayoral Combined Authority), Keith Richardson (South Yorkshire Apprenticeship Hub) and Andrew Hartley (The Sheffield College).



About the South Yorkshire Mayoral Combined Authority

The South Yorkshire Mayoral Combined Authority (SYMCA) is a formal partnership of councils that shapes policy and leads on decision-making. Formed in 2014 as Sheffield City Region Combined Authority, the constituent members are Barnsley, City of Doncaster, Rotherham and Sheffield City councils.



The South Yorkshire Apprenticeship Hub is a new initiative funded by the South Yorkshire Mayoral Combined Authority and the South Yorkshire Colleges Partnership working with the South Yorkshire Providers Network. Launched in 2023, the Hub's ambition is to recruit 300 apprentices in companies that have not traditionally used them by 2026. Since 90% of businesses in South Yorkshire employ less than nine people, the Hub's resources will be primarily focused on small and medium-sized enterprises (SMEs).

The Apprenticeship Hub works directly with SMEs and micro-businesses through outreach, marketing and consultation with trained advisors to help them articulate their skills needs and recruit apprentices. The Hub also works with training providers and schools' careers advisors to raise the profile of apprenticeships with young people, and to match apprentice candidates to available vacancies. In a region with higher-than-average unemployment (4.97% in South Yorkshire vs 3.78% nationally, ONS Annual Population Survey 2022), and where women represent nearly two-thirds of that group in Sheffield city itself (7.57% unemployment), apprenticeships offer a real opportunity to match the skills demand with supply.

Regarding the Hub, Mayor Oliver Coppard was quoted as saying:

“South Yorkshire doesn't just need a bigger economy, we need a better economy. But if we're going to get there, and if everyone is going to be able to access the jobs and opportunities that the new economy will bring, we need make sure people have the right education and skills.

That's what this new Apprenticeship Hub is all about; offering people, organisations and businesses a 'one-stop shop' for all the information and support they need to get the right skills, in the right place, so we can all benefit from a better, bigger South Yorkshire economy.”

Plans are already in place to expand the Hub beyond 2026, which will ensure that the talent pipeline into and out of apprenticeships is bolstered in the future.

[Click here to return to the main report](#)

Physics powering South Yorkshire's aspirations for a greener economy

South Yorkshire has ambitious plans for clean growth and energy efficiency. 2040 Targets aim for 90% of commercial lighting to be LED and 1,500 new jobs to be created in the low carbon and renewable energy sector. Examples of apprenticeships that will power these efforts include Wind Turbine Technicians, Solar Photovoltaic

Installers, Renewable Energy Engineers, Hydroelectric Plant Technicians and Energy Efficiency Advisors. In order to understand the power and energy needs of industry and homes in the region, apprentices in these roles will be taught ways of reasoning and analysis informed by a physics way of thinking.

Local business partnership initiatives boost small employer access to apprenticeships

Case Study E: SME network increases sector attractiveness for apprenticeship talent

Manufacturing & Engineering Growth & Advancement (MEGA), in Mid Ulster, Northern Ireland

MEGA apprentice receiving training from their employer.



About MEGA

MEGA is a collaborative member network of 43 small and medium-sized enterprises (SMEs). Part funded by Invest NI and the Mid Ulster Council, it seeks to tackle the skills shortage and ensure a talent pipeline that bolsters Northern Ireland's share of almost 50% of the global market for manufacturing crushing, screening, recycling and materials-handling equipment.



MEGA promotes the advanced manufacturing and engineering sectors as a source of high-value, long-term employment, and provides tools and resources to: those starting or seeking to boost their career in the sector, parents, carers and teachers, as well as employers seeking to address skills gaps in their workforce. Its easily accessible website provides information on apprenticeships and offers a uniquely centralised and facilitative resource that enables apprentice applicants to easily access the opportunities available in the region.

Over the past few years, MEGA has enabled 87 different apprenticeship pathways and supported the recruitment to 270 apprenticeship vacancies; a trend that is boosting apprentice numbers against a backdrop of low employment in the country; only nine percent of Northern Ireland businesses employ an apprentice.

MEGA has been a real champion of apprenticeships, working with schools to inspire young people of all backgrounds via an ambassador programme comprised of its members. It also collaborated with the Magherafelt and Rural Learning Partnership Careers Committee to host the inaugural Explore Engineering Expo in October 2023, showcasing the diverse range of engineering career paths available.

In 2021, it launched the MEGA Degree Apprenticeship in partnership with Ulster University and the Department for the Economy, Northern Ireland's first ever Degree Apprenticeship in Manufacturing and Engineering.

“Apprenticeships...empower all young people, regardless of their socio-economic backgrounds, to attain higher level education at no cost...In addition, the apprentices positively impact their companies with real-time application of their theory.

We have a range of students with testimonies on just how active they are in astoundingly short periods of employment. For those people who respond positively to experiential learning, and with the right support mechanisms in place, an apprenticeship creates a springboard for a promising career and can ignite so many opportunities for the participants as well as their employers.”

Maria Curran, MEGA Project Director

[Click here to return to the main report](#)

The physics in the MEGA Degree Apprenticeship

This apprenticeship leads to a variety of career options including Design, Manufacturing, Production or Project Engineer – all requiring the knowledge and skills provided by physics. For example, apprentices will develop the ability to relate properties of a material to its structure and composition. They will solve problems from first principles and be able to explain effects by drawing

on models relating to electricity, the weather and the structure of the atom. Graduates from the program might embark on a variety of other careers too, from being part of the team at Formula 1, to developing nuclear weapons, financial trading or building wind turbines. An equivalent full-time degree would be completed in the same length of time, with a tuition cost in excess of £18k.

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

Case study F: Collaboration between schools and employers stimulates interest in STEM careers

North of Tyne Combined Authority (CA)
North East of England

A Komatsu employee leads a workshop with participating students at Callerton Academy.



About the North of Tyne Combined Authority

The North of Tyne Combined Authority (CA) covers the areas of Newcastle, North Tyneside and Northumberland local authorities. There are several physics powered businesses in the region, with construction, green energy, industrial decarbonisation and net zero foci.



The North of Tyne CA funded the North East Local Enterprise Partnership (LEP) to deliver a pilot to raise profiles of locally available STEM careers to young people. The North East LEP has been working on initiatives to bolster the region's economy and reduce skills shortages over the past decade, and has identified that young people need to understand how their learning relates to possible future careers. Entitled Linking Curriculum to the World of Work, the LEP pilot paired 10 schools with 19 local employers, involving over 1,500 11-14-year-olds.

Teachers and industry professionals created curricular resources in partnership, to help link the curriculum to relevant to jobs in the local area - for example, related to radioactivity, electromagnetism, renewable energy, forces and motion. Students visited workplaces and did practical challenges, and participating companies sent ambassadors with varied career and educational experiences to give talks at schools. Equinor - an international energy company and partner in Dogger Bank Wind Farm - engaged its own apprentices in the school visits, promoting apprenticeships as a route into rewarding local careers.

Participating employers enjoyed and benefitted from the opportunity to inspire future talent and all 19 partnerships are continuing to develop. Kromek - a technology company that develops and manufactures radiation detection equipment for the nuclear, medical and security sectors - heard how students were excited by the breadth of careers that physics can offer and enjoyed empowering teachers to bring the curriculum to life.

The pilot was successful and is now being expanded. Teachers welcomed the collaboration to develop relevant resources, and their knowledge about locally available work and study options increased.

Student surveys indicated the pilot's effectiveness at breaking stereotypes about STEM careers. At one school, the perception that you must be 'highly academic to work in STEM' fell by 40%, and at another, the number of students that thought STEM jobs are 'only for boys' fell from 15% to 0%.

Across the 1,500 students, 84% were able to make a connection between the curriculum and the world of work, a jump from 40% before the project.

[Click here to return to the main report](#)

The physics of radiation sensitive equipment

Technology has led to the development of radiation sensitive equipment which can detect Gamma radiation which is highly penetrating and able to travel long distances. Understanding the physics of gamma rays allows companies like Kromek to build equipment that can have a variety of real-world applications. Police officers

are often equipped with gamma ray detectors as part of their CBRNE (Chemical, Biological, Radiological, Nuclear and Explosive) kit. This allows them to pick out individuals or vehicles that may be carrying dangerous materials from more than 50 metres away.

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

Case study G: Large employer puts apprenticeships at the heart of its talent pipeline

British Airways in London, England

British Airways apprentices and staff member, at one of the company's hangars.



About British Airways

A well-known international brand, British Airways was the 2023 winner of the IOP's Apprenticeship Employer Award. While we all understand how a commercial airline might operate, behind the scenes engineers are critical in ensuring that aircraft are fit for flight. Due to the ageing demographic of the engineering workforce across the STEM sector, British Airways has been working to build a lasting talent pipeline of future aircraft engineers through its aircraft Maintenance Apprenticeships.



British Airways has taken great strides to attract and recruit diverse talent via apprenticeships, starting with its “Inspire Programme”; an aviation industry, employability-focused, work experience programme for school and college age students. It uses this to highlight the apprenticeship opportunities available, often using its own apprentices to support outreach. In fact, one in five of its engineering apprentices previously completed work experience at the company.

The apprentice recruitment journey is accessible and facilitated with offers of coaching to help candidates feel confident and prepared. Once hired, apprentices have access to all staff networks, and their own peer network across other departments and teams. Their first year's accommodation is fully covered by the company. Their salary is routinely increased in their second year, and they are supported to develop on the job skills – including a period living and working at Cotswold Airport, as well as other local and international placements.

Of the 300 apprentices that started their Aircraft Maintenance Apprenticeship with British Airways since 2010, more than 80% are still working there.

Harnessing the reach and wide recognisability of its brand, British Airways is breaking down the stereotypes around apprenticeships by organising recruitment events specifically targeting diverse young people and their families. British Airways invests in local recruitment and outreach, knowing that it is likely its apprentices will come from local geographies. This is with a specific focus on recruitment of more women into engineering – a persistent challenge for the sector (women only make up of 12.9% of roles in engineering, according to WISE Workforce Statistics). Across its business, British Airways has reached double the UK government's target for recruitment of women into STEM organisations and is actively working on increasing diversity at all experience levels.

[Click here to return to the main report](#)

The physics of aircraft

Aircraft are controlled by a mixture of hydraulic or fly-by-wire (electronic) systems. Applying the physics of forces, an aircraft maintenance or flight engineering apprentice will study how hydraulic systems transmit and amplify the forces from the cockpit to the flaps or brakes on the aircraft, to ensure it can safely take off, fly and land.

Using and developing their ability to independently reason through problems, make measurements and analyse results, Aircraft Maintenance Apprentices will test and replace the various electronic components in the aircraft's systems for safe and effective functioning.

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

Case study H: Apprenticeships at the heart of a small business

ABS Precision Engineering, North East of England

An ABS Precision Engineering apprentice in the workshop.



ABS Precision Engineering

ABS Precision Engineering is a small manufacturing company, with 42 staff working round the clock at its 20,000 square foot engineering facility. It offers a range of advanced machinery services including computer numerical control turning and milling, and wire electrical discharge enabled machining. Since ABS Precision Engineering were founded 20 years ago, it has employed 18 apprentices, 17 of which still work at the company.



A small business that has put apprenticeships at the heart of its organisation, ABS Precision Engineering has built a culture of support for its apprentices from early on. It liaises with potential applicants and encourages them to bring along parents or carers to visit and talk about the opportunities that an apprenticeship can offer. It offers work experience placements for secondary students, and one of its recent apprentice hires was inspired by such an opportunity. The company also actively participates in primary school outreach in its region as it believes young people can be powerfully inspired.

“I chose to do an apprenticeship because I wanted to progress a career, I didn’t want to be in full time learning and wanted a hands-on, interactive experience. In Year 10 I did a week of work experience at ABS, during which I gained some valuable insights into the company and also what doing an apprenticeship entails.”
Current ABS apprentice

The company invests time and effort into enabling informed choices, whilst breaking down any negative pre-conceptions of what an apprenticeship is. Once apprentices join, they are offered tailored onboarding support, and their needs are proactively accommodated. Having recently hired its first female apprentice, ABS Precision Engineering immediately sourced PPE kit that is appropriately fitted – a known health and safety challenge for women.

Its apprentices are mentored by highly skilled specialists but are also included in the work community - including team building events and company charity drives. Apprentices are encouraged to share their learning with other apprentices, building trust and confidence.

[Click here to return to the main report](#)

The physics of precision engineering

Computer numerical control turning is a type of precision engineering that relies on making careful measurements to get the right outcome. It involves the use of computer-controlled machines to create shafts, bolts, and other cylinder-shaped parts for machinery, that must be precisely shaped to move and withstand the required pressure and vibration. Understanding how objects change

shape when stressed and how they respond to vibrations require a physics way of looking at the world. Apprentices working in this field will focus on ensuring the functioning of such machinery is at a high standard through the maintenance of the various parts, and the system as a whole.

Physics-powered organisations engaging their communities to raise awareness of and tackle limiting stereotypes about apprenticeships

Case study I: Employer actively championing apprenticeships in their local community

CMB Engineering in Cardiff, Wales

CMB apprentices at the Building Engineering Services Association's 2023 Industry Awards, attending as shortlisted nominees. From left to right: Tom Price, Nathan Kelly and Kieran Frampton.



CMB Engineering

CMB Engineering is the largest independently owned building services engineering and construction firm in Wales. Winner of several business awards, in 2023 CMB Engineering was recognised as a Top 30 Construction Company in Wales (by Wales Business Insider) and received two awards for its projects at the Construction Excellence South West Awards.

CMB Engineering runs a well-established apprentice training scheme, where its apprentices work alongside experienced staff in mechanical, electrical and ductwork engineering. It has recently been awarded a large contract to construct and fit out a sizeable research, innovation and manufacturing facility in Newport, and it is proactively growing its apprentice workforce to meet the demand.



CMB Engineering offers apprenticeships at various levels of qualification within its business. The firm's leadership has first-hand experience of the value of apprenticeships – its managing director and founder, Steve Borley, started out his career as an engineering apprentice, and 10 of the 14 of its business directors were apprentices themselves.

The company's ethos is 'train and retain' and it considers apprenticeships a highly valuable route to gaining and retaining qualified and experienced staff; in fact, 95% of staff hired as apprentices have stayed on at the company. To make sure its apprentice workshop enables high-quality hands-on training, the company led an equipment donation drive with its partners and suppliers.

It champions its apprentices externally, frequently nominating them for regional and national award competitions. At the 2023 Building Engineering Services Association Cymru awards, three of its apprentices were nominated as finalists

for the Industrial & Commercial Level 3/ BSE Craftsperson Apprentice of the Year. CMB Engineering has also led sponsorship drives so that apprentices recognised by such award schemes also walk away with toolkits of their own, often a costly expense for someone at such an early stage of their career.

Recognising the investment in their success, CMB Engineering's apprentices are active in its numerous recruitment and outreach activities. To raise the profile of careers in mechanical, electrical and ductwork engineering, CMB Engineering attends exhibitions such as Wales Tech Week and visits local school and college careers events where it hosts stalls, offers students mock interview practice and one on one conversations with its experienced staff.

[Click here to return to the main report](#)

The physics in mechanical engineering

Mechanical engineering involves the design, analysis, manufacturing, and maintenance of mechanical systems. It is one of the oldest and broadest of the engineering branches, combining many substantive ideas from the domains of physics, mathematics and materials science. To be able to design efficient and reliable mechanical systems in large machinery, or transportation craft,

mechanical engineers draw on ideas from physics such as kinematics (the geometry of motion), structures, energy transfers and fluid mechanics (the flow of liquids and gasses). Mechanical engineering apprentices will be learning about these to understand the design, manufacture and maintenance of mechanical systems.

The Institute of Physics is a charity registered in England and Wales (no. 293851) and Scotland (no. SC040092).

iop.org

The IOP is the professional body and learned society for physics in the UK and Ireland, with an active role in promoting cooperation in physics around the world. We strive to make physics accessible to people from all backgrounds. Our 22,000 members demonstrate their professional expertise in physics in settings ranging from schools, universities and national research facilities, to businesses of all sizes, and in roles as varied as teacher, researcher, apprentice, technician, engineer and product developer.

Report published February 2024