

Transition
→ **Economics**



An emergency plan on green jobs for young people

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**Denis Fernando,
climate
campaigner at
Friends of the
Earth**

“There’s a serious risk that this country is going to leave its young people to a future devastated by the climate crisis and unemployment. But it’s not too late to turn this around. Investing in green apprenticeships in areas such as renewable energy and woodland creation could prevent a new wave of youth unemployment, while helping the UK towards a more climate-friendly future.”

“Young people have borne the brunt of the job losses caused by the coronavirus pandemic, and we need an urgent plan to make sure this experience doesn’t scar their future. We know that investment in the skills required to get Britain to net zero, and in the good green jobs that will deliver it, could provide the opportunities young people desperately need now. This report is an important contribution to making that happen - and we look forward to working with everyone committed to ensuring that we deliver a better future both for young people and for the planet”

**Paul Nowak,
Deputy General
Secretary,
TUC**

**Serena Murdoch,
17, campaigner at
Teach the Future**

“As young people we are faced with an impending double crisis. We will have to deal with the disproportionate economic fallout from Covid-19, and begin our adult lives in an age of greater and greater climate injustice. Over recent years students have shown the world we have the energy and determination to rise to the climate emergency, but we can’t do it alone. This timely report gives politicians some concrete steps to begin providing good green jobs for the next generation of workers, and to unleash our energy to help build a safer, fairer future.”

“Young people are bearing the brunt of the unemployment crisis, yet our national green skills gap continues to get bigger. The Government must urgently invest new money into education and training, preparing young people to gain meaningful employment that delivers our carbon reduction commitments, halts the climate crisis and contributes to climate justice. The scale must be commensurate with an investment in an entire generation of young people, our lives now and our futures, but it must also be made in a socially just way. All young people, including marginalised young people, deserve a chance to gain paid work that delivers a more just present and secures our collective future – a future that puts people and planet ahead of profit.”

**Larissa Kennedy,
President of the
National Union of
Students**

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The research report [Chapters 1-3] is researched and written by Mika Minio-Paluello and Anna Markova (Transition Economics). With thanks for feedback and input from Mike Childs and Denis Fernando (Friends of the Earth), Kirsi-Marja Kekki and Iain Murray (TUC), Graham Petersen (Greener Jobs Alliance), Paul Gregg (University of Bath), Gianni De Fraja (University of Nottingham) and our supporting organisations. Any errors and omissions remain the authors'. Case studies were compiled by Friends of the Earth staff.

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Executive summary

An emergency plan on green jobs for young people – why and how?

There are over 500,000 young people aged 16-24 out of work, and this is before the government's furlough scheme closes. The numbers are expected to grow substantially with the end of the furlough scheme. It is also well recognised that the claimant count is an underestimate of the true unemployment figures. It is very conceivable that there could be over 1 million unemployed young people by early summer.

This is a youth unemployment emergency.

Providing young people with green jobs is one of the means of addressing youth unemployment. After all, the climate and ecological emergency will mostly harm young people and future generations as it unfolds, so addressing both these emergencies together is a win-win for young people.

Friends of the Earth commissioned consultancy Transition Economics to identify how to create green jobs quickly, with a focus on green apprenticeships, and to identify the scale of funding needed. And to put the level of funding into context, we also asked them to estimate the economic scarring impact from periods of unemployment.

Figures have been calculated for economic scarring and Green Apprentice creation at a local authority level in England and Wales, as well as combined authority level in England.

The research report by Transition Economics identifies:

- The economic scarring impact of one year's unemployment **for an 18-20 year old comprises lost earnings of £42,000 - £133,000 over the next twenty years**. For comparison, the Institute of Fiscal Studies recently estimated that school pupils could lose out on £40,000 of lifetime earnings due to missing classroom time.
- Current levels of youth unemployment could lead to **£32 - £39 billion in wage scarring across the UK**, if all currently unemployed 16-24 year olds stayed unemployed for 1 year. For an average-sized local authority area in England and Wales this represents £86 - £105 million in lost local earnings.
- The cost of creating 250,000 green apprenticeships over the next three years is tiny in



comparison. Rapid roll-out of a green apprenticeship scheme would cost £6.2 - £10.6 billion in total funding over 5 years. This covers wages subsidies at 50% or full cost, training costs and diversity funding. Such an investment would be a natural successor to the job-saving furlough scheme, banking its success.

- Significant skills gaps and shortages in sectors essential for delivering net zero climate goals threaten to derail efforts to decarbonise buildings, transport and energy. The report identifies occupations by Standard Occupational Classification (SOC) code where these are particularly acute.
- There are 161 existing apprenticeships standards in England that can support decarbonisation, out of a total of 571 approved for delivery by December 2020. However, many apprenticeship standards do not even exist yet (e.g. whole-house retrofits), whilst others need important updates and/or numbers to be expanded significantly (e.g. heat-pump installers).
- Funding the green infrastructure needed to meet climate goals – such as retrofitting existing homes and building new green homes, upgrading the railways, and afforestation – could create over 1 million jobs over the next two years, and provide the basis for recruiting and training green apprentices.

The report makes a number of recommendations. These are:

- A “green opportunity guarantee” is needed for young people that commits to ensuring all young people are offered a job, an apprenticeship, or training. A government funded £40 billion-a-year green infrastructure programme would create over 1 million jobs, and deliver significant co-benefits including healthier air, warmer homes and saving the NHS tens of billions of pounds.
- The UK government should invest up to £10 billion over the next 5 years to create 250,000 green apprenticeships in England and Wales, with wage subsidies of 50-100% depending on need. Devolved nations should receive equivalent funding for programmes within their borders.
- National and local government procurement programmes should require the employment of apprentices. Requirements for apprenticeships already exist in framework agreements like for HS2 and in the Offshore Wind Sector Deal.
- Green Apprenticeships should include a greater proportion of time spent in “off-the-job” college or workshop-based learning than currently happens. Rules and standards are needed to ensure apprentices are not exploited as cheap labour or used to replace existing paid jobs. Pay rates for apprentices should be higher than the minimum wage, and negotiated nationally with trade unions.
- Diversity Bursaries of £1,500 should be paid to green apprentices from historically disadvantaged groups, to improve access and participation, and employers should also be paid a Diversity Bonus payment of £1,000. Race equality conditions should be applied to all employers using the funded scheme.
- A 10-year funding settlement for Further Education Colleges should be announced immediately, ahead of the spending review, to enable the apprenticeship and training programmes to begin delivery fast.
- A network of National and Regional “Centres of Excellence for Zero Carbon Skills” should be created at further education colleges, serving as hubs for Green Apprenticeship and Traineeship training. The Centres should be tasked with developing updates to existing vocational training, instituting new courses, and supporting



schools to incorporate low carbon skills into the school curriculum so that students are more equipped and informed to start green careers. The existing Skills Bootcamp programme should be expanded, targeting provision of green skills to unemployed young people.

- Combined authorities, working with local authorities and Local Economic Partnerships, should leverage existing skills funding and programmes to develop and grow Green Apprenticeships, as well as using borrowing powers to invest into local green infrastructure.
- New apprenticeship standards should be rapidly developed where necessary – including for whole-house retrofits, energy assessments, environmental restoration, sustainable farming, and circular economy manufacturing – and others will need additional modules, e.g. electric vehicle maintenance for car mechanics.
- A public awareness campaign to launch the programme and recruit Green Apprentices should be run, including through schools, local authorities, Job Centre coaches, and via influencers trusted by young people.

Apprenticeships and training are devolved matters, so the recommendations above apply to the devolved nation governments where appropriate as well as to the UK government. In the full report, Transition Economics make further recommendations. The full report also provides data on wage scarring and on Green Apprenticeship creation at a local authority level in England and Wales and at a combined authority level in England.

To support the report Friends of the Earth has interviewed young people currently working in green jobs. The case studies are available [here](#).



Chapter 1. The problem: Covid-driven youth unemployment and economic scarring

1.1. Summary

Young people are one of the groups hardest hit by the economic crisis as a result of the Covid pandemic. This chapter quantifies the lost future wages that today's unemployed young people could experience if the government does not act in time to guarantee jobs and training opportunities.

An 18-20 year old who experiences one year of unemployment during the pandemic crisis could lose out on £42,000 - £133,000 in future wages over the next 20 years, as a result of lower future pay.

The collective scarring impact of youth unemployment during the pandemic could see £31 - 39 billion lost wages in England and Wales over the following 20 years, if as many young people as are unemployed now experienced a year of unemployment.

On a Combined Authority and Metro Mayor level, the greatest estimated collective scarring impacts fall on West Midlands (£2.1 billion - £2.5 billion), Greater Manchester (£1.4 billion - £1.8 billion) and London (£5.5 - £7.2 billion), corresponding to the greatest numbers of unemployed young people. The estimated 27,000 unemployed young people in Wales could lose between £1.3 billion - £1.6 billion in future wages over 20 years.

The real scarring impact could be greater, as youth unemployment is expected to soar following the end of the furlough scheme, and as a significant proportion of young people on furlough are likely to also experience scarring impacts.¹ At the same time, it is unlikely that every currently unemployed young person will remain unemployed for a year. Our model aims to strike a balance and represent a reasonable worst case scenario.

The impacts of widespread youth unemployment, coupled with isolation enforced as part of the pandemic response, is by no means limited to individuals' lost wages. Future life satisfaction, physical and mental health are likely to be affected, as is wellbeing on a community level.

A successful economic recovery that rapidly brings young people back into employment and training would significantly reduce the scarring impact. Such a recovery could offer meaningful work with a sense of social purpose. This will require stronger and more interventionist government policies to stem the torrent of youth unemployment than exist at present.

¹ Thanks to Paul Gregg for commentary on the furlough and scarring issue.



1.2. Generation Covid and youth unemployment

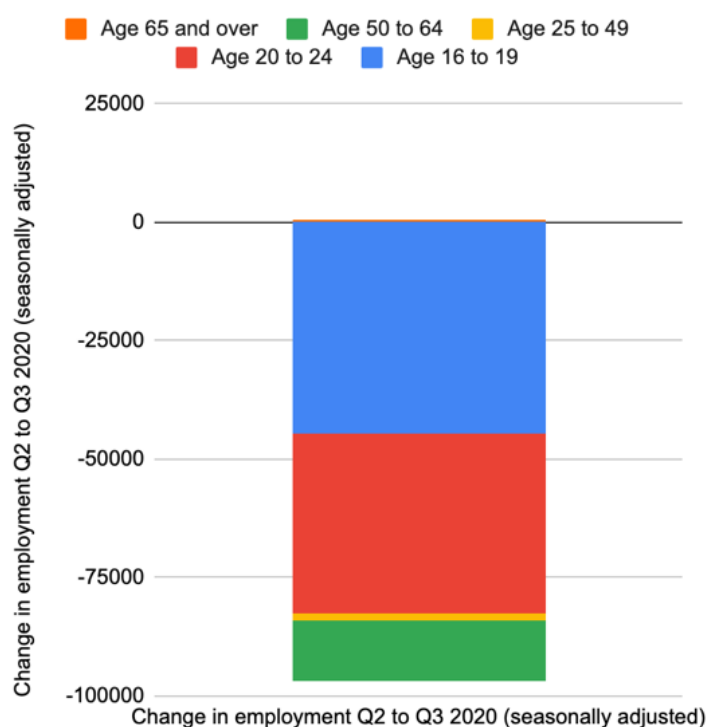
The Covid pandemic has led to soaring unemployment, despite government interventions like the furlough scheme. Young people - Generation Covid - have been hit especially hard by jobs losses, hours reductions and falling pay, and were twice as likely to be furloughed as older workers.²

Historical evidence suggests that the young, the least educated and especially minorities are hit hardest in a recession.³ But the current crisis has also particularly targeted the livelihoods of young people, by forcing the closure and shrinkage of many sectors - e.g. hospitality and retail - where young people make up a disproportionate part of the workforce.

By October, the number of young people in employment had fallen by 278,000 since the start of the pandemic, a 7% fall, with a further 181,000 young people becoming economically inactive. The number of young people claiming unemployment related benefits increased by 282,000 from March to November 2020, an increase of 120%.⁴ Overall, rising unemployment has been driven by young people losing their jobs, with young people making up 62% of the total fall in employment in the quarter to October 2020.⁵

Figure 1. Young people made up the majority of the total fall in employment in the quarter to October 2020

Source: Labour Force Survey headline indicators (seasonally adjusted)



² <https://www.bbc.co.uk/news/explainers-54005156>

³ D.G. Blanchflower and R.B. Freeman (editors), *Youth Employment and Joblessness in Advanced Countries*, University of Chicago Press and NBER, 2000 and Freeman, R. B. and D. A. Wise, (editors), *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*, University of Chicago Press and NBER, 1982

⁴ Youth Unemployment Statistics, House of Commons Library, 15 December 2020 <https://commonslibrary.parliament.uk/research-briefings/sn05871/>

⁵ https://www.employment-studies.co.uk/system/files/resources/files/IES%20briefing%20-%20Labour%20Market%20Statistics%20December%202020_2.pdf



Alternative opportunities are limited, with falling vacancies particularly targeting younger workers, including those fresh out of university.⁶ Apprenticeship starts also crashed with the onset of the pandemic, with younger apprentices being more hard hit.⁷ Young workers are also most likely to have seen their pay slashed, with over a third of 18-24-year-olds (excluding full-time students) having had their pay reduced since before the outbreak.⁸

Current statistics are struggling to even capture the scale of the current jobs crisis, with at least 300,000 out-of-work people missing from official unemployment figures.⁹

1.3. It will become worse before it gets better

There is a wide consensus that without far greater government intervention, the jobs crisis for young people will get much worse before it gets better.

The furlough programme has been an effective tool in holding back a torrent of unemployment. It played a key role in preventing the 6.1% increase in unemployment projected by the Office for Budget Responsibility, which could have increased the youth unemployment rate to 27%.¹⁰ But this postponed the potential crash, rather than preventing it. The planned end of the furlough scheme threatens to send employment off a precipice in 2021. The Learning and Work Institute estimated that 290,000 18-24 year olds could become long-term unemployed by autumn 2021, five times the existing levels and higher than the peaks seen in the previous two recessions.¹¹

Evidence from autumn 2020 showed that young and black, Asian and minority ethnic workers (BAME) workers were far more likely to be made unemployed after furlough ends. A Resolution Foundation survey found that 19% of 18-24 year olds who were furloughed during the spring 2020 lockdown were unemployed in September, compared to 22% for BAME workers but only 9% for the general population.¹²

The largest numeric impact in terms of employment loss in 2021 is likely to be experienced by those in low paid occupations often with low skills and low-level educational qualifications. Recessions tend to be longer and deeper for young people without higher qualifications.¹³ The post-Covid labour market will be a hostile environment for adults finding themselves unemployed, in which their existing skills are likely to be poorly matched with the opportunities that will be available when we recover from the Covid crisis.¹⁴

1.4. The long-term scarring impacts of youth unemployment

While being unemployed is damaging in real time – potentially putting health, well-being and access to housing at risk – the experience can also scar a person's livelihood for years to come. This is particularly worrying for young people, who are more likely to experience

⁶ <https://www.bbc.co.uk/news/explainers-54005156>

⁷ <https://feweek.co.uk/2020/06/25/apprenticeship-starts-continue-to-plummet-since-lockdown-new-data-reveals/>

⁸ <https://www.resolutionfoundation.org/publications/young-workers-in-the-coronavirus-crisis/>

⁹ <https://www.theguardian.com/society/2021/jan/24/gordon-brown-300000-uk-jobless-hidden-by-official-figures>

¹⁰ <https://www.resolutionfoundation.org/app/uploads/2020/05/Class-of-2020.pdf>

¹¹ <https://learningandwork.org.uk/resources/research-and-reports/time-to-act-tackling-the-looming-rise-in-long-term-unemployment/>

¹² <https://www.resolutionfoundation.org/press-releases/one-in-five-young-people-and-over-one-in-five-bame-workers-who-were-furloughed-during-lockdown-have-since-lost-their-jobs/>

¹³ <https://www.fenews.co.uk/press-releases/62190-kickstart-changes-government-must-extend-the-scheme>

¹⁴ <https://repec-cepeo.ucl.ac.uk/cepeow/cepeowp20-12.pdf>



unemployment during a downturn, and who have their whole working lives ahead of them.¹⁵

Historical evidence from past recessions shows that youth unemployment has impacts beyond the immediate negative effects on individuals, society and public finances. Numerous studies in the UK and internationally demonstrate that past periods of unemployment between the ages of 18 and 25 left persistent “scarring” effects on people’s future job prospects including their pay and employment status, but also on their future life satisfaction and mental health¹⁶ and on physical health.¹⁷ A 2009 UK survey found that young people who were unemployed in many cases suffered rejection, depression and hopelessness leading some to feeling suicidal.¹⁸ These effects on mental health tend to persist over the long-term, even into people’s forties.

The potential economic scarring impacts of youth unemployment caused by the Covid pandemic have been highlighted by policy makers, think tanks and journalists repeatedly in 2020. A Deputy Governor of the Bank of England warned that “scarring matters profoundly for the living standards and wellbeing of everyone in the economy” in a November 2020 speech on the potential long-term effects of Covid.¹⁹ The Financial Times has referred to “scarring” 32 times already in the first three months of the pandemic²⁰, and the National Institute of Economic and Social Research warned in July 2020 that economic scarring in the labour market would maintain unemployment at high levels for the coming years.²¹

Young people leaving education in the midst of the pandemic face a future where they are less likely to be employed, and could suffer scars to their pay for decades to come, even after the economy has recovered.²² A range of studies have quantified the long term scarring impacts of youth unemployment on future pay:

- Arulampalam found for young people that a spell of unemployment carries a wage penalty “of about 6% on re-entry in Britain, and after three years, they are earning 14% less compared to what they would have received in the absence of the unemployment”.²³
- Data from the National Child Development Survey analysed by Gregg and Tominey found that a significant spell of youth unemployment leaves a permanent scar, reducing wages for men at 23 years old by 21%, and even at age 42 by 13%, compared to someone with no youth unemployment.²⁴

¹⁵ <https://www.resolutionfoundation.org/app/uploads/2020/05/Class-of-2020.pdf>

¹⁶ Bell, D. and Blanchflower, D. (2011) Young people and the Great Recession. *Oxford Review of Economic Policy*, 27, 241-267.
<https://academic.oup.com/oxrep/article-abstract/27/2/241/429358>

¹⁷ Maclean, J. (2013) The health effects of leaving school in a bad economy. *Journal of Health Economics*, 32, 951-964.
<https://www.sciencedirect.com/science/article/abs/pii/S0167629613000970>

¹⁸ Bell, D. and D.G. Blanchflower (2010), ‘Youth Unemployment: Déjà vu’, IZA Discussion Paper 4705
<https://www.iza.org/publications/dp/4705/youth-unemployment-deja-vu>

¹⁹ Ramsden, D. (2020) Speech: The potential long-term economic effects of COVID-19 <https://www.bankofengland.co.uk/-/media/boe/files/speech/2020/the-potential-long-term-effects-of-covid-speech-by-dave-ramsdem.pdf?la=en&hash=FA29F3EE33EF0439FF20F0EBE91E55B4F64DA9B6>

²⁰ <https://voxeu.org/article/lasting-scars-covid-19-crisis>

²¹ Lenoël, C., Macqueen, R. and Young, G. (2020) Prospects for the UK economy. *National Institute Economic Review*, 253, F4-F34.
<https://www.niesr.ac.uk/publications/prospects-uk-economy-37>

²² <https://www.resolutionfoundation.org/app/uploads/2020/05/Class-of-2020.pdf>

²³ Arulampalam, Wiji, 2001. “Is Unemployment Really Scarring? Effects of Unemployment Experiences on Wages,” *Economic Journal*, Royal Economic Society, vol. 111(475), pages 585-606, November
<https://www.jstor.org/stable/798307?seq=1>

²⁴ https://www.researchgate.net/publication/222700813_The_Wage_Scar_from_Youth_Unemployment



- In 2017, De Fraja, Lemos and Rockey used data from the UK Lifetime Labour Market Database to show that one additional month of unemployment at age 18-20 causes a permanent income loss of 2%.²⁵
- Tumino finds an increased probability of experiencing future unemployment of up to 9% when comparing with similar other workers.²⁶
- Paul Gregg and Lindsey Macmillan estimated the future lost output (measured as wages foregone) through long-term youth unemployment following the 2008 economic crisis as £6.7 billion.²⁷
- In the US, the Center for American Progress think tank modelled scarring impacts described in existing US-based studies to conclude that young people unemployed as a result of the 2008 financial crisis were likely to lose out on a cumulative \$2 billion in future wages.²⁸

Transition Economics analysis builds on these studies to estimate the potential long-term loss of pay to individuals and local communities resulting from youth unemployment scarring during the Covid pandemic, and the resulting total loss in foregone wages in England and Wales.

1.5. Youth unemployment scarring quantified

Our modelling tells a cautionary tale of the losses that could result from this - losses to individuals and to their communities.

An 18-21 year old who experiences one year of unemployment during the pandemic crisis will lose out on £42,000 - £133,000 in future wages over the next 20 years, as a result of lower pay, according to our modelling.²⁹ These are our lowest and highest estimates for local authorities in England and Wales, from Rother in East Sussex and Wandsworth in London. See Appendix 3 for numbers for all local authorities. Table 1 below shows the potential 20 year wage scarring for individuals by region or nation, and Table 2 by Combined Authority.

²⁴ https://www.researchgate.net/publication/222700813_The_Wage_Scar_from_Youth_Unemployment

²⁵ De Fraja, G, Lemos, S and Rockey, J. 2017. 'The Wounds That Do Not Heal. The Life-time Scar of Youth Unemployment'. London, Centre for Economic Policy Research. <https://www.york.ac.uk/media/economics/documents/seminars/2016-17/The%20Wounds%20That%20Do%20Not%20Heal.pdf>

²⁶ Tumino, Alberto, (2015), The scarring effect of unemployment from the early '90s to the Great Recession, No 2015-05, ISER Working Paper Series, Institute for Social and Economic Research, <https://EconPapers.repec.org/RePEc:ese:iserwp:2015-05>

²⁷ <https://cmpo.wordpress.com/2012/02/06/the-cost-of-youth-unemployment/>

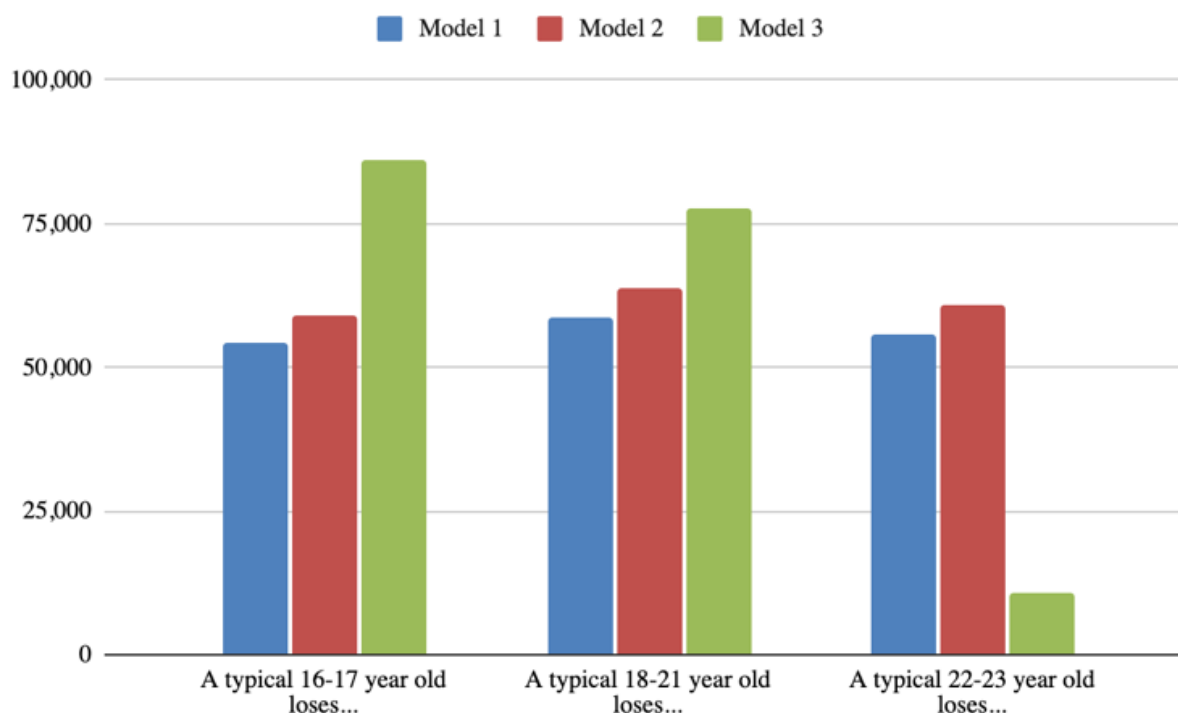
²⁸ <https://www.americanprogress.org/issues/economy/reports/2013/04/05/59428/the-high-cost-of-youth-unemployment/>

²⁹ These are the lowest and highest estimates in the model, from Rother in East Sussex and Wandsworth in London.



Figure 2 shows the 20-year projected scarring impacts of youth unemployment by age bracket (at the time of unemployment) in England and Wales for the three models used.

Figure 2. Future wage scar over 20 years, by age and by model, England & Wales average (£)



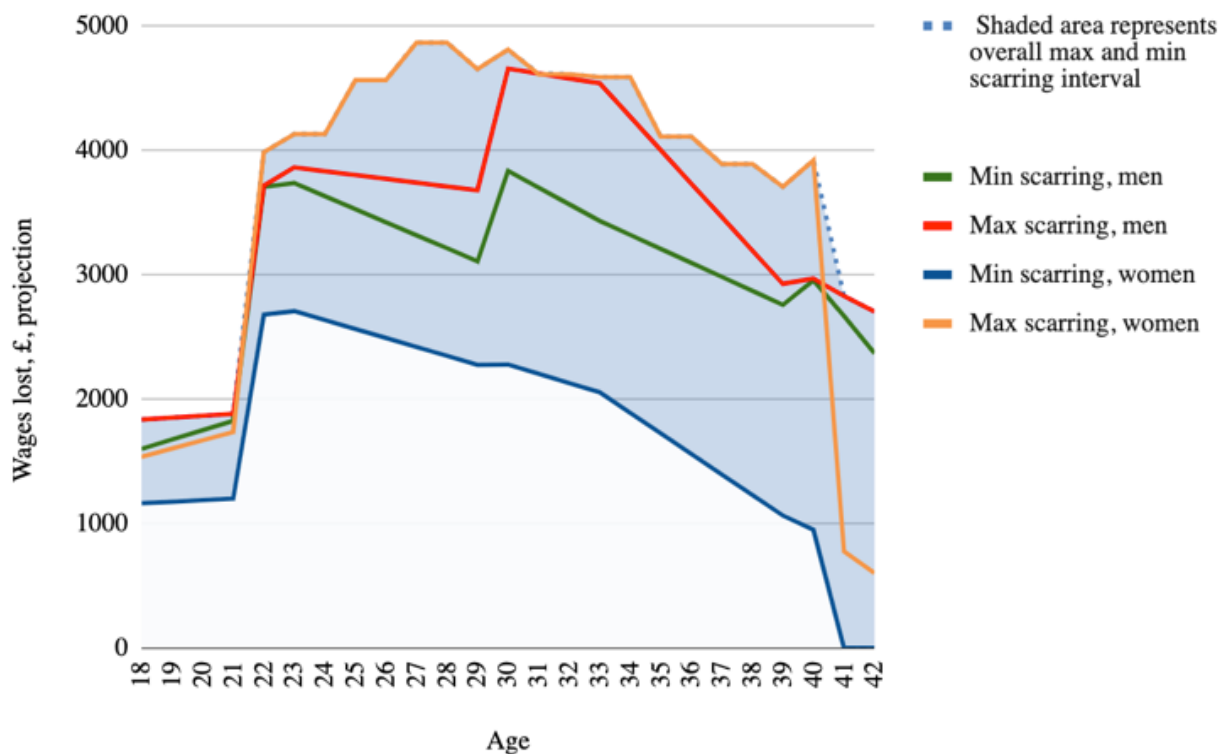
Source: Transition Economics analysis, ONS data

Annual losses are significant - an 18-year-old in Manchester who has been unemployed for a year can expect to lose between £2,000 and £4,900 in wages for every year of their twenties. Figure 3 shows the future reduction in annual wages for the next 24 years³⁰ faced by an 18-year-old in Manchester who was unemployed for a year.

³⁰ All cumulative wage scarring losses modelled in this report (both for individuals and by local authority or Combined Authority) are for losses over 20 years. The graph demonstrates 24 for illustrative purposes.



Figure 3. Annual wage scar for an 18-year-old in Manchester who has been unemployed for a year



Source: Transition Economics analysis

Adding up the impacts for all 16-24 year olds in a local authority facing a stretch of unemployment, the collective impacts of lower wages over the coming two decades build up. This means less disposable incomes to spend locally, lower local council incomes, and a greater need for welfare support. Today's youth unemployment threatens to cause a town like Wrexham in Wales to miss out on £48 million - £62 million, while Blackpool in England would lose £99 million - £115 million in local wages paid over 20 years.

The Sheffield City Region Combined Authority would lose £658 - £838 million in future wages over 20 years, and the West Midlands Combined Authority between £2.1 billion and £2.6 billion. See Table 1 for collective estimates for regions and nations and Table 2 for all Combined Authorities.

Across the UK, if all currently unemployed 16-24 year olds stayed unemployed for 1 year, they are projected to lose £32 - £39 billion in wages in the next 20 years.

Our modelling follows the findings of studies on economic scarring and long term wage reductions caused by youth unemployment, and applies the magnitude of the scarring effect (by gender, age, and length of unemployment) to estimated wage trajectories for the 30th percentile for each local authority. It is assumed that overall future wages follow current patterns by age and gender, that wages keep up pace with price inflation (in other words, the calculation reflects future lost wages in today's currency), and that people affected by youth unemployment are likely to be non-graduates (therefore having lower than average projected future earnings even without unemployment exposure).³¹ Please see Appendix 1 for more detail on the methodology behind these findings.

³¹ Thanks to Paul Gregg for discussion on this point.



Although in recent history, long-term unemployed people (whose unemployment spell lasted more than 12 months) made up under one fifth of unemployed people³², the Covid crisis threatens to drop far greater numbers of young people into longer term unemployment. Modelling the impacts of theoretical future long-term unemployment equalling current unemployment is a reasonable worst-case scenario, given that the end of the furlough scheme is expected to significantly increase youth unemployment if schemes to bring young people back into employment (such as Kickstart) continue to fail to deliver.³³

Table 1. Economic scarring from youth unemployment, if all currently unemployed young people (16-24 year olds) experienced 1 year of unemployment, by region / country³⁴

Region or country	Unemployed young people (Dec 2020)	Economic scarring estimate (£ lost wages over 20 years)		After 1 year's unemployment, over the next 20 years an average 18-21 year old loses... (£)	
		(min)	(max)	(min)	(max)
North East	28,436	1,464,026,300	1,781,455,228	54,715	71,925
North West	69,069	3,379,403,759	4,277,959,855	54,291	72,443
Yorkshire and The Humber	51,412	2,560,394,146	3,192,025,493	55,124	72,593
East Midlands	42,098	2,363,159,834	2,643,051,731	57,072	74,935
West Midlands	64,150	3,336,297,800	3,954,979,883	55,574	73,198
East	48,534	2,721,605,326	3,222,648,822	59,283	77,730
London	94,479	5,527,476,559	7,191,743,838	69,677	94,507
South East	65,644	3,670,980,811	4,514,507,196	61,553	81,599
South West	43,621	2,343,356,341	2,638,161,893	54,519	71,949
Wales	26,749	1,309,673,383	1,607,309,082	52,799	71,771
United Kingdom	534,191	31,642,695,929	38,758,738,648	58,166	77,422

Source: Transition Economics analysis, ONS data.

For comparison: an analysis published by the Institute for Fiscal Studies (IFS) estimates that children and adolescents missing half a year's schooling during the pandemic will experience a lifetime loss in earnings of £40,000³⁵ – a similar scale but smaller loss than that experienced by a young person following a year's unemployment (£17,000-£134,000 over the following 20 years for an 18-20 year old in our analysis). The cumulative future income losses we estimate – £43 billion to £50 billion – are smaller than those estimated by IFS in relation to missed schooling (£350 billion), but more concentrated and therefore more prone to exacerbate economic inequality.

³² <https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/datasets/unemploymentbyageanddurationseasonallyadjustedunem01sa>

³³ Fewer than 2,000 young people had started new Kickstart roles by January 2021. <https://www.bbc.co.uk/news/business-55790439>

³⁴ Note that unemployment and the scarring estimates reflect not only 18-20 year olds (who are worst affected) but also 16-17 and 22-24 year olds. Therefore the scarring estimate does not equal unemployed people times average scarring for 18-21 year olds.

³⁵ <https://www.ifs.org.uk/publications/15291>



The findings by Combined Authority and Metro Mayor area are demonstrated in Table 2.

Table 2. Economic scarring from youth unemployment, if all currently unemployed young people (16-24 year olds) experienced 1 year of unemployment, by Combined Authority and Metro Mayor area³⁶

Combined Authority or Metro Mayor area	Unemployed young people (Dec 2020)	Economic scarring estimate (£ lost wages over 20 years)		After 1 year's unemployment, over the next 20 years an average 18-21 year old loses... (£)	
		(min)	(max)	(min)	(max)
Greater Manchester	30,222	1,436,588,892	1,836,814,151	53,244	71,345
Sheffield City Region	13,665	658,285,214	838,132,785	54,646	70,869
West Yorkshire	25,109	1,275,031,353	1,577,008,939	56,030	74,297
Liverpool City Region	16,135	791,064,354	1,015,774,090	54,687	73,378
Tees Valley	7,870	403,901,877	493,343,336	53,680	70,464
West Midlands	41,524	2,147,744,812	2,560,659,826	55,891	73,752
Cambridgeshire and Peterborough	6,173	378,304,649	437,644,325	63,789	84,511
West of England	7,462	400,631,680	500,834,773	60,981	81,019
North East	12,392	641,252,616	776,052,289	55,447	72,895
North of Tyne	8,094	419,616,627	517,184,205	55,294	72,601
London	94,479	5,527,476,559	7,191,743,838	69,677	94,507

Source: Transition Economics analysis, ONS data.

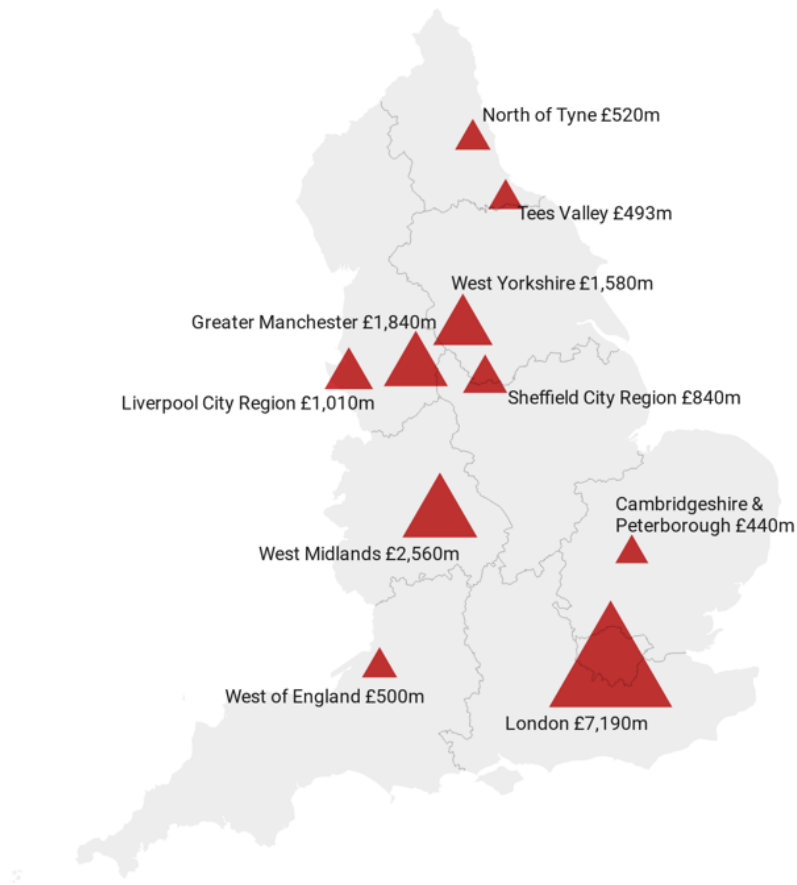
³⁶ Note that unemployment and the scarring estimates reflect not only 18-20 year olds (who are worst affected) but also 16-17 and 22-24 year olds. Therefore the scarring estimate does not equal unemployed people times average scarring for 18-21 year olds.



Figure 4. Map of economic scarring from youth unemployment (max estimate), by Combined Authority and Metro Mayor area

Estimated max scarring by Metro Mayor Combined Authority

Potential economic scarring for unemployed young people



Map: Transition Economics • Source: transitioneconomics.net • Map data: © Crown copyright and database right 2018 • Created with Datawrapper

Source: Transition Economics analysis, ONS data.

The findings by local authority area are demonstrated in Appendix 3.



Chapter 2. The problem: the green skills shortage

2.1 Introduction

Decarbonising our economy and adapting to climate change will require changes to the ways of working – and therefore changes to training – for almost any occupation. UK skills policy has failed to grapple with the magnitude of this challenge: for instance, the recent Skills for Jobs white paper on technical education makes no reference whatsoever to climate change or decarbonisation.³⁷

Existing reviews that attempt to assess the need for “green skills” tend to have a relatively narrow focus. For example, a 2012 study found that the UK had the largest green skills gap among European countries, based on an assessment of skills gaps for nine target occupations (from engineering technologist to waste collector).³⁸ A 2020 Local Government Association assessment estimates green job creation based on existing ONS low-carbon economy definitions (for sectors like energy-efficient products and renewable energy).³⁹

Most existing studies assume that future demand for skills follows existing market demand, or at best a linear pathway to net zero by 2050. However, the Climate Change Committee’s Sixth Carbon Budget published in December 2020 makes clear that most climate action needs to take place within the coming 14 years.⁴⁰ Emissions need to fall by 80% by 2035 (previously the 2050 goal). Achieving this will mean that many decarbonisation projects – retrofitting the UK’s 28 million homes, increasing public transport and cycling infrastructure, shifting from internal combustion engines to electric vehicles, expanding renewable power, creating new woodlands – need to be primarily delivered within the next decade.

If the necessary pace of decarbonisation is to be delivered, then demand for green skills over the coming 15 years will be significantly higher than most studies expect.

This chapter provides an industry-by-industry overview of evidence of skills gaps and shortages, drawing on existing published assessments. We draw the distinction between skills gaps – where an existing workforce needs additional training, and skills shortages – where employers struggle to recruit for vacancies because not enough people looking for jobs have the required skills. For each industry, we examine the skills context for a number of key projects (e.g. creating new woodland, expanding renewables generation, EV manufacturing, energy-efficiency retrofits) essential to the climate transition. We then highlight specific occupations within the sector (organised by Standard Occupational Classification code, where possible), and summarise:

- Current skills shortages - i.e. whether under “business as usual”, employers already struggle to fill vacancies
- Whether significant retraining is needed for current workforces to meet decarbonisation needs
- Whether major updates are needed to qualification standards to meet decarbonisation needs

³⁷ <https://www.gov.uk/government/publications/skills-for-jobs-lifelong-learning-for-opportunity-and-growth>

³⁸ https://www.cedefop.europa.eu/files/5524_en.pdf

³⁹ <https://local.gov.uk/local-green-jobs-accelerating-sustainable-economic-recovery>

⁴⁰ <https://www.theccc.org.uk/2020/12/09/building-back-better-raising-the-uks-climate-ambitions-for-2035-will-put-net-zero-within-reach-and-change-the-uk-for-the-better/>



- Green skills shortages - whether decarbonisation needs dictate a significantly expanded skilled workforce.

As this overview is based on a literature review, and some industries (e.g. construction) are better represented in recent skills policy literature than others (e.g. waste), this chapter should not be treated as an exhaustive catalogue of every possible green occupation, nor a comprehensive assessment of every skills shortage.

This chapter shows that:

- There is an urgent need to align qualification standards to the needs of the climate transition;
- The industrial shifts, infrastructure upgrades, and land use changes we need will struggle without a huge effort to recruit and skill up new workers, as well a upskilling and reskilling already existing workforces.

2.1 Agriculture, forestry, and land management

A successful green transformation requires changes in land use, switching large amounts of land from pasture or brownfield to forestry or agroforestry, environmental restoration including peatlands and seagrass meadows, and changing farming practices.

Public sector bodies responsible for land and ecosystem management are calling for investment in forestry skills. According to the National Audit Office, “Natural England, the Environment Agency and the Forestry Commission raised concerns with us around funding or skills shortages”.⁴¹ According to DEFRA, “both scientific and project management skills are required to make progress, particularly in the Environment Agency and Natural England as key delivery bodies”.⁴²

Creating new woodland

A larger skilled workforce, nursery capacity and seed availability are all required to accelerate woodland creation and plant tens of millions of trees each year. The UK does not have these, relying on imports of saplings – which in turn creates risks to tree health.

This will require upskilling and retraining across public and private sector forestry bodies, existing forestry workforces and land managers, as well as significantly expanded workforces to rear saplings, plant trees, manage woodland, and harvest timber.⁴³ Increasing the capacity of tree nurseries to supply tree-planting efforts, and carrying out tree planting itself, requires training up significantly more people in horticultural trades.⁴⁴ Planting and managing forests will require significant increase in agroforestry, forestry and other forms of environmental land management skills, and qualified forest managers ready to manage previously unmanaged woodland.⁴⁵

⁴¹ <https://www.nao.org.uk/wp-content/uploads/2020/11/Achieving-governments-long%E2%80%91term-environmental-goals.pdf>

⁴² <https://publications.parliament.uk/pa/cm5801/cmselect/cmpubacc/927/92707.htm>

⁴³ <https://policyexchange.org.uk/wp-content/uploads/2019/12/BIGGER-BETTER-FORESTS.pdf>

⁴⁴ <https://www.nao.org.uk/wp-content/uploads/2020/11/Achieving-governments-long%E2%80%91term-environmental-goals.pdf>

⁴⁵ <https://policyexchange.org.uk/wp-content/uploads/2019/12/BIGGER-BETTER-FORESTS.pdf>



Environmental Restoration

Programmes to restore natural carbon sinks (e.g. peatlands, seagrass meadows) require environmental and conservation professionals, as well as horticultural tradespeople. Rewilding and peatland restoration will require a significant expansion of skills from a very limited base. There are currently few existing training opportunities or qualifications in peatland or other restoration.⁴⁶ More opportunities exist for rewilding, including work experience based “learning by doing” traineeships⁴⁷ and a number of conservation degrees. Nonetheless, there is a need for significantly increased training schemes, to be able to meet labour demand.

Agricultural transformation

A review commissioned by the Climate Change Committee concluded that to decarbonise agriculture, farmers and farm workers will “need training to help them manage, conserve and/or harvest trees”,⁴⁸ and/or to make changes to farming practices (livestock diets, fertiliser and pesticide use, and manure storage and use).⁴⁹ Smallholding farmers will need more support in order to be able to allot time and resources to upskilling.⁵⁰

Summary

Table 3 summarises available data on skills gaps in agriculture, forestry and land management.

Table 3. Green skills gaps in agriculture, forestry and land management

Occupation	SOC code(s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Farmers	5111	No	Yes	Yes	Insufficient data
Horticultural trades e.g. growers, nursery staff, nursery assistants, countryside rangers.	5112, 5119	No	No	No	Yes
Farm workers	9111	Yes	Insufficient data	Insufficient data	Yes
Forestry workers	9112	Yes	Yes	Yes	Yes
Forest managers	1212	No	Yes	Yes	Yes
Environmental and conservation professionals	215	No	No	No	Yes

2.3 Utilities (including Energy & Water)

Electricity generation has decarbonised faster than most other sectors of UK society. However, the necessary electrification of heat, industry and transport means that the roll-out of offshore wind, onshore wind, solar power, tidal stream and other renewables needs to accelerate significantly. The Climate Change Committee’s Sixth Carbon Budget calls for a sales phase-out date for gas boilers of 2030 in commercial buildings and 2033 in residential

⁴⁶ <https://www.iucn-uk-peatlandprogramme.org/resources/peatland-learning-training>

⁴⁷ <https://www.planitplus.net/Apprenticeships/ViewVacancyCA/456/7>

⁴⁸ <https://policyexchange.org.uk/wp-content/uploads/2019/12/BIGGER-BETTER-FORESTS.pdf>

⁴⁹ <https://www.theccc.org.uk/wp-content/uploads/2020/01/Vivid-Economics-and-ADAS-2020-Policy-framework-for-deep-emissions-reductions-and-carbon-removals-in-agriculture-and-land-use-in-the-UK.pdf>

⁵⁰ <https://policyexchange.org.uk/wp-content/uploads/2019/12/BIGGER-BETTER-FORESTS.pdf>



buildings, with annual heat-pump installations expanding from 26,000 in 2019 to over 400,000 in 2025 and over 1 million by 2030.⁵¹ The UK's water infrastructure will also need large-scale upgrades, both to decarbonise and to adapt to climate change.

Expanding clean electricity generation and reinforcing networks

An assessment by Energy & Utility Skills lists the following occupations as being in shortage in the electricity sector (starred occupations also appear on the UK Shortage Occupations list):⁵²

- Business and commercial
- Maintenance technicians
- Protection Engineer*
- Customer service and stakeholder engagement
- Marketing and communications
- Site Manager*
- Commercial capabilities
- Planners
- Substation electrical engineer*
- Commissioning engineers*
- Power System Engineer*
- Substation fitters
- Control Engineer*
- Planning / development engineer*
- Telecommunications and digitisation
- Data analytics
- Project Engineer*
- Quality, health, safety and environment engineer*
- Design Engineer*
- Project Manager*
- Quantity surveyors
- Jointers (HV and LV)
- Proposals Engineer*

Specifically for offshore wind installations, Energy & Utility Skills highlighted a shortage of graduate-level engineers and the expanded need for Operations and Maintenance technicians as more installations complete construction. Skills that will be essential to expansion of offshore wind include technical skills covering mechanical, electrical, and control and instrumentation, blade and turbine technicians, and offshore skills like working at heights and in confined spaces.⁵³

According to the Local Government Association, “an uptick in demand [for solar] would require technicians to be trained at NVQ level 3 equivalent to develop a larger installer base to deliver grid connected solar for utility scale/decentralised generation.”⁵⁴

With the need to significantly expand and reinforce electricity distribution and transmission networks, as well as to build out renewable electricity generation on a mass scale, the shortages, particularly in the technical roles, will become more pressing.

⁵¹ <https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf>

⁵² <https://ore.catapult.org.uk/app/uploads/2018/10/Aura-EU-Skills-UK-Offshore-Wind-Skills-Study-Full-Report-Oct-2018.pdf>

⁵³ <https://ore.catapult.org.uk/app/uploads/2018/10/Aura-EU-Skills-UK-Offshore-Wind-Skills-Study-Full-Report-Oct-2018.pdf>

⁵⁴ <https://local.gov.uk/local-green-jobs-accelerating-sustainable-economic-recovery>



Hybrid heating and heat-pump installation and maintenance

To reach zero heating emissions, homes where a district heat network connection is challenging will need an electric heat pump or a hybrid heat pump installed. This needs a skilled workforce of nearly 70,000 people that does not currently exist. According to the Heat Pump Association, the challenge is rolling out retraining schemes for the existing workforce of gas engineers: “The current route to becoming a heat pump installer is too costly, bureaucratic and confusing, with outdated content still being taught.”⁵⁵

Heat networks installation and maintenance

Heat networks today supply under 0.5 million UK homes. By 2030, the UK should aim to build out and maintain heat networks serving at least 1.5 million homes,⁵⁶ and 5 million homes by 2050,⁵⁷ according to the Climate Change Committee.

A 2020 BEIS-commissioned study⁵⁸ looked at the skills challenges for the heat network sector, and found that the lack of heat network-specific apprenticeships, foundation degrees, or graduate degrees impeded workers’ entry into the sector, and caused quality issues. The study found “High” skills gaps for project delivery managers, heat network development managers, energy master planners, and control system specialists, and “Medium” skills gaps for design engineers, commercial managers, and legal and financial specialists. On the other hand, on-the-job training was considered efficient and relatively easy for pipe layers and installers coming from other sectors.

Water infrastructure

Upgrades to water infrastructure, including a new National Water Transfer network as recommended by the National Infrastructure commission,⁵⁹ is an essential part of climate-change adaptation over the following decades, requiring an expanded civil engineering and water treatment workforce.

A variety of industry sources cite an ageing workforce as a major current problem for skills in the water sector, with estimates of 63,000 vacancies to be filled by 2027.⁶⁰ The industry already struggles to fill 35% of vacancies due to skills gaps. Assessments of current skills shortages in the water sector vary. Clean Water Operatives are currently a periodic skills shortage (depending on water companies’ investment cycles).⁶¹ Energy and Utilities Skills Group reports shortages of technical skills in R&D in chemical and biological engineering, meter installation, water efficiency and leakage prevention.⁶² On the other hand, a survey of engineers and employers within the water sector (commissioned by the Chartered Institution

⁵⁵ https://www.heatpumps.org.uk/wp-content/uploads/2020/06/Building-the-Installer-Base-for-Net-Zero-Heating_02.06.pdf

⁵⁶ <https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/>

⁵⁷ <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>

⁵⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919521/heat-network-skills-review.pdf

⁵⁹ <https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf>

⁶⁰ <http://www.watertrain.co.uk/tackling-the-water-industrys-skill-shortage>

⁶¹ <https://www.rullion.co.uk/media/436567/insights-talent-on-tap.pdf>

⁶² <https://www.euskills.co.uk/wp-content/uploads/2018/05/Water-Profile-2017-Final-140518-v2.pdf>



of Water and Environment Managers) highlights current and imminent gaps in a range of engineering professions:

- Flood Risk Engineer
- Civil Design Engineer
- Mechanical Design Engineer
- Hydraulic Modelling
- Electrical Design Engineer
- Process Design Engineer
- Geo-environmental Engineering
- Environmental Assessment/ Auditing
- Geotechnical Engineering
- Ecology
- Air Quality/Acoustics

Summary

Table 4 summarises available data on green skills gaps in utilities (electricity generation and supply, and water supply).

Table 4. Green skills gaps in utilities

Occupation	SOC code (s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Engineers (Electrical, protection, commissioning, control, project, quality / HSE, design, proposals, flood risk, civil, mechanical, process, geo-environmental, geotechnical, hydraulic modelling)	212, 2152, 2481	Yes	No	No	Yes
Planners, energy master planners	2129	Insufficient data	Yes	Yes	Yes
Commercial manager, project manager, data analytics	2432, 2455, 3544	Insufficient data	Insufficient data	Yes	Yes
Heat network development manager (Project manager)	2455	Yes	No	Yes	Yes
Control system specialist (Engineering professional n.e.c.)	2129	Yes	Insufficient data	Yes	Yes
Quantity surveyor	2453	Yes	No	No	Yes
Technicians (operations, maintenance, installation), Joiners	311, 5316	Yes	No	No	Yes
Clean water operative	8134	Periodic	No	No	Yes
Ecologist	2152	No	No	No	Yes
Environmental assessment / audit	2152	No	Yes	No	Yes
Heat network installer (Plumbers and HVAC trades)	5315	No	No	Yes	Yes
Heat pump installers and maintenance engineers (retraining gas boiler engineers)	5315	No	Yes	Yes	Yes
Pipe layer	5214	No	No	No	Yes



2.4 Manufacturing

The number of new green jobs that will be created in manufacturing depends heavily on government policy and investment choices: to what extent building the technologies for net zero domestically in the UK is prioritised, and whether direct public investment, local content requirements, and other tools are used to ensure this.⁶³ Table 5 below summarises green skills gaps across manufacturing, assuming active policy choices are made to maintain and develop UK-based manufacturing for zero-carbon.

Heat pump manufacturing

Transferring the boiler manufacturing workforce to making heat pumps is critical both for safeguarding UK employment and harnessing existing skills. Whilst the technology is different, many of the engineering and component assembly processes are similar. The exceptions are pipe brazing and the handling of refrigerant, which are specific processes associated with heat pumps, but not boilers. Individuals with these skills could come from other sectors like air-conditioning manufacture in the case of refrigerants, and the automotive industry for shaping and brazing.⁶⁴

Vehicles and batteries manufacturing

According to the Faraday Institution, new gigafactories – factories making batteries for electric vehicles – will require factory systems engineers, database development engineers, and thermal management engineers with a higher order of skills (including PhDs) than usual in automotive manufacturing, as a response to factory advances such as industrial Internet of Things, data-driven production, optimisation, automation, materials analysis, continuous improvement and simulation. Manufacturing battery packs instead of internal combustion engines also requires greater breadth and depth of knowledge – in particular, multi-skilled engineers, who are as comfortable with chemistry as they are with electrical and mechanical engineering.⁶⁵ These will mostly be people not working in the automotive industry today. Within vehicle assembly (rather than battery manufacture), the switch to producing electric vehicles will necessitate some retraining to existing staff.⁶⁶ Graduate research and development jobs will also be necessary in the development of hydrogen fuel cells needed for zero-carbon lorries, ferries and other heavy transport.⁶⁷

Remanufacturing and refurbishment

Recent research by Zero Waste Scotland and Circle Economy suggests changes to existing manufacturing and engineering skills provision across all qualifications (from apprenticeships through to CPD courses) that are needed to enable remanufacturing and repurposing, including digital skills, “elimination of waste from production processes, complex problem-solving and life-cycle engineering.”⁶⁸

⁶³ Transition Economics, STUC, upcoming in 2021.⁵⁶ <https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/>

⁶⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943712/heat-pump-manufacturing-supply-chain-research-project-report.pdf

⁶⁵ Skills and Training Needs for the UK Transition to Electric Vehicles. The Faraday Institution. 25 April 2019

⁶⁶ https://faraday.ac.uk/wp-content/uploads/2020/03/2040_Gigafactory_Report_FINAL.pdf

⁶⁷ https://www.ecuity.com/wp-content/uploads/2020/06/Local-green-jobs-accelerating-a-sustainable-economic-recovery_final.pdf

⁶⁸ <https://www.zerowastescotland.org.uk/sites/default/files/ZWS1543%20Future%20of%20Work%20-%20Emp%20%26%20Skills%20report%20FINAL.pdf> p. 47



The Scottish Government has a Circular Economy strategy to support manufacturers in this direction, including a programme to expand remanufacturing skills provision, although so far no specific plans have been published.⁶⁹ Authorities in the rest of the UK have not yet made any moves to institute remanufacturing training.

Hydrogen electrolysis and storage

If and when at-scale production starts, green hydrogen is expected to become an important source of zero-emissions fuel and feedstock for heavy and marine transport and for chemical industries. The operation of electrolyzers is likely to require skill sets similar to those existing in the chemical industry. According to a study commissioned by the Engineering Construction Industry Training Board, the construction and maintenance of electrolyzers requires “minor upskilling” to ensure an appropriate “workforce specialised in the connection of large electric equipment to the grid, as well as technical assistance for the connection to water utilities ... and to hydrogen transport infrastructure”.⁷⁰

Summary

Table 5. Green skills gaps in manufacturing

Occupation	SOC code (s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce? ⁷¹
Remanufacturing (all occupations)	1121, 212, 2161, 248, 311, 52, 81, 913 and others	N/A	Yes	Yes	Yes
Vehicle manufacturing (all occupations)		No	Yes	Yes	No
Batteries, hydrogen electrolysis and zero-carbon chemicals (all occupations)		N/A	N/A	Yes	Yes
Wind and marine energy supply chains (all occupations)		Yes	No	Yes	Yes

2.5 Construction

Across construction occupations, producing buildings that require “near zero” energy and minimising embedded emissions requires sweeping changes to training standards and practices, both to integrate new materials, digital technologies, and offsite manufacturing, and to give workers confidence in making choices that affect a building’s energy performance.

The Climate Change Committee has highlighted that “the chopping and changing of UK Government policy has led to a skills gap in housing design, construction and in the installation of new technologies. Important steps in reducing emissions are being held back as a result.”⁷² Skills development within the construction sector is limited, particularly given the industry’s fragmented nature where the vast majority of workers are either self-employed or work for

⁶⁹ <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/pages/9/>

⁷⁰ <https://www.ecitb.org.uk/wp-content/uploads/2020/03/Net-Zero-Report-Web.pdf>

⁷¹ If developing respective manufacturing sectors within the UK

⁷² <https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf>



small and micro firms. In addition, 20-25% of the UK's construction workforce is expected to reach retirement or transition out of the industry within the next decade, according to a Construction Leadership Council commissioned review.⁷³

An industry-wide culture shift and reskilling process is needed to mainstream “energy literacy” and a holistic approach to a building's energy efficiency. According to the Centre for the Production of the Built Environment, this means integrating expertise in “Nearly Zero Energy Buildings” (including “airtight building envelopes, thermal-bridge free construction and on-site renewable energy sources”) across the board of vocational training programmes.⁷⁴ Linda Clarke further argues that “transversal abilities” (effective communication, project management, problem solving and autonomous working) are integral to implementing Low Energy Construction and are not present in current vocational qualification standards.⁷⁵

Energy efficiency retrofits (trades, planning and design)

In a 2019 assessment of the UK residential sector, the Climate Change Committee warned that the installation of low-carbon heat, particularly heat pumps, was impeded by “difficulty in finding trusted installers with the right skills. ... There is an urgent need to create standards and qualifications to ensure that low-carbon heat, mechanical ventilation, passive cooling measures, water efficiency, property-level flood resilience and Sustainable Drainage Systems (SuDS) are installed, maintained and used properly”.⁷⁶

Preliminary findings from the “Building Skills for Net Zero” survey conducted by the Construction Industry Training Board showed that over 80% of self-employed workers believe that there is a skills gap in their occupation to deliver decarbonisation. Top skills identified as missing were “Ventilation training”, “Energy & Low Carbon Design” and “Understanding Sustainable Materials”.⁷⁷

The CITB also identified that training courses do not exist to meet the current gap, with the following identified as lacking content or provision at the scale provided: retrofit coordinator and retrofit workers (both domestic and non-domestic), heat-pump installation, hydrogen boiler installation / maintenance / conversion, low-carbon systems training, and inter-trade training. Reaching net zero will require urgently addressing priority skills supply gaps, particularly retrofit designers and coordinators, heat-pump installers and insulation installers.⁷⁸

Skills gaps play a key role in creating the “performance gap”, where incorrect and poor-quality installation results in a “gap between the energy standards intended and achieved, jeopardising emission savings.”⁷⁹ The risk of inappropriate design and installation is highlighted in the case of Fishwick Road in Preston, where 387 council homes were fitted out with external wall insulation in 2013. Because of pressure to maximise the area insulated in the shortest time possible, and a lack of appropriate standards, the contractor used the cheapest materials available, and committed a number of design mistakes. As a result, the homes became afflicted with damp and mould, leading to costs of up to £20,000 per household, and the hospitalisation of one resident with asthma.⁸⁰

⁷³ <https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2016/10/Farmer-Review.pdf>

⁷⁴ <https://committees.parliament.uk/writtenevidence/21513/pdf/>

⁷⁵ <https://www.tandfonline.com/doi/full/10.1080/01446193.2016.1248988>

⁷⁶ <https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf>

⁷⁷ Richard Bayliss (Oct 2020) “Building Skills for Net Zero - Preliminary research findings” Construction Industry Training Board https://stbauk.org/wp-content/uploads/2021/01/STBA-SPAB-Annual-Conference-2020-Day-2_Richard-Bayliss-compressed.pdf

⁷⁸ Richard Bayliss (Oct 2020) “Building Skills for Net Zero - Preliminary research findings” Construction Industry Training Board https://stbauk.org/wp-content/uploads/2021/01/STBA-SPAB-Annual-Conference-2020-Day-2_Richard-Bayliss-compressed.pdf

⁷⁹ <https://committees.parliament.uk/writtenevidence/21513/pdf/>

⁸⁰ <https://themetor.org/2020/06/26/climate-crisis-demands-retrofit/>



The skilled trades involved in building retrofits and low-carbon heating installation are recognised among the top construction occupations in short supply: the Construction Skills Network forecasts an annual recruitment requirement of 2,380 wood-and-interior fit-out tradespeople and 1,900 plumbers and HVAC tradespeople in 2019-2023.⁸¹ Alongside these trades, the Federation of Master Builders additionally includes plasterers and roofers in its top six occupations in short supply.⁸²

In addition to the trade-specific knowledge, workers involved in home retrofits need to be able to understand the effects of interventions on a building's energy performance, and make decisions on the basis of that understanding, meaning a broader set of knowledge and know-how is also required.⁸³

Changing methods of construction and sustainable materials

A shift towards more sustainable construction materials, expanding the uses of timber and plant fibres, alongside Modern Methods of Construction, such as modular and volumetric construction, is commonly seen as key to decarbonising the construction industry. This has the potential to reduce the embedded emissions of a new build by 20 to 60%, plus operational emissions reductions,⁸⁴ and has implications for both the industry's hiring requirements by occupation, and its qualification and training needs. The CITB has identified a shortage in training capacity and content for Modern Methods of Construction, including new-build domestic and non-domestic, and retrofit.⁸⁵

As modelled by the Construction Skills Network, the shift to modular and volumetric construction is projected to reduce the need for future recruits among Labourers; Construction Trades Supervisors; Wood trades and interior fit out; Bricklayers and Glaziers.⁸⁶ On the other hand, the offsite construction methods have a greater need for factory-based workers.

According to the Construction Skills Board, the challenge of maximising offsite construction involves “up-skill[ing] existing workers to cover the site management, integration, onsite placement and assembly that will be increasingly required for MMC,” and “ensur[ing] that the professional, management, technical and non-manual workforce develops the digital skills that will be an increasing part of construction work in the future.”⁸⁷

The use of sustainable construction materials is at present a niche subject in some qualifications offered (from architecture to trades training), while materials and technologies develop year-on-year, bringing existing training out of date. The International Labour Organisation recommends that “green” construction-skills training needs to be broad, to prepare workers with background understanding of the subject rather than just the application of specific technologies, and that “skills-led strategies which are based on developing skills and capabilities ahead of current practice can make a very strong contribution to the policy objective of driving green building forward.”⁸⁸

⁸¹ https://www.citb.co.uk/Documents/research/csn_outlook_2021_2025.pdf

⁸² <https://www.fmb.org.uk/asset/39D72E7C%2DB37F%2D4C54%2D9D568CDD7744439D/>

⁸³ <https://www.tandfonline.com/doi/full/10.1080/01446193.2016.1248988>

⁸⁴ <https://policyexchange.org.uk/wp-content/uploads/2019/12/BIGGER-BETTER-FORESTS.pdf>

⁸⁵ Richard Bayliss (Oct 2020) “Building Skills for Net Zero - Preliminary research findings” Construction Industry Training Board https://stbauk.org/wp-content/uploads/2021/01/STBA-SPAB-Annual-Conference-2020-Day-2_Richard-Bayliss-compressed.pdf

⁸⁶ <https://www.citb.co.uk/Global/research/CITB-MMC-REPORT-MAR-2019.pdf>

⁸⁷ <https://www.citb.co.uk/Global/research/CITB-MMC-REPORT-MAR-2019.pdf>

⁸⁸ http://apskills.ilo.org/resources/greening-of-the-building-sector-is-held-back-by-skill-shortages.-skills-led-strategies-can-drive-green-building-forward/at_download/file1



Flood defences, port expansion and broadband

Civil engineers are recognised on the Shortage Occupation list.⁸⁹ The Construction Skills Network estimates an annual recruitment requirement of 1,190 civil engineers across the UK between 2018 and 2023,⁹⁰ a requirement that will grow if significant green infrastructure (e.g. flood defences, expansion of ports, broadband upgrades) is to be delivered.

Railway construction

A skills baseline study by the Strategic Transport Apprenticeship Taskforce estimated that 50,000 extra people are needed to deliver the planned investment into rail by 2033, including 2,000 extra signallers by 2021.⁹¹ The National Skills Academy for Rail analysis showed that an ageing workforce has led the UK's rail sector to increasingly rely on overseas and "third-tier" workers. It also said that the rail sector will lose "huge numbers" of skilled workers over the next few years, with 15,000 workers due to retire by 2025.⁹²

Alongside this, higher level skills are increasingly required in railway construction, with technology development including digital transport systems, and offsite and modular methods of construction and engineering.

Transport electrification

A mass roll-out of electric vehicle (EV) charging infrastructure, as well as the electrification of rail and parts of water transport, will require a significant number of electricians. While there are accredited courses that enable existing electricians to take on EV charging work, electrical trades themselves are in short supply.

The Federation of Master Builders identifies electricians as one of the top six occupations in short supply. The Construction Skills Network estimates an annual recruitment requirement of 1,570 electricians across the UK between 2019 and 2023, while ERF Electrical-commissioned analysis forecasts an upcoming shortage of up to 15,000 electricians.⁹³ According to an Electrotechnical Skills Partnership (ESP) assessment, on a UK level "an additional total of 8,500-10,000 electricians and 4,000-5,000 new apprentices will be needed" between 2018 and 2023, only to meet forecast economic growth and sector expansion with electrification, and do not account for workforce retirement.⁹⁴

The ESP analysis highlights a looming shortage of skills amongst electricians with expertise in smart meters, EVs and batteries, with employers citing concern about a lack of skilled capacity to cope with the growing volume of demand for electric charging.⁹⁵ A further survey showed 69% of electricians felt they did not have the necessary skills and knowledge to install EV-charging equipment confidently.⁹⁶

⁸⁹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/927352/SOL_2020_Report_Final.pdf

⁹⁰ https://www.citb.co.uk/Documents/research/csn_outlook_2021_2025.pdf

⁹¹ Strategic Transport Apprenticeship Taskforce: skills forecasting baseline study (2019) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/713469/dft-nsar-report.PDF

⁹² <https://www.cityandguildsgroup.com/-/media/cgg-website/documents/cgg-back-on-track-report-pdf.ashx?la=en&hash=07668348451D8F75A8526EBC033870739293AB19>

⁹³ <https://www.erfelectrical.co.uk/shortages-of-electricians-in-uk/>

⁹⁴ <https://www.the-esp.org.uk/wp-content/uploads/2019/11/TESP-LMI-Report-2019.pdf>

⁹⁵ <https://www.the-esp.org.uk/wp-content/uploads/2019/11/TESP-LMI-Report-2019.pdf>

⁹⁶ https://www.learninglounge.com/social/blog/post/107964022/nearly_70_electricians_feel_prepared_electric_vehicle_revolution



Summary

Table 6 summarises the main construction industry skills gaps related to decarbonisation. Bearing in mind the wide changes required, this summary is not intended as exhaustive, but rather indicative of the main current and impending shortages identified by literature to date.

Table 6. Green skills gaps in construction

Occupation	SOC code(s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Managers and supervisors	1122, 5330	Yes	Yes	Yes	Yes
Civil engineers	2121	Yes	Yes	Yes	Yes
Electrical trades	524	Yes	Yes	No	Yes
Plumbing and HVAC trades	5315	Yes	Yes	Yes	Yes
Energy assessors	3541	Insufficient data	Insufficient data	Insufficient data	Yes
Retrofit Coordinators (Construction and building trades supervisors)	5330	No	Yes	Yes	Yes
Insulation Installers (Construction and building trades n.e.c.)	5139	No	Yes	Yes	Yes
Bricklayers	5313	Yes	Yes	Yes	No
Other occupations	53, 815, 912, 1122, 245	Insufficient data	Yes	Yes	Yes

2.6 Transport & Logistics

Transport is now the UK's biggest contributor to climate change, accounting for a third of carbon emissions. Alongside electrification of private vehicles (covered under construction), public transport will need to expand significantly to enable reduced car mileage of up to 20%.⁹⁷ Universal and comprehensive public transport systems as proposed by Transport for Quality of Life and Friends of the Earth require more regular bus, tram and underground and suburban train services.⁹⁸ Construction and electrification of necessary infrastructure is covered in the Construction section, while changes to vehicle maintenance due to the shift to EVs are under Services.

Public transport

The UK's railways workforce faces a "retirement cliff-edge", with over 28% of workers in the current workforce over the age of 50, plus a squeeze on the availability of EU workers. Research by City & Guilds and the National Skills Academy for Rail suggests that 120,000 additional recruits may be needed in rail between 2020-2025, and that the industry

⁹⁷ <https://policy.friendsoftheearth.uk/insight/radical-transport-response-climate-emergency>

⁹⁸ <https://policy.friendsoftheearth.uk/insight/radical-transport-response-climate-emergency>



particularly needs to attract young people.⁹⁹ The occupations flagged in this research as having the highest annual recruitment requirement are:

- Between 3,000 - 5,000 new roles annually: Customer Service Assistant, Train Driver, Maintenance Operative
- Between 1,000 and 2,000 roles annually: Maintenance Technician, Operator, Engineer, Operations Manager, Project Manager
- Between 500 and 1,000 roles annually: Operations Signaller, Maintenance Fitter, Engineering Supervisor, Engineering Manager, Project Management Supervisor, Customer Service Co-ordinator, Business Manager, Customer Service Supervisor

Decarbonising freight will add requirements for additional railway staff including transport and distribution clerks and freight operations assistants.

Expanding public transport networks to significantly reduce the need for car travel will also require expansion of bus network workforces, including transport planners, customer service staff, maintenance technicians, and bus drivers.

Rentals, product-as-service, and logistics

As services like car-sharing and tool-lending displace the demand for new goods, and as homeworking overtakes office work, this requires expanded postal service, logistics and reverse logistics sectors,¹⁰⁰ including managers and operatives in logistics and warehousing.

Summary

Table 7 summarises the green skills gaps in transport and logistics. (Note that skills gaps in transport electrification upgrades are covered under Construction.)

Table 7. Green skills gaps in transport and logistics

Occupation	SOC code(s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Railway operations (including customer service, train drivers, maintenance operatives and technicians, engineers, operations and project managers, clerks, freight operations assistants and others)	6214, 8153, 8231, 8234, 4243, 721, 1121, 1241, 4143, 8239 and others	Yes	No	No	Yes
Bus network operations (including bus drivers, customer service, transport managers)	8212, 1241, 721, 8239	No	No	No	Yes
Directors, managers and operatives in logistics and warehousing	114, 1242, 1243, 9252	Yes	Yes	Yes	Yes

¹⁰⁰ <https://www.cityandguildsgroup.com/research/back-on-track>

¹⁰¹ <http://www.wrap.org.uk/sites/files/wrap/Opportunities%20to%20tackle%20Britain's%20Labour%20Market%20Challenges%20full%20report.pdf>



2.7 Services

The climate transition will require shifts in working practices – and therefore some retraining – across all manner of services occupations, from health through to town planning, and catering through to care work. Rather than attempting to catalogue these shifts, this section points to the skills gap implications of infrastructural changes described elsewhere in this report for several service industries, summarised in Table 8.

Repair and maintenance

Designing waste out of the economy requires a massive expansion in repair services, to enable product-as-service provision and second-hand goods to displace redundant purchases of new goods. There are no UK-wide assessments available of repair skills provision, but a Zero Waste Scotland study in 2014 found that there were not enough repair and maintenance courses, particularly accredited courses, available in Scotland. No courses at all were available in furniture upholstery repair, only one course in small electric appliance fault diagnosis and repairs, and no repair Quality Assurance courses for furniture, electronics, or textiles. No bicycle repair courses were accredited.¹⁰¹ This data is not recent, nor does it cover England and Wales, but it highlights the scale of the challenge for recognising and resourcing repair skills. If repair and maintenance are to be scaled up in a way that will significantly displace waste, the relevant workforce and the skills provision will need to expand proportionately.

Procurement change (in business services and public sector)

Procurement professionals do not have sufficient confidence in and understanding of growing technologies (including offsite and structural timber-based construction, remanufacturing and refurbishment) to enable public and private sector clients to make the switch. There are recently developed toolkits to support “circular procurement”, i.e. to “maximise the value of products and materials while in use and recover and repurpose them at the end of their lives, eliminating waste.”¹⁰² However this type of training is far from mainstream. In construction, the Farmer Review of the UK Construction Labour Model describes this as “a deep-seated cultural resistance to change”,¹⁰³ and recommends the development and promotion of new procurement models, to enable both clients and industry to move towards Modern Methods of Construction.

Electric Vehicle maintenance and services

The maintenance needed for electric vehicles is very different than for traditional combustion engine vehicles – electric engines don’t require oil changes, have far fewer moving parts and rarely break down.¹⁰⁴ Instead, electric vehicles are more likely to need digital calibration and the high voltage batteries create a greater level of risk and danger, requiring a skills transition for mechanics and technicians.¹⁰⁵ In 2018, the Institute of the Motor Industry assessed 97% of active mechanics as not suitably qualified to work on electric vehicles.¹⁰⁶

¹⁰¹ <https://www.zerowastescotland.org.uk/sites/default/files/Scoping%20repair%20training%20for%20the%20re-use%20sector.pdf>

¹⁰² <https://www.rypeoffice.com/how-government-can-meet-its-sustainability-targets-and-transform-furniture-procurement/>

¹⁰³ https://www.citb.co.uk/documents/research/local_construction_skills_needs_scotland_summary_july2018.pdf

¹⁰⁴ <https://www.washingtonpost.com/news/innovations/wp/2017/12/11/people-are-freaking-out-why-electric-vehicles-might-doom-your-neighborhood-auto-mechanic/>

¹⁰⁵ Skills and Training Needs for the UK Transition to Electric Vehicles. The Faraday Institution. 25 April 2019

¹⁰⁶ <https://www.autoexpress.co.uk/car-news/96082/only-3-of-mechanics-qualified-to-work-on-electric-vehicles>



The shift toward EVs necessitates retraining for vehicle technicians, mechanics and electricians, emergency response staff, and service station staff.¹⁰⁷ The mainstreaming of hydrogen fuel cells for heavy vehicles later on would likely require additional retraining.

Summary

Table 8. Green skills gaps in services

Occupation	SOC code(s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Repair skills and repair occupations across skilled trades	52, 541, 544	No	Yes	Yes	Yes
Procurement professionals (e.g. purchasing managers, planning officers and consultants, buyers and procurement officers)	1134, 2452, 3551 and others	Insufficient data	Yes	Yes	Insufficient data
Vehicle technicians, mechanics and electricians, service station staff, emergency response staff	5231, 6132	No	Yes	Yes	No

2.8 Education

Teaching staff – the workers who will deliver the retraining needed to bridge green skills gaps – will themselves need upskilling to deliver new curricula. The Association of Colleges, the University and College Union, and Students Organising for Sustainability have called on the government to allocate extra resources to FE colleges to “bring in experienced additional staff to prioritise the development and delivery of low-carbon vocational training and reskilling”, as well as creating National Centres of Excellence to lead the curricula development and teaching-staff training necessary to bridge the green skills gap.¹⁰⁸

Table 9. Green skills gaps in education

Occupation	SOC code(s)	Current skills shortage?	Needed for decarbonisation		
			Workforce reskilling?	Qualification standards update?	Expanded workforce?
Further education and Higher education teaching professionals	2311, 2312	No	Yes	Yes	Yes

¹⁰⁷ https://faraday.ac.uk/wp-content/uploads/2020/03/2040_Gigafactory_Report_FINAL.pdf

¹⁰⁸ <https://www.ucu.org.uk/media/10999/Retraining-revolution-letter-Jul-20/pdf/20200702-jointletter-retrainingrevolution.pdf>



Chapter 3. Solutions

3.1. Summary

What will it take to overcome the UK's gaping youth unemployment crisis, and to solve the green skills shortage?

This report advocates for a Green Opportunity Guarantee for young people, delivered through 3 policy strands:

1. Create green jobs in the immediate-term through a large-scale green infrastructure based recovery stimulus, and set a clear economic direction for decarbonisation.

Public investment is the most effective way to recover following a recession and create much needed jobs. Following proposals published by the TUC, a green infrastructure stimulus could create an emergency 1.24 million-jobs boost in the immediate two years through a public investment of £85 billion across the UK. Such a programme would make significant progress on the UK's decarbonisation needs: upgrade cycling and pedestrian infrastructure, plant forests, restore peatlands, install electric vehicle chargers, retrofit public buildings, and much more. Infrastructure investment should be subject to a job creation test to ensure the projects deliver good quality jobs locally, including jobs appropriate for young people.

2. Resource training bodies to mainstream green skills in curricula, take on more students, and expand green traineeships.

A bold expansion of green skills provision could help rebuild from the pandemic, reduce youth unemployment rapidly and shrink long-term economic scarring. This should include the expansion of Skills Bootcamps targeting green skills, the creation of a network of National Centres of Excellence for Zero Carbon Skills, and increased training and traineeships resources within Further Education Colleges.

3. Create an emergency Green Apprenticeship programme to set 250,000 young people on a pathway into green careers in the following three years.

This chapter sets out in detail how Green Apprenticeships can become a 21st-century version of US President Roosevelt's New Deal Civilian Conservation Corps, and help prevent future wage scarring of tens of billions of pounds from today's youth unemployment. It learns from the furlough system's success in using simple processes to deal with a jobs crisis.

Apprenticeships combine off-the-job training with paid work, offer a recognised qualification and long-term prospects. While apprenticeship starts have crashed during the pandemic,



this chapter argues that combining a green infrastructure stimulus with apprentice wage and training support and targets for employers can deliver Green Apprenticeships on the scale needed.

Section 2.3 details how 250,000 Green Apprenticeships can be created over 3 years. Wage subsidies, training costs, and diversity access funding would cost £1.2 billion to £2.1 billion per year, for five years.

This will:

- Reduce and prevent the long-term economic scarring caused by extended youth unemployment, undermining both individual incomes and local productivity.
- Provide the immediate term workforce to deliver emergency green infrastructure as part of the recovery from the Covid crisis.
- Enable the UK to face up to the climate and environmental emergencies by boosting the domestic green skills base.

3.2. Green infrastructure jobs for young people

Skills programmes must sit alongside a larger and well-coordinated green-infrastructure and job-creation programme that reboots the UK economy to recover from the Covid crisis. The TUC outlined how a new plan for green jobs, overseen by a National Recovery Council bringing together unions, business and government, can prevent the despair of mass unemployment. Designed right, it can help address some of the UK's biggest challenges – the need to reach a net zero-carbon economy, to address persistent race, class, gender, disability, regional and wider inequalities, and to deliver a higher skill and higher paid, more productive economy. Public investment is the most effective way to recover following a recession, and to restore the public finances.

This report uses the investment plan published by the TUC¹⁰⁹ in June 2020 as a model, while also examining others including those published by IPPR,¹¹⁰ NEF,^{111,112} Greenpeace.¹¹³ This could create an emergency 1.24 million-jobs boost in the immediate two years through a public investment of £85 billion. See Table 10 below to see the detailed breakdown by project.

Green infrastructure projects that could create immediate-term direct and indirect jobs include:

- Investment in high-speed broadband could help create over 40,000 new jobs
- Research and development in decarbonising technology in manufacturing could help create over 38,000 new jobs
- Expanding and upgrading the rail network could help deliver over 120,000 new jobs
- Investing in the electrification of transport, including electric buses, new electric ferries, battery factories, and electric charging points could help deliver 59,000 jobs

¹⁰⁹ <https://www.tuc.org.uk/research-analysis/reports/rebuilding-after-recession-plan-jobs>

¹¹⁰ Jung C and Murphy L (2020), Transforming the economy after Covid-19: A clean, fair and resilient recovery <https://www.ippr.org/news-and-media/press-releases/investing-in-a-green-recovery-could-create-1-6-million-new-jobs-after-covid-crisis-report-finds>

¹¹¹ Lukasz Krebel, Alfie Stirling, Frank van Lerven, Sarah Arnold (2020), Building a Green Stimulus for Covid-19: A recovery plan for a greener, fairer future <https://neweconomics.org/uploads/files/green-stimulus-covid.pdf>

¹¹² Donal Brown, Hanna Wheatley, Chaitanya Kumar, Joanne Marshall (2020), A green stimulus for housing - The macroeconomic impacts of a UK whole house retrofit programme

¹¹³ <https://neweconomics.org/2020/07/a-green-stimulus-for-housing>

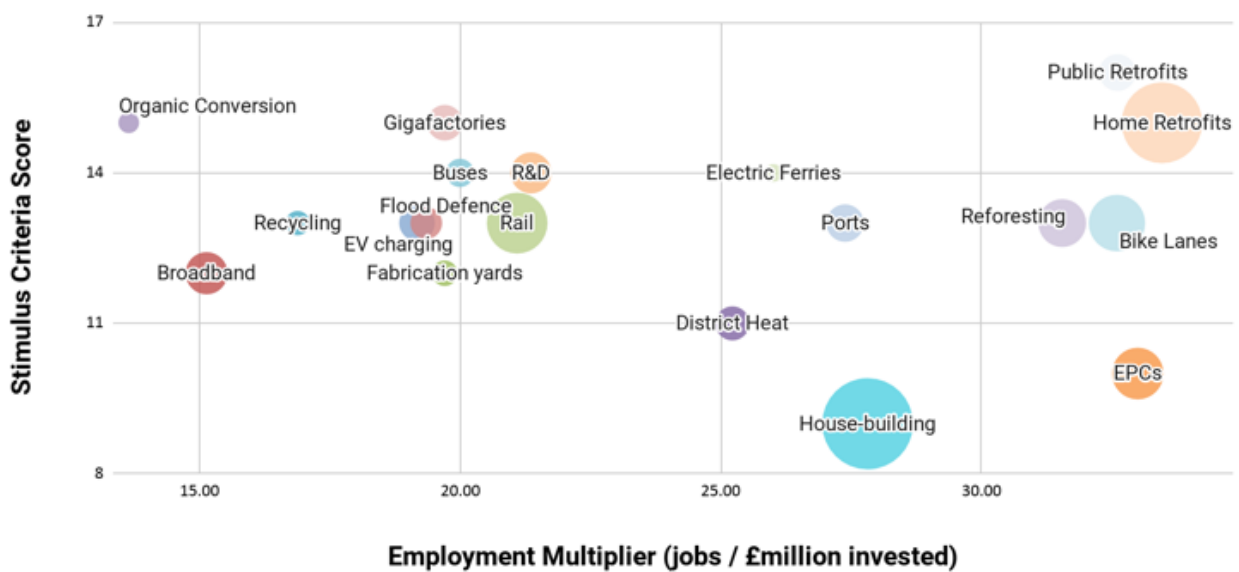


- Building new social housing and retrofitting existing social housing could create well over 500,000 jobs
- A rapid roll-out of cycle lanes and pedestrianisation could deliver 100,000 jobs
- Land restoration, reforestation and agricultural improvements could create 81,000 jobs

Figure 5 provides an overview of the potential infrastructure projects, demonstrating their employment multipliers (x-axis), broader societal benefits scoring (y-axis) and short-term job creation potential (bubble size).¹¹⁴

Figure 5. Infrastructure projects assessed by job creation multiplier and benefits score

Source: Transition Economics analysis. Bubble size represents scale of job creation.



Public investment into shovel-ready green infrastructure can save thousands of workers from bad work or no work at all, by creating accessible, secure, and meaningful work for those at risk of unemployment. 16 of the 23 projects analysed can be targeted particularly at “held back” regions.

As the UK emerges from repeated lockdowns and when the Job Retention Scheme is wound down, a green infrastructure stimulus on this scale can ensure the success of the furlough system in preventing mass redundancies is not lost and delivers sustainable jobs across the UK.

¹¹⁴ Greenpeace (2020), A Green Recovery - How we get there <https://www.greenpeace.org.uk/wp-content/uploads/2020/06/A-green-recovery-how-we-get-there-Greenpeace-UK.pdf>



Table 10 summarises the UK wide scale of investment and job creation expected from a green infrastructure stimulus programme, as outlined by the TUC.

Table 10. Green infrastructure stimulus programme: spend and job creation

Source: Transition Economics analysis for the TUC

Project	UK-wide public investment, £bn	Jobs supported over 2 years
Broadband upgrade	3.50	42,365
R&D for decarbonising heavy industry	3.00	38,440
Expand bus network (buy new electric buses from domestic manufacturers)	1.20	9,597
Expand and upgrade rail network	15.00	126,540
Commission new electric ferries for island travel	0.20	2,081
Build battery factories for EVs	1.00	23,640
Electric car charging points (rural)	2.00	23,768
Build cycle lanes & pedestrianisation	7.90	103,018
Build plastics recycling plants	0.25	5,063
Build social housing (using domestic offsite manufacture)	13.00	361,613
Retrofit social housing	20.00	267,715
EPCs and Building Renovation Passport for all homes	6.00	79,200
Retrofit public buildings	2.00	26,089
Upgrade ports and shipyards for offshore wind supply chain	1.30	28,478
Build manufacturing facilities for offshore (including floating) wind turbines	0.40	6,304
District Heating	1.00	20,177
Reforestation schemes	5.00	63,102
Environmental restoration (incl flood defences)	2.00	15,477
Support farmers to switch to Organic Agriculture	0.38	2,045
Total	85.13	1,244,712



Table 11 lays out levels of investment needed for the largest infrastructure upgrades at a Combined Authority level.

Table 11. Green infrastructure stimulus investment by Combined Authority (£ million)

Source: Transition Economics analysis

Combined Authority	Build cycle lanes & pedestrianisation ¹¹⁵	Build social housing (using domestic offsite manufacture)	Retrofit social housing	Domestic energy efficiency assessments
Cambridgeshire and Peterborough	42	167	232	78
Greater Manchester	468	1,062	1,011	261
Liverpool City Region	274	404	584	152
London	404	2,542	3,166	767
North East	182	195	502	115
North of Tyne	124	223	326	83
Sheffield City Region	228	504	502	131
Tees Valley	116	146	232	66
West Midlands	413	571	1,052	251
West of England	128	215	208	68
West Yorkshire	Insufficient data	784	816	265

¹¹⁵ The national-level proposals are for central government funding, which should be targeted towards regions where there is less existing investment into cycling infrastructure. For this reason, London was excluded from the national level assessment, and the investment need reflected here for London does not correspond to that factored into the national assessment.



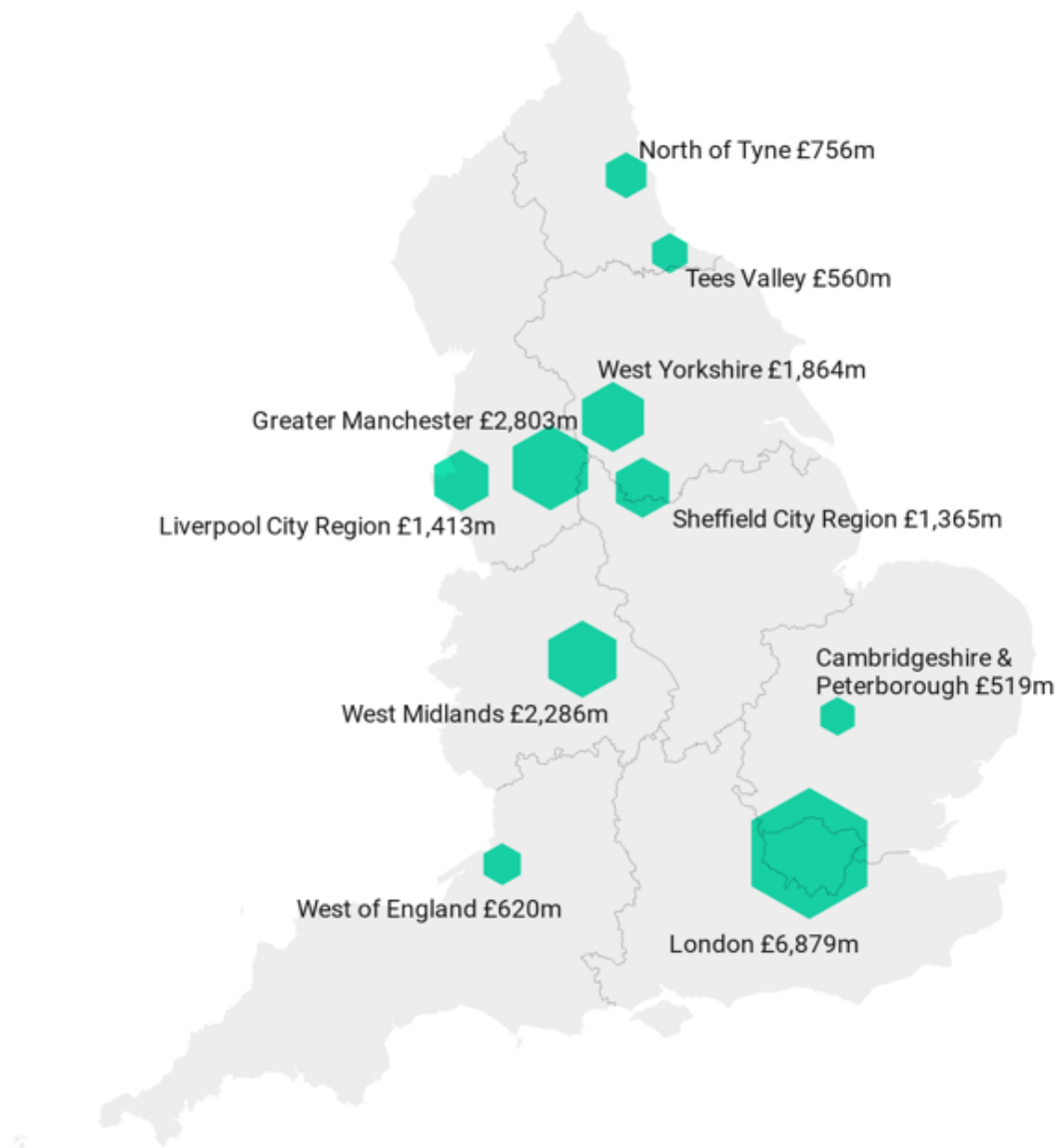
Figure 6 shows a geographic breakdown of levels of total investment needed for domestic retrofits, energy assessments, building zero-carbon social housing and cycling/pedestrian infrastructure. It only includes investments at Combined Authority/Metro Mayor level in England.

Figure 6. Green infrastructure stimulus investment by Combined Authority (£ million)

Source: Transition Economics analysis

Green Infrastructure investment needed by Metro Mayor Combined Authority

Only includes investments for domestic retrofits, energy efficiency assessments, building zero-carbon social housing and cycle lanes/pedestrianisation.



Map: Transition Economics • Source: transitioneconomics.net • Map data: © Crown copyright and database right 2018 • Created with Datawrapper



Co-Benefits of the Green Infrastructure programme

Cycling & Pedestrian Infrastructure

50% of English and Welsh towns and cities receive best-practice cycle lanes and pedestrianisation, at the level of “Mini-Hollands” in Waltham Forest, Kingston and Enfield.

This could lead to healthcare savings between £5 billion and £34 billion, according to Transition Economics analysis using studies cited by “The Value of Cycling” report commissioned by the Department for Transport.¹¹⁶

Analysis by Kings’ College London of the projected improvement in air pollution in Waltham Forest deriving from Mini-Holland estimated that the local population would gain 41,000 life-years as a result of the scheme.¹¹⁷

“The Value of Cycling” analysis commissioned by the Department for Transport from the University of Birmingham found that each typical “cycling city” could be worth £377 million to the NHS in healthcare cost savings, in 2011 prices.¹¹⁸

Domestic Retrofits

An additional 40% of social homes retrofitted to at least EPC level C, passing 90% of total social housing at this level.

This could should save households anywhere between £122¹¹⁹, and £190¹²⁰ and £600¹²¹ per year.

Over ten years, this could save households across England and Wales between £2.1 and £10.2 billion on their energy bills.

Better home energy efficiency could help prevent the 3,200 deaths each year directly linked to cold, damp homes¹²², and reduce the estimated cost to the NHS

¹¹⁶ Raje F and Saffrey A (2016) The value of cycling. University of Birmingham and Phil Jones Associates for Department for Transport. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/509587/value-of-cycling.pdf
Citing Gotschi, T. (2011), ‘Costs and Benefits of Bicycling Investments in Portland, Oregon’, Journal of Physical Activity and Health, 2011, 8(Suppl 1), S49-S58

¹¹⁷ Air Quality: concentrations, exposure and attitudes in Waltham Forest For: Waltham Forest By: David Dajnak, Heather Walton, Gregor Stewart, James David Smith and Sean Beevers. Reported and linked from here: <https://airqualitynews.com/2018/08/03/waltham-forest-sees-health-benefit-from-cycling-and-walking-scheme/>

¹¹⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/509587/value-of-cycling.pdf

¹¹⁹ Element Energy (2020), Development of trajectories for residential heat decarbonisation to inform the Sixth Carbon Budget - a study for the Climate Change Committee <https://www.theccc.org.uk/publication/development-of-trajectories-for-residential-heat-decarbonisation-to-inform-the-sixth-carbon-budget-element-energy/>

¹²⁰ The Element Energy paper cited above assumes significantly lower investment per home than we do. The £190 figure is derived by assuming a greater percentage in annual energy consumption, using figures from Rosenow, J., Eyre, N., Sorrell, S., & Guertler, P. (2017). Unlocking Britain’s First Fuel: The potential for energy savings in UK housing. http://www.cied.ac.uk/wordpress/wpcontent/uploads/2017/09/3900_UKERC_CIED_briefing_final.pdf

¹²¹ The government’s estimated potential saving from Green Homes Grants, which provides a maximum of £10,000 (in the care of home-owners on a low-income) is equivalent to the £10,000 costs we have modelled per house. <https://www.gov.uk/government/news/greener-homes-jobs-and-cheaper-bills-on-the-way-as-government-launches-biggest-upgrade-of-nations-buildings-in-a-generation>

¹²² <https://www.e3g.org/publications/cold-homes-and-excess-winter-deaths-a-preventable-public-health-epidemic/>



from poor quality housing of £1.4 - £2 billion per year, in England alone.¹²³

Additional co-benefits

- Rural electric vehicle charging roll-out covering 56% of rural businesses
- Public buildings save 28% on energy consumption from energy-efficiency retrofits¹²⁴
- Flood defences in line with Environment Agency needs
- New social housing construction in line with Shelter demands
- Plastic-recycling infrastructure enables an end to plastic exports
- Domestic clean manufacturing protected and boosted
- Accelerated Full Fibre Broadband rollout

3.3. Green skills and apprenticeships for young people

The Prime Minister has promised a high-wage and highly skilled future.¹²⁵ But UK government spending on adult education per person is only two-thirds of the European average, and UK employers invest just half the EU average in training for their workers.¹²⁶ Emergency support during the pandemic (e.g. existing subsidies for traineeships and apprenticeships) is struggling to stem the collapse in prior training opportunities, let alone create new possibilities. The current pathway will fail young people in the short term, and leave the UK falling further and further behind on green skills.

Alongside this, the green skills gaps identified in Chapter 2 threaten to derail the UK's decarbonisation effort, and to shrink the domestic economic benefit gained from the climate transition.

Alternatively, a bold expansion of green-skills provision could help rebuild from the pandemic, reduce youth unemployment rapidly and shrink the long-term economic scarring.

The following elements should be included: a large-scale Green Apprenticeship programme, the expansion of Skills Bootcamps targeting green skills, the creation of a network of National Centres of Excellence for Zero Carbon Skills, and increased training and traineeships for green skills in Further Education Colleges.

Green Apprenticeships

Government should ensure the creation of 250,000 Green Apprenticeships over the next three years, underwritten by £6.2 - 10.6 billion of funding towards wage subsidies, training and diversity measures.

The difficult economic context requires significant incentives for both public and private employers to hire Green Apprentices, including 50-100% of apprentice wages being

¹²³ Nicol S. et al. (2015), The cost of poor housing to the NHS - cited in The Climate Change Committee (2020) The Sixth Carbon Budget report <https://www.theccc.org.uk/publication/sixth-carbon-budget/>

¹²⁴ https://www.c40.org/case_studies/re-fit-programme-cuts-carbon-emissions-from-london-s-public-buildings

¹²⁵ <https://www.conservatives.com/news/boris-johnson-unveils-a-new-deal-for-britain>

¹²⁶ <https://www.tuc.org.uk/blogs/fe-white-paper-missed-opportunity-boost-retraining-and-skills>



covered by government, alongside training support and bonuses. There will also need to be higher apprentice targets for public sector bodies, and specific requirements for private sector companies receiving government Green Industrial Revolution support to hire Green Apprentices.

Launching the programme in the immediate term requires starting from 161 existing apprenticeship standards that help deliver the zero carbon transition. New standards, or updates to existing apprenticeship standards, should cover areas including environmental restoration, whole-house retrofits, residential thermal insulation, energy assessments, and remanufacturing. To meet future skills needs, Green Apprenticeships should provide a broad base of training and education, preparing apprentices not only for one job, but a career in delivering the climate and environmental transition over the coming four decades.

The Green Apprenticeship programme should provide good quality jobs and training to young people, and take a proactive approach through Diversity Bursaries for apprentices, Diversity Bonuses for employers, and best-practice advertising and hiring, to increase take-up of Green Apprenticeships by underrepresented and historically marginalised groups.

Section 3.3 details how a Green Apprenticeship programme can be delivered and financed.

Further Education colleges and Green Traineeships

We need to see a substantial increase in Green Traineeships provided by FE Colleges, alongside a broader expansion of courses providing training in skills necessary for the zero-carbon transition. This must be underpinned by specific funding lines, alongside a clear long-term funding settlement brought forward (and not left until the Autumn 2021 Spending Review). As part of this, the government needs to set a clearer steer on the skills required to deliver the climate transition.

FE colleges are often expected to deliver much of the heavy lifting to prepare the workforce for net zero. However, the existing practice of FE colleges responding to signals from local employers, who in turn respond to signals from government on the long-term direction and shape of the economy, is failing to deliver the college-based training system we need to see to decarbonise rapidly. A recent survey by the Construction Industry Training Board showed that “the specific skills required to develop low-carbon retrofit and new-build designs are not (yet) in demand”.¹²⁷ This is exacerbated in sectors like energy-efficiency retrofits, where most activity is delivered by small and medium companies, who are less likely to influence training delivery.

A proactive and coordinated national plan should set out the key skills and competencies that the FE sector needs to deliver in the coming 15 years to achieve accelerated decarbonisation. It should also learn from the successes in qualifying existing and new workforces for low-energy construction in Belgium, Austria and Germany.¹²⁸ These have focused on college-based learning to mainstream zero-carbon skills into curricula, and benefitted from a social partnership model with significant union involvement.¹²⁹

Increased government funding to FE colleges should specifically target a ramp-up in Green Traineeships, investment into well-equipped and modern workshops and the creation of green skills curricula for broad occupational profiles.

¹²⁷ Richard Bayliss (Oct 2020) “Building Skills for Net Zero - Preliminary research findings” Construction Industry Training Board https://stbauk.org/wp-content/uploads/2021/01/STBA-SPAB-Annual-Conference-2020-Day-2_Richard-Bayliss-compressed.pdf

¹²⁸ Clarke, L., Gleeson, C.P., Sahin-Dikmen, M., Winch, C. and Duran-Palma, F. (2019), Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC Final Report, <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

¹²⁹ Clarke, L., Sahin-Dikmen, M., & Winch, C. (2020). Transforming vocational education and training for nearly zero-energy building. *Buildings and Cities*, 1(1), 650–661. <https://journal-buildingscities.org/articles/10.5334/bc.56/>



National and Regional Centres of Excellence for Zero Carbon Skills

A network of National and Regional Centres of Excellence for Zero Carbon Skills should be created at further education colleges, serving as hubs for Green Apprenticeship and Traineeship training.¹³⁰ The Centres of Excellence should be geographically spread to help with the levelling-up agenda, based on regional hubs that integrate with local industry.

Collectively the network can lead on designing new teaching resources, retrofitting zero-carbon skills into existing apprenticeship and traineeship curricula, reskilling teaching staff, and sharing best practice. Training centres should be prioritised towards sectors where deployment is already cost-competitive, but the UK skills base is lagging behind other countries, such as energy-efficient construction and retrofits, electric vehicle battery manufacture and maintenance, heat pump manufacture, remanufacturing and the circular economy.

Green Skills Bootcamps and the National Skills Fund

The existing Skills Bootcamp programme should be expanded, targeting provision of green skills to unemployed young people. The National Skills Fund should also support additional upskilling and retraining opportunities to boost the domestic green-skills base and access green jobs.

The government's recently launched skills bootcamps provide free 12-16 week courses. These initially focused on digital skills, and were trialled in Derbyshire and Nottinghamshire, Greater Manchester, Liverpool City Region, Leeds City Region and parts of South West England. Technical skills have been added in areas like welding, construction and engineering, including Marine Electronics at South Devon College¹³¹ and fibre-optic broadband installation at Shipley College in West Yorkshire¹³².

There is scope for a significant increase in Green Skills bootcamps to create pathways to green jobs for unemployed young people. These could particularly target geographic areas where skills shortages have been identified, and be linked to Green Apprenticeships.

Retraining the existing workforce

This report explicitly focuses on the potential for an emergency jobs and skills plan for *young people* - here defined as 16-25 year olds.

There are also very important challenges on how to reskill and upskill the existing over-25 workforce to deliver the climate transition, including ensuring a just transition for those currently working in high-carbon industries. Most of the workforce who will deliver the climate transition over the coming two decades are already working. Policies that have been proposed to address this include a right to paid time off to train, wage compensation, guaranteed jobs pathways, greater union voice and social dialogue, union learning, workplace framework agreements, local content requirements and greater levels of public ownership. This report does not aim to address this challenge.

¹³⁰ <https://www.ucu.org.uk/media/10999/Retraining-revolution-letter-Jul-20/pdf/20200702-jointletter-retrainingrevolution.pdf>

¹³¹ <https://www.southdevon.ac.uk/course/marine-technical-electronics-autonomous-satellite-control-bootcamp-supporting-progression-level-3>

¹³² <https://www.skillsbootcamps.com/copy-of-overhead-lines>



3.4. Green Apprenticeships

This section describes the proposed programme: the work apprentices would do, the employers, training providers, and training standards involved, the policy challenges in a quick delivery at scale, costing, and considerations of futureproofing, diversity, and job quality.

Current apprenticeship & training policy context

The UK's apprenticeship programme was already struggling to deliver before the Covid economic crisis. Apprenticeship starts fell by a quarter in 2019, with the National Audit Office concluding that the government's target of 3 million starts in 2020 was "very unlikely" to be met.¹³³ The UK's biggest employers underspent £400 million in expired apprenticeship levies between May and December 2019.¹³⁴

Some sectors have structurally weak training-and-apprenticeship programmes. UK construction in particular has an extremely weak training infrastructure, in large part because over half the workforce is self-employed and much of the rest are in small or micro firms. Large contractors do not employ their workforce. The sector employs far too few apprentices, and most construction trainees are not apprentices but full-time in FE colleges.¹³⁵

With the Covid economic crisis underway, apprenticeship starts have further collapsed by over 50%.¹³⁶ A further 12% of existing apprentices had been made redundant during the pandemic by October 2020.¹³⁷ The weak economy and many struggling businesses make it difficult for employers to commit to hiring apprentices.

In their 2019 Manifesto, the Conservatives pledged to improve the working of the apprenticeship levy,¹³⁸ and the Prime Minister has recently said that the levy will be reformed.¹³⁹

Since the pandemic began, the government has promised to guarantee an apprenticeship for every young person who wants one, with the Prime Minister saying in June that "Young people, I believe, should be guaranteed an apprenticeship."¹⁴⁰ In July 2020 the government announced its Plan for Jobs 2020, including £1.6 billion in support for boosting worksearch, skills and apprenticeships. This included a new payment to employers in England for each new apprentice they hire: £2,000 for each apprentice under 25, and £1,500 for each apprentice aged 25 and over from 1 August 2020 to 31 January 2021 (extended to 31 March 2021).¹⁴¹ This payment is in addition to the £1,000 payment the government already provides for new 16-18 year old apprentices, and those aged under 25 with an Education, Health and Care Plan.¹⁴²

However, this has not been enough to stem the collapse in apprentice numbers, and was described by Make UK as "a drop in the ocean in covering the cost of taking on an apprentice".

¹³³ <https://www.bbc.co.uk/news/business-47462193>

¹³⁴ <https://www.peoplemanagement.co.uk/news/articles/more-than-400m-expires-from-apprenticeship-levy-pots>

¹³⁵ Input from Linda Clarke, University of Westminster. January 2021.

¹³⁶ <https://www.fenews.co.uk/fevoices/52381-apprenticeships-and-traineeships-july-20202>

¹³⁷ <https://www.suttontrust.com/news-opinion/all-news-opinion/new-sutton-trust-survey-shows-covid-19-is-continuing-to-have-an-impact-on-apprentices/>

¹³⁸ <https://www.conservatives.com/our-plan>

¹³⁹ <https://hansard.parliament.uk/Commons/2020-01-15/debates/2CA2C0F3-F47F-4201-AFB2-3D951B3C2F29/Engagements#contribution-6FA2CDBE-57D2-4F00-8D98-EB6333433A6C>

¹⁴⁰ <https://www.ft.com/content/38afd505-c816-43cf-9fb8-a839cc7da949>

¹⁴¹ <https://www.gov.uk/guidance/incentive-payments-for-hiring-a-new-apprentice>

¹⁴² <https://www.gov.uk/government/publications/a-plan-for-jobs-documents/a-plan-for-jobs-2020>



The Plan for Jobs budgeted for 100,000 incentive payments, but data showed that only 18,670 apprentices had been taken on under the scheme by 8 January 2021.¹⁴³ Costs are the largest barrier to hiring apprentices, with apprenticeships in engineering and manufacturing costing employers up to £80,000.¹⁴⁴ Wage and management costs of £15,000 - £40,000 are more usual, but the wage costs remain the key obstacle.

In January 2021, the government also announced a £1,000 grant for businesses to take on new trainees.¹⁴⁵

This followed the existing Kickstart Scheme launched in September, a £2 billion fund to create six-month work placements aimed at 16-24 year olds who are on Universal Credit and deemed at risk of long-term unemployment. The funding covers 100% of the relevant National Minimum Wage for 25 hours a week plus associated employer National Insurance contributions, per person.¹⁴⁶ However, as of mid-January, less than 2,000 young people had begun their placements.¹⁴⁷ The scheme has also been criticised by the Association of Employment and Learning Providers and the Labour Party, including for the short-term nature of Kickstart employment compared to apprenticeships¹⁴⁸ and because “Apprenticeships offer young people the skills training needed for sustainable employment, but they are now being displaced by Kickstart which doesn’t require any training. In terms of incentives, we need a level playing field.”¹⁴⁹

The Institute for Apprenticeships and Technical Education has recently recruited a Green Apprenticeships Advisory Panel to advise how to make existing apprenticeship standards greener, and identify skills gaps.¹⁵⁰ This can create a pathway to ensuring that apprenticeship standards are proactively meeting tomorrow’s skills needs. However, it is concerning that the Institute for Apprenticeships and Technical Education focused its recruitment on employers, given the key role of environmental organisations, training bodies, and trade unions in identifying the green skills required to transition.

What projects can employ Green Apprenticeships quickly?

A large-scale and coordinated public green infrastructure programme creates the potential for the massive Green Apprenticeship programme laid out in this chapter.

This report takes the £85 billion green infrastructure investment programme identified in the TUC’s “Rebuilding after Recession: a plan for jobs” as its starting point. A public investment programme of this type – necessary to kickstart the economy out of the Covid crisis and to prevent spiralling unemployment – also hands the government important levers to ensure apprenticeships are recruited, and that job quality and diversity targets are met. A co-ordinated programme also allows a more high-profile recruitment drive.

Different sectors can take on new apprentices at different proportions. However, the scale of overall jobs growth for different green infrastructure projects can give an indication of the potential for Green Apprenticeship creation within it.

The following table (Table 12) takes the shovel-ready green projects and infrastructure upgrades identified by the TUC, with the addition of ‘Insulating privately-owned homes’, ‘Heat

¹⁴³ <https://labour.org.uk/press/labour-calls-for-wage-subsidy-to-boost-apprenticeships-as-government-incentive-fails-to-create-opportunities/>

¹⁴⁴ Make UK evidence to Employment and Covid-19 inquiry <https://committees.parliament.uk/writtenevidence/12143/html/>

¹⁴⁵ <https://www.gov.uk/government/news/funding-boost-to-get-young-people-get-into-work>

¹⁴⁶ <https://www.gov.uk/government/news/landmark-kickstart-scheme-opens>

¹⁴⁷ BBC (2021) Kickstart: Most job roles for youths not yet filled <https://www.bbc.co.uk/news/business-55790439>

¹⁴⁸ <https://feweek.co.uk/2021/01/08/labour-party-calls-for-apprentice-wage-subsidy/>

¹⁴⁹ <https://inews.co.uk/news/politics/labour-calls-apprenticeships-support-young-people-training-slumps-809359>

¹⁵⁰ <https://www.instituteforapprenticeships.org/about/newshub/news-events/invitation-to-join-new-green-apprenticeships-advisory-panel/>



pump installation’, and ‘Urban Greening’. It ranks the different proposed projects against the scale of potential emergency job creation, their readiness to deploy, employers’ ability to take on apprentices and the existence of relevant accredited apprenticeship standards.

Table 12. Potential for Green Apprentices by sector

	Scale of job creation (short-term) ¹⁵¹	Projects ready to deploy (at scale) ¹⁵²	Employer capacity ¹⁵³	Apprenticeship standard in place ¹⁵⁴
Environmental efficiency audits (EPCs / DECs) of buildings	4	5	3	1
Insulating public buildings and social homes	5	5	3	3
Insulating privately-owned homes	3	4	2	3
Heat pump installation	2	4	1	5
Cycle-lanes and pedestrianisation	3	3	3	5
Railway expansion and electrification	4	2	4	5
Green manufacturing (e.g. EVs, heat pumps, insulation)	2	2	2	3
Zero carbon social home construction	5	3	3	1
Clean energy infrastructure (e.g. renewables, port upgrades, district heating)	3	4	3	5
Electric vehicle charging networks	2	5	3	5
Flood defences	2	5	3	3
Nature restoration (eg peatlands, salt marshes, rewilding)	2	5	3	1
Afforestation	3	5	3	3
Urban Greening	2	4	4	5
Environmental efficiency audits (EPCs / DECs) of buildings	4	5	3	1

As demonstrated in Table 12 above, employer capacity to take on apprenticeships is the most significant block to readiness. This is for a mix of reasons including employers shedding workforces during the economic crisis and pre-existing skills gaps concerning both management skills (across the board) and project-specific skills (e.g. in energy efficiency

¹⁵¹ Scoring criteria:

<5,000 jobs = 1; 5,000 - 40,000 jobs = 2; 40,000 - 100,000 jobs = 3; 100,000 - 200,000 jobs = 4; 200,000+ jobs = 5

Sourced from Transition Economics calculations related to: https://www.tuc.org.uk/sites/default/files/TUC%20Jobs%20Recovery%20Plan_2020-06-17_proofed.pdf

¹⁵² Scoring criteria relates to pace at which projects can be deployed at scale. All projects included can be initiated at scale within the next two years. Scoring criteria: Can only start in 18 months time = 1; Can start immediately = 5

Sourced from Transition Economics analysis related to: https://www.tuc.org.uk/sites/default/files/TUC%20Jobs%20Recovery%20Plan_2020-06-17_proofed.pdf

¹⁵³ Transition Economics assessment in the context of green infrastructure stimulus at scale.

Few relevant employers exist = 1; employers exist but have skills gaps = 2; employers have relevant team = 3; team likely ready to be expanded = 4; team likely ready to take on new staff = 5.

¹⁵⁴ No necessary apprenticeship standards in place = 1; some = 3; all the necessary standards = 5. Transition Economics analysis of existing apprenticeship standards in England.



retrofits). Mitigation for this challenge should include support to employers' management capacity by funding Continued Professional Development courses. Furthermore, in many cases employers who need time to build up capacity to manage apprentices and slot them into their work programme, can recruit apprentices who then spend several months in off-the-job training with a training provider, before joining the employer properly. These mitigations are discussed in greater detail across the rest of this section.

How to ensure employers recruit Green Apprentices?

A range of public sector and private sector employers should take on Green Apprentices, as part of delivering Green Industrial Revolution infrastructure and Covid recovery programmes. The House of Lords Economic Affairs Committee has called for an opportunity guarantee including "public sector job creation and hiring incentives for private sector job creation."¹⁵⁵ Significant government incentives and support will be required to motivate employers to recruit sufficient numbers of Green Apprentices, while maintaining apprenticeship quality.

Ensuring employers recruit Green Apprenticeships at the necessary scale requires government to

- **Cover a large proportion if not the entirety of the wages for Green Apprentices**
- **Ensure that training costs are covered for all Green Apprentices**
- **Significantly expand training capacity and employers' management capacity.**

Most employers are not focused only on green activities. Receiving the financial incentives for recruiting a Green Apprentice should require completing a simple form affirming that the apprentices will be working primarily on green activities.

Public sector bodies can provide the backbone of rapidly creating Green Apprenticeship provision. Large public bodies in England have an existing target to employ at least 2.3% of their staff as new apprentice starts¹⁵⁶, but this should be dramatically increased for target public bodies.

Alongside this, private companies receiving government support as part of the climate transition will need to step up and create relevant apprenticeships. Ambitious training targets, decarbonisation targets, and recovery spending need to go hand in hand here.

Regardless of incentives offered for taking on new staff, employers who foresee a downward trend in turnover during an economic crisis will be hesitant to take up new staff. New apprentice recruits are not worth the investment if it means going beyond the employer's needs. On the other hand, employers who foresee expanding operations will be more willing to hire apprentices. Beyond training costs and wages, there are additional costs to employers (e.g. existing staff supervising apprentices). This points to a different skills shortage of its own: 57% of all skills gaps among existing UK workforces are down to "a lack of management and leadership skills" (Employers' Skills Survey 2019).¹⁵⁷

Trade unions should be involved in developing the Green Apprenticeship programme from early on, bringing their expertise into ensuring successful training and employment practices in the workplace.

¹⁵⁵ <https://publications.parliament.uk/pa/ld5801/ldselect/ldeconaf/188/18806.htm>

¹⁵⁶ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/837900/Apprenticeship-and-levy-statistics-October-2019-main-text-2.pdf

¹⁵⁷ <https://www.gov.uk/government/publications/employer-skills-survey-2019-uk-excluding-scotland-findings>



Green Apprentice employers will need to include:

- Local authorities

Local councils have a motivation to reduce local unemployment as well as long-term scarring impacts, and to boost green skills in their locality. They also have significant relevant responsibilities for delivering the zero-carbon transition, including improving energy efficiency, delivering more sustainable local transport including cycling, walking and public transport, installing EV charge networks, and greater urban greening.

Local councils could significantly expand in-house building maintenance and building assessment teams to plan and carry out retrofit works of social housing to reach EPC level C and higher. An expanded Green Homes Grant Local Authority Delivery scheme could include requirements for hiring apprentices, in return for additional funding for wider delivery in the community beyond social-rent homes.

A coordinated and large-scale approach to energy-efficiency retrofits by local authorities with guaranteed central government funding could help address the existing market-driven failure to skill up new and existing construction workers. The many small businesses that deliver most private home retrofits currently see little benefit in expensive training for the short-lived Green Homes Grants scheme, despite its initial extension.¹⁵⁸ Focusing the expansion of energy-efficiency programmes on local authorities and social homes could accelerate both installations and skills development. Potential scale of investment ranges from £9.75 billion¹⁵⁹ to £20 billion.¹⁶⁰

- Other public bodies such as the Environment Agency, Forestry Commission, Natural England and Natural Resources Wales

Non-ministerial departments and non-departmental public bodies with existing responsibilities for the environment in England and Wales need to take leadership roles as part of the Green Industrial Revolution and Covid recovery in repairing and expanding flood defences, restoring environments like peatlands, saltmarshes and coastlines, and reforesting our landscapes. There is significant scope for a radical expansion of Green Apprenticeships here.

- Private sector recipients of green infrastructure funding

Where government funding is provided to private sector contractors, it should be made conditional on the creation of Green Apprenticeships, e.g. in railway electrification, port upgrades, or electric bus manufacturing.

This should apply to large and small private companies. For example, many companies delivering retrofit works as part of the Green Homes Grants are SMEs. The existing cap of 10 apprenticeship starts for non-levy paying employers should be lifted for Green Apprenticeships.¹⁶¹

Where possible, framework agreements should be developed with employers to ensure the creation of specific numbers of high-quality apprenticeships (and jobs) at a decent wage rate in the delivery of green infrastructure by private companies. The HS2/TUC Framework Agreement¹⁶² specifies commitments on apprenticeships, training and wider issues on

¹⁵⁸ <https://eciu.net/blog/2021/what-to-look-for-in-the-governments-buildings-decarbonisation-plan>

¹⁵⁹ Lukasz Kriebel, Alfie Stirling, Frank van Lerven, Sarah Arnold (2020), Building a Green Stimulus for Covid-19: A recovery plan for a greener, fairer future <https://neweconomics.org/uploads/files/green-stimulus-covid.pdf>

¹⁶⁰ <https://www.tuc.org.uk/research-analysis/reports/rebuilding-after-recession-plan-jobs>

¹⁶¹ <https://feweek.co.uk/2020/07/14/small-employer-apprenticeship-cap-on-starts-to-increase-from-3-to-10/>

¹⁶² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/515079/HS2_Ltd_and_TUC_initial_framework_agreement_April_2016.pdf



employment terms and conditions, with similar agreements covering the London Olympics and Heathrow T5.¹⁶³

How to train Green Apprentices?

The necessary scale of Green Apprenticeships demands a scale-up of training capacity, which has been hit hard by the Covid crisis.

Off-the-job apprenticeship training is provided both by FE colleges and by private training providers. The trade body for private providers, the Association of Employment and Learning Providers, claims that they train seven out of every 10 apprentices in England.¹⁶⁴

A number of FE colleges already provide the “off-the-job”-based learning for renewable energy apprenticeships. For example, Furness College¹⁶⁵ in Cumbria and Grimsby Institute¹⁶⁶ in North East Lincolnshire both partner with offshore wind company Ørsted to run three-year Maintenance & Operations Engineering Technician apprenticeships. Privately-provided training for low-carbon apprenticeships include Total People’s off-the-job training for bus electrician apprenticeships for First Bus in Doncaster¹⁶⁷ and Level 3 Refrigeration Air Conditioning and Heat Pump Engineering Technician apprenticeships for Atmostherm in Manchester.¹⁶⁸

Colleges and other training bodies will need to build up the requisite skills and teaching capacity to deliver large-scale Green Apprenticeship training. Further Education has been stripped of capacity and hollowed out by years of privatisation and austerity. In the current funding model in England, FE college funding is allocated largely on the basis of the number of students taught during the previous year, precluding significant expansion of provision.¹⁶⁹ This likely contributes to a situation where FE colleges are hesitant to adopt new climate-relevant curricula.¹⁷⁰

In addition to individual funding per apprentice, apprenticeship-training providers need support to rapidly expand classroom provision for Green Apprenticeships. Given the need for a rapid roll-out, upfront funding should be available to colleges to support recruitment of staff, specialist equipment and infrastructure required for new apprenticeships. Careers pathways teams, secondary education teachers and FE teachers will need accelerated training and professional development support to be able to support students to identify green apprenticeships as meaningful progression routes,¹⁷¹ as well as ensuring the apprenticeships are rolled out at the appropriate pace.

Common base curricula (with scope to tailor) for Green Apprenticeships in specific sectors would make it more affordable for colleges and businesses to develop the new training programmes. These should cover essential knowledge and skills to apply the apprenticeship learning to the climate transition. National and Regional Centres of Excellence for FE could lead on developing these and supporting professional development for FE staff.

¹⁶³ <https://www.tuc.org.uk/wmca-industrial-strategy-consultation-infrastructure>

¹⁶⁴ <https://www.peoplemanagement.co.uk/news/articles/apprenticeships-threatened-uncertain-funding-providers-warn>

¹⁶⁵ <https://orsted.co.uk/en/Careers/Graduates-and-Apprenticeships/Apprenticeships>

¹⁶⁶ <https://www.grimsbytelegraph.co.uk/news/business/dong-energy-grimsby-institute-offering-120049>

¹⁶⁷ <https://www.totalpeople.co.uk/apprenticeships/electrician-apprentice-doncaster-doncaster-1625597>

¹⁶⁸ <https://www.totalpeople.co.uk/apprenticeships/air-conditioning-heating-apprentice-manchester-1644827>

<https://debut.careers/jobs/air-conditioning--heating-apprentice-atmostherm-limited-22315>

¹⁶⁹ <https://www.resolutionfoundation.org/app/uploads/2020/05/Class-of-2020.pdf>

¹⁷⁰ Anecdotal evidence reported by Combined Authorities.

¹⁷¹ Build on existing programmes like <https://carbonliteracy.com/>



There also needs to be a clear long-term financial guarantee to the FE sector to provide stability over the coming ten-year period – an absolutely essential period for delivering green skills – so that apprenticeship training providers are prepared to invest and not at risk of the government pulling the plug in the short term. This should happen in the immediate term, so that the FE sector can play its role in green skills as part of the Covid recovery, rather than waiting for the spending review in autumn 2021.¹⁷² (Note that this guarantee is not included in our costings of a Green Apprenticeship programme.)

Green Apprentices can spend a greater proportion of their time in “off-the-job” training

Some green sectors and professions require greater levels of classroom/workshop training than is currently the norm. This is especially the case where current working practices within the industry do not match the required practices to decarbonise.

For example, the large “performance gap” in energy efficiency retrofits – where a retrofit does not meet the predicted goal in improved energy efficiency – has been ascribed to the lack of skills in the sector.¹⁷³ Construction for a zero-carbon future requires knowledge, skills and competencies that challenge existing apprenticeship and training systems in construction, requiring a deeper knowledge and understanding of energy efficiency, higher technical skills and a holistic approach to the building process.¹⁷⁴ It demands a fundamentally different approach from conventional construction methods, one that recognises the building envelope as a single thermal unit and as made up of elements that come together through the social interaction of different occupations, including bricklaying, carpentry, plastering, floor laying, insulation, electrical engineering and plumbing. The “technical” challenges illustrate the need for this broader, “energy literacy”, expertise.

Lessons from Belgium, Austria and elsewhere show that a greater proportion of time spent in college- and workshop-based learning can address this. It delivers a more qualified and energy-literate workforce with a stronger theoretical grounding.¹⁷⁵

Depending on the sector, Green Apprenticeships should include a greater proportion of time spent in “off-the-job” college- or workshop-based learning. The wage subsidies for Green Apprenticeships should enable this shift where it is deemed necessary. The greater qualification levels and improved work standards will benefit climate action, local communities and the employers.

It would also be possible for Green Apprentices to initiate their off-the-job training significantly before beginning their on-the-job work. This would be especially useful where further Covid lockdowns mean that workplaces are shut, or where employers are not immediately ready to manage the arrival of significant numbers of Green Apprentices.

¹⁷² <https://www.tuc.org.uk/blogs/fe-white-paper-missed-opportunity-boost-retraining-and-skills>

¹⁷³ Clarke, L., Gleeson, C.P., Sahin-Dikmen, M., Winch, C. and Duran-Palma, F. (2019) , Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC Final Report, <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

¹⁷⁴ Written evidence to Environment Audit Committee, submitted by Professor Linda Clarke, Dr Fernando Duran Palma, Dr Melahat Sahin-Dikmen and Professor Christopher Winch. January 2021 <https://committees.parliament.uk/writtenevidence/21513/pdf/>

¹⁷⁵ Clarke, L., Gleeson, C.P., Sahin-Dikmen, M., Winch, C. and Duran-Palma, F. (2019) , Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC Final Report, <https://www.fiec.eu/our-projects/completed-projects/vet4lec>



What updates do apprenticeship standards need?

Short-term

Our analysis of existing approved apprenticeship standards in England showed 161 standards that can or definitely do contribute to net zero (See Appendix 2).

However, in the short term, several gaps need to be rapidly plugged to deliver the green infrastructure needed.

The largest gaps appeared to be in standards preparing workers to deliver large-scale domestic-building retrofits and environmental restoration. Missing content can potentially be incorporated into existing apprenticeship standards, rather than requiring the creation of new standards.

Introducing additional modules with base curricula (with scope to tailor) for all Green Apprenticeships would make it more affordable for colleges and businesses to develop the new training programmes. These should cover essential knowledge and skills to apply the apprenticeship learning to the climate transition. For example, buildings-related apprenticeships within this programme should include both theoretical and practical energy-efficiency components.

Buildings-based apprenticeships do not cover:

- “Whole-house approach” to retrofits
- Energy-efficiency assessments
- Domestic thermal insulation (as opposed to commercial or industrial)

Training programmes in other European countries tend to give construction workers focused on domestic buildings a holistic set of skills – covering bricklaying, roofing, window installation, floor-laying, insulation and other skills. This broader training and education leaves workers better prepared for the “whole-house approach” to energy-efficiency retrofits. In comparison, UK training tends to be more atomised and focused.¹⁷⁶ As described in the Skills chapter, the Construction Industry Training Board also highlights “retrofit designers and coordinators”, “insulation installers” and “general low-carbon systems training” as skills gaps requiring greater training content and provision.¹⁷⁷

Land-based and agricultural apprenticeships do not cover:

- Environmental restoration – including peatland, saltmarshes, seagrass meadows or rewilding
- Aquaculture
- Sustainable farming

There are several apprenticeships related to reforestation, including “Forest Operative”, “Arborist” and “Land-based Service Engineer”. Two others are in development: “Arboriculturist” and “Professional forester”, and should be finalised rapidly.

¹⁷⁶ Interview, Linda Clarke, Professor of Organisations, Economy and Society, University of Westminster

¹⁷⁷ Richard Bayliss (Oct 2020) “Building Skills for Net Zero - Preliminary research findings” Construction Industry Training Board https://stbauk.org/wp-content/uploads/2021/01/STBA-SPAB-Annual-Conference-2020-Day-2_Richard-Bayliss-compressed.pdf



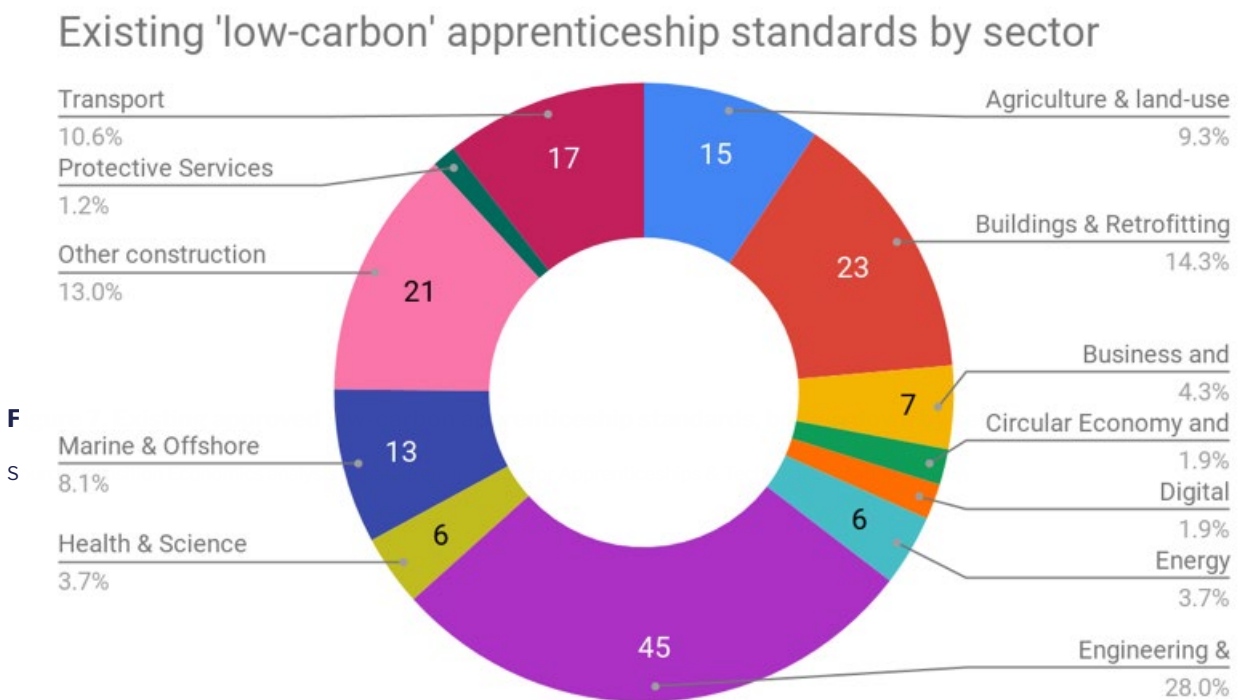
Manufacturing apprenticeships do not cover:

- Remanufacturing and circular economy processes
- Electric vehicle and battery manufacture

Figure 7 shows a breakdown of 161 existing apprenticeship standards that can contribute to reducing emissions, broken down by Transition Economics into relevant sectors. Numbers within the slices are absolute numbers of apprenticeship standards.

Figure 7. Existing approved low-carbon apprenticeship standards, broken down by sector.

Source: Transition Economics analysis of data from Institute for Apprenticeships & Technical Education



Medium- and long-term

In the medium- and long-term, the details of skill sets required to deliver the climate transition will change as technologies mature and evolve, and as mass industrial programmes begin and are completed (e.g. building retrofits). It is important that training programmes do not create a problem of overspecialisation, and strive to limit the need for retraining down the line.

Green Apprenticeships should provide a broad base of training and education, preparing apprentices not only for one job, but a career in delivering the climate and environmental transition. This is consistent with the approach taken by countries with mature and successful apprenticeship systems, that have a smaller number of broader apprenticeship standards. Germany has 320 apprenticeships standards, Switzerland has 240¹⁷⁸ – while the UK's Institute for Apprenticeships and Technical Education lists over 700.¹⁷⁹ The Swiss and German systems are seen as focusing on quality where the English one offers quantity, often at a lower skill level.¹⁸⁰ As training standards are developed and upgraded, a more holistic approach will ensure that Green Apprenticeships create the skills base needed for the future.

¹⁷⁸ <https://www.hrmagazine.co.uk/article-details/assessing-the-apprenticeship-levy-three-years-on>

¹⁷⁹ <https://www.instituteforapprenticeships.org/apprenticeship-standards/>

¹⁸⁰ <https://www.hrmagazine.co.uk/article-details/assessing-the-apprenticeship-levy-three-years-on>



How to deliver at speed, scale and quality

Delivering the Green Apprentice programme at the necessary scale and speed to meet the unemployment emergency will be a challenge. Employers' and training providers' capacity to take on apprentices and meet training standards makes apprenticeships harder to scale up.¹⁸¹

The need for rapid, joined-up and concerted programme delivery has been a key requirement of responding to the Covid crisis, whether it is the vaccine roll-out, tracking and tracing infections or emergency food deliveries to shielding households. Years of whittling down the public sector has left the UK unprepared for many of these challenges. However, the Green Apprenticeship programme itself can provide a stepping stone to building greater capacity for future crises – including the climate crisis.

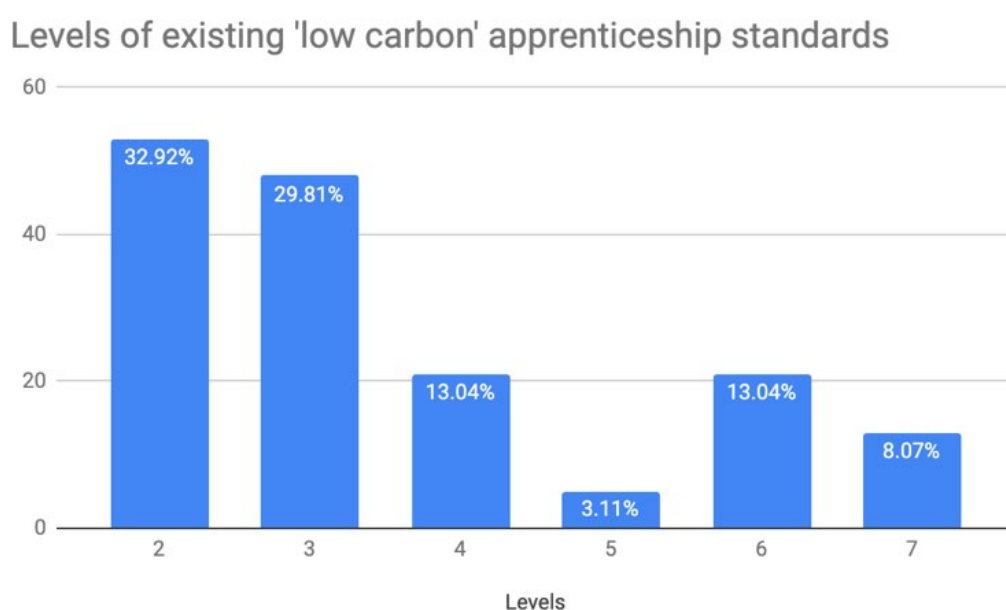
Plugging the enormous green skills gap through apprenticeships, traineeships and other programmes will require a more coordinated effort than the existing employer-led apprenticeship-standard process, which focuses on the present needs and not a society-wide transformation over a decade. The government needs to work together with trade unions, training bodies and civil society as well as employers to ensure that Green Apprenticeships meet our collective needs.

Accessibility of existing low-carbon apprenticeships to young people

Transition Economics identified 161 existing approved apprenticeship standards in Appendix 2 that can contribute to net zero.

Of these, 33% are Level 2, 30% are Level 3 and almost 15% are Level 4. This means that over 60% of existing relevant standards are entry-level and suitable for young people with or without formal qualifications at GCSE level. Over 75% are suitable for young people with GSEs or A-Levels.¹⁸² Levels 5-7 (making up less than 25% of relevant apprenticeship standards) tend to require some prior experience in relevant industries. See Figure 8 for an overview.

Figure 8. Existing “low-carbon” apprenticeship standards, by Apprenticeship Level



¹⁸¹ <https://repec-cepeo.ucl.ac.uk/cepeow/cepeowp20-12.pdf>

¹⁸² <https://www.ucas.com/alternatives/apprenticeships/apprenticeships-england/entry-requirements-apprenticeships-england>



Recruiting tens of thousands of Green Apprentices from a standing start

A public awareness campaign about the availability of Green Apprenticeships and the process to apply should include public announcements by government and local authorities, specific outreach by Job Centre mentors¹⁸³, public engagement by influencers trusted by young people, media adverts and targeted social media.

Care should be taken to ensure that Green Apprenticeships are not presented as a form of charity. Instead, signing up to be a Green Apprentice should be framed as serving the collective good and building a better future for all of us, instilling a sense of pride alongside the individual skills and career benefits.

Transforming existing apprenticeship standards into “Green Apprenticeships”

The urgency means the roll-out should begin before adjusting the contents of existing apprenticeship standards or developing new standards. Transition Economics identified 161 existing approved apprenticeship standards in Appendix 2 that can contribute to net zero.

These range from the clearly “green” – e.g. “Tramway Construction Operative” and “Transport Planner”, to the potentially “green” – e.g. “Road Surfacing Operative” and “Civil Engineer”.

All 161 existing standards in England can carry the badge “Green Apprenticeship”, with the ensuing financial benefits, where the employer signs a simple document affirming that the apprentice will be working primarily on carbon-reducing areas.

Additional curricula components to improve the climate skills and knowledge acquired through the apprenticeship should be incorporated during the first year. For example, buildings-focused apprenticeships like “Roofer”, “Floor-layer” and “Fenestration Installer” should have additional components on whole-house retrofit and sustainable construction methods added to them.

In the medium-term, Green Apprenticeships should be adapted to ensure apprentices gain a broader skillset preparing them for a range of careers in delivering the zero-carbon transition, with input from employers, unions and other stakeholders.

Scaling up employers of apprentices

The rapid growth required for the Green Apprentice programme will require employers to take on larger numbers of apprentices than they are used to.

The initial focus should be on employers who can be pushed to scale up rapidly. Past experience of job creation programmes such as the 2009 Future Jobs Fund indicates that public sector employers are more able and prepared to take on new staff in a short timeframe.¹⁸⁴

Institutions best able to take on large numbers of Green Apprentices in the immediate term are public sector bodies delivering green infrastructure, who also have an interest in boosting skills in their locality and sector. These include local authorities, alongside central bodies such as the Environment Agency, Forestry Commission and Natural Resource Wales.

This could involve expanding existing local authority-led components of the green recovery alongside requirements for significant green apprenticeships. For instance, the £500 million Local Authority Delivery scheme within the Green Homes Grants programme should be expanded to cover more homes as well as mass energy-efficiency assessments.

¹⁸³ <https://www.bbc.co.uk/news/uk-politics-53297306>

¹⁸⁴ <https://www.tuc.org.uk/research-analysis/reports/new-plan-jobs-why-we-need-new-jobs-guarantee>



Most employers are not focused entirely on climate transition activities, whether they are an engineering firm, a local authority or an energy company. Receiving the financial incentives for recruiting a Green Apprentice should require completing a simple form affirming that the apprentices will be working primarily on carbon-reducing or other green activities.

Online curricula and scaling up apprentice training programmes

In the Covid pandemic context, initial off-the-job training for Green Apprenticeships will need to be online. Many existing training providers have already moved teaching and learning online given the lockdown regulations and closing of schools.¹⁸⁵ Teaching online initially could enable more rapid scaling up of Green Apprenticeships and make more training more geographically accessible.

It would also be possible for Green Apprentices to initiate their off-the-job training significantly before beginning their on-the-job work. This would be especially useful where further lockdowns mean that workplaces are shut, or where employers are not immediately ready to manage the arrival of significant numbers of Green Apprentices.

FE colleges and other training providers will need to adjust their online teaching to meet the needs of Green Apprentices. Careful measures are also needed to avoid dilution or reduction in quality of apprenticeships.

Ensuring high-quality work, skills and climate action

An oversight board should monitor the implementation and delivery of the Green Apprenticeship programme, to ensure high quality of learning and work, as well as contribution to the climate transition.

Membership should include trade unions representing relevant sectors, environmental organisations and bodies engaged in the climate transition, in balance with employers, central and local government.

How can Green Apprenticeships create a more diverse green workforce?

The apprenticeship programme as it currently stands is not delivering solutions to the pay and unemployment gaps between men and women, white and BAME people or non-disabled and disabled people.

The proportion of ethnic minority people who apply for an apprenticeship is far higher than the proportion who start one. In 2015/16, 38% of the applications for apprenticeships were from individuals not classed as white British, but only 17.2% starts in that year were from this group.¹⁸⁶ TUC research based on ONS data¹⁸⁷ revealed that the unemployment gap between BME and white workers with training in craft skills is nearly 5%, while in apprenticeships the gap is a shocking 23% (that is, 28.6% of BME people who have completed an apprenticeship are unemployed, as compared to 5.5% of white people).

¹⁸⁵ <https://grimsby.ac.uk/news/>

¹⁸⁶ <https://feweeek.co.uk/2017/02/26/ethnic-minority-target-for-apprenticeship-diversity-group/>

¹⁸⁷ <http://www.tuc.org.uk/sites/default/files/BlackQualifiedandunemployed.pdf>



The proportion of all apprentices who are disabled fell from 11.5% to 9.9% in the ten years from 2005 until 2015.¹⁸⁸ By 2019/2020, the apprentices declaring a learning difficulty or disability still only account for 12.5%.¹⁸⁹

Key sectors for the climate transition (e.g. engineering, construction) are faring even worse for diversity than other sectors, particularly on gender. Women made up only around 8% of STEM apprenticeship starts in 2016/17, and only 7.4% for engineering and manufacturing technologies in 2017/2018.¹⁹⁰ Only 1% and 3% of apprenticeship starts by under-19 year olds were by women in construction and engineering, respectively.¹⁹¹

How can the Green Apprenticeship programme improve on this? Diversity Bursaries of £1,500 can promote participation in Green Apprenticeships among historically disadvantaged groups, including BAME, women and disabled people. Young and disadvantaged people can find pursuing an apprenticeship difficult financially, and struggle to cover expenses like travel, subsistence, clothing and equipment.¹⁹² Bursaries will enable more applicants to take up an apprenticeship. Green Apprenticeship bursaries for disadvantaged groups can be modelled on the care leavers bursary,¹⁹³ where 16-24 year old care-leavers receive a bursary of £1,000 if they become an apprentice.¹⁹⁴

Alongside this, employers need to be pushed to recruit Green Apprentices from disadvantaged groups, to overcome the imbalance between applications and starts cited above. A Diversity Bonus of £1,000 could be explored, paid to employers who recruit from disadvantaged groups. This is also modelled on the existing £1,000 payment to employers and training providers when they take on 19-24 year olds who were in care or who have an Education, Health and Care plan.¹⁹⁵

Government should introduce race equality requirements into Apprenticeship funding, making sure that the work required to meet them is proportional to the size and resources of employers. Requirements could include: monitoring and reporting of equalities data (for larger employers); the use of anonymised application forms in recruitment; recruitment promotion targeted at underrepresented groups; BAME representation in hiring panels and other relevant decision-making bodies; equal opportunities training for staff involved in running the apprenticeships programme; and support for apprentices in accessing further training or employment.¹⁹⁶ The Institute for Apprenticeships and Technical Education needs to improve its own processes, following criticism for having no BAME representation on its board¹⁹⁷ and not including improving diversity amongst its criteria for a good quality apprenticeship.¹⁹⁸

Green Apprenticeships should be promoted particularly to women, BAME and disabled people, with proactive outreach activities and active engagement of unions to negotiate with employers on this agenda.¹⁹⁹ Studies indicate that women are more likely to be attracted to “eco construction” than to traditional construction training schemes.²⁰⁰ So a “green” framing

¹⁸⁸ <https://explore-education-statistics.service.gov.uk/find-statistics/apprenticeships-and-traineeships/2019-20#dataBlock-33d78555-fff5-42eb-8c76-08d884b70554-tables>

¹⁹⁰ <https://www.nao.org.uk/wp-content/uploads/2019/03/The-apprenticeships-programme.pdf>

¹⁹¹ https://www.unison.org.uk/content/uploads/2018/08/TUC-Apprenticeships-pack-sheets-2018-Low_res-Unison-version.pdf

¹⁹² Education Select Committee <https://publications.parliament.uk/pa/cm201719/cmselect/cmeduc/344/344.pdf>

¹⁹³ The Education Select Committee recommended that the Government introduces more apprenticeship bursaries for disadvantaged groups modelled on the care leavers’ bursary. Education Select Committee <https://publications.parliament.uk/pa/cm201719/cmselect/cmeduc/344/344.pdf>

¹⁹⁴ <https://www.gov.uk/government/news/new-support-for-young-care-leavers-starting-an-apprenticeship>

¹⁹⁵ <https://www.gov.uk/government/news/new-support-for-young-care-leave>

¹⁹⁶ <https://www.unionlearn.org.uk/sites/default/files/publication/UL%20Supporting%20BME%20Apprentices.pdf>; <http://www.tuc.org.uk/sites/default/files/BlackQualifiedandunemployed.pdf>

¹⁹⁷ <https://feweek.co.uk/2020/10/15/revealed-government-appoints-two-new-board-members-at-apprenticeships-quango/>

¹⁹⁸ <https://feweek.co.uk/2020/10/23/anger-and-dismay-as-bame-apprenticeship-figures-fall/>

¹⁹⁹ <https://www.unionlearn.org.uk/equality-and-diversity-apprentices>

²⁰⁰ Interview, Linda Clarke, Professor of Organisations, Economy and Society, University of Westminster



of apprenticeships in engineering and construction will hopefully improve gender diversity.

Green apprenticeships should enable flexible working hours, especially part-time apprenticeships to meet the needs of specific groups, such as carers, parents, disabled people etc.²⁰¹

The government should monitor the outcome of apprenticeships to ensure that people from under-represented groups gain access to long-term employment opportunities.²⁰²

How to ensure job quality

Incentives for Green Apprenticeships must not lead to job substitution. Safeguards need to ensure that apprentices are not used for job substitution as a way to save on wage costs, and that employers plan for future skills gaps.²⁰³ Lessons can be learned from the Future Jobs Fund, which effectively ensured that jobs were both “real” and “new”: “new” in that a FJF job could not replace a pre-existing one.²⁰⁴

Apprentices in the UK are entitled to the same set of workplace rights as regular employees, with a lower minimum wage during the first year of training. Apprenticeships for some sectors (e.g. construction) have nationally negotiated set pay rates.

The government should set higher pay rates for Green Apprenticeships, to strengthen job quality, the attractiveness of Green Apprenticeships and commitment to them, and to boost the economy further. We suggest that Green Apprentice pay rates should mirror those already negotiated by the Construction Industry Joint Council for apprentices.²⁰⁵ Trade union membership of Green Apprentices should also be proactively encouraged.

The Institute for Apprenticeships²⁰⁶ and the TUC Charter²⁰⁷ lay out guidelines for apprenticeship quality, with elements including:

- Trade union involvement in schemes
- Training quality
- Mentorship
- Safeguarded training time
- Health and safety protections
- Pathways to continued employment

The Green Apprenticeship programme should include strong measures to maintain high apprenticeship quality, such as an oversight board including trade unions to monitor the Green Apprenticeship programme, to ensure high quality of learning and work is delivered in practice. The Institute for Apprenticeships and Technical Education should also include a trade union representative on its overall board.²⁰⁸

²⁰¹ https://www.unison.org.uk/content/uploads/2018/08/TUC-Apprenticeships-pack-sheets-2018-Low_res-Unison-version.pdf

²⁰² https://www.unison.org.uk/content/uploads/2018/08/TUC-Apprenticeships-pack-sheets-2018-Low_res-Unison-version.pdf

²⁰³ https://www.unison.org.uk/content/uploads/2018/08/TUC-Apprenticeships-pack-sheets-2018-Low_res-Unison-version.pdf

²⁰⁴ <https://www.resolutionfoundation.org/app/uploads/2020/05/Class-of-2020.pdf>

²⁰⁵ <https://builduk.org/wp-content/uploads/2018/06/Working-Rule-Agreement-CIJC-May-2018.pdf>

²⁰⁶ <https://www.instituteforapprenticeships.org/quality/what-is-a-quality-apprenticeship/>

²⁰⁷ <https://www.unionlearn.org.uk/tuc-charter-apprenticeships>

²⁰⁸ Greener Jobs Alliance Statement on Green Jobs and Skills November 2020 <https://www.greenerjobsalliance.co.uk/wp-content/uploads/2020/11/GJA-statement-on-Green-Jobs-and-Skills-2.pdf>



How to finance the Green Apprenticeship Programme

Overall costs for a programme of 250,000 Green Apprentice starts in the coming three years in England and Wales are estimated at £6.2 - £10.6 billion (shown in Table 13). These costs would be spread over 5 years, and cover wage subsidies, all direct apprentice training costs, and diversity bursaries and bonuses. Initial costs in Year 1 are estimated at £1.1 - £1.7 billion.

In our model, the 250,000 Green Apprenticeships supported start across three years: 100,000 each in the years 2021-2022 and 2022-2023, and 50,000 in 2023-2024 (see Figure 9).²⁰⁹

Figure 9. Timeline of Green Apprenticeship starts and total number of Green Apprentices

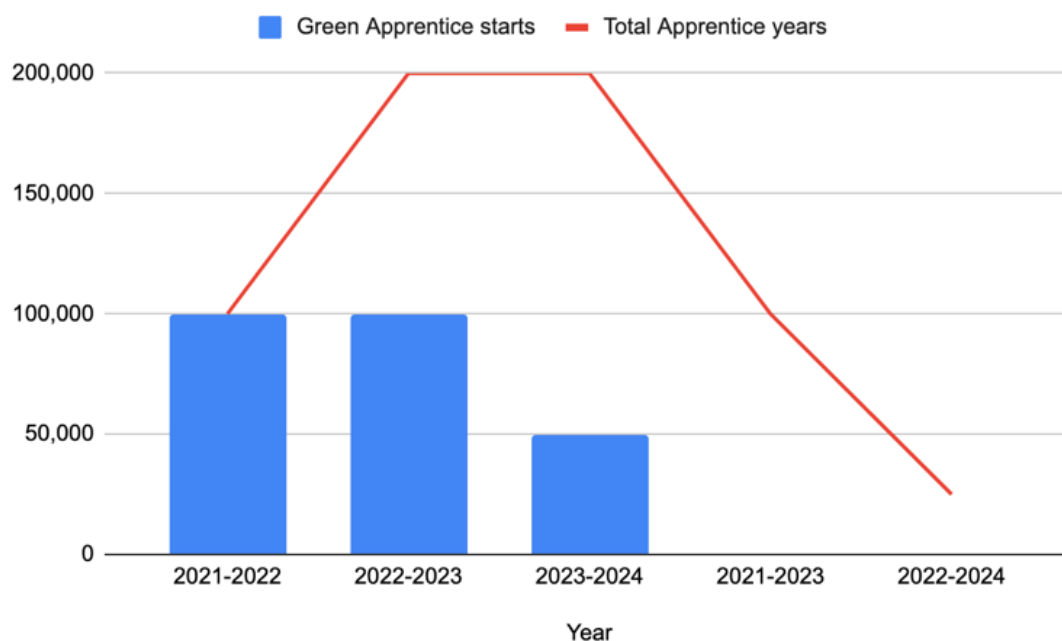


Table 13 shows Green Apprenticeship starts and estimated costs by year, broken down by wage subsidy, diversity funding and training costs. Note that these costings do not include the budget for administration or promotion of the scheme, nor funding available for CPD courses to support employers' capacity to train and manage apprentices.

Table 13. Target Green Apprentice starts and costs breakdown by year

Source: Transition Economics estimates

Year	Apprentice starts	Wage costs ²¹⁰ (£)		Bursaries and bonuses (£)	Training costs (£) ²¹¹
		min	max		
2021-2022	100,000	577,980,000	1,155,960,000	82,500,000	475,232,000
2022-2023	100,000	1,267,500,000	2,535,000,000	82,500,000	950,464,000
2023-2024	50,000	1,498,185,000	2,996,370,000	41,250,000	59,464,000
2024-2025		864,435,000	1,728,870,000		-
2025-2026		259,837,500	519,675,000		-

²⁰⁹ The modelling does not factor in that some Green Apprentices will not complete their apprenticeships. Depending on drop-out rates, this means that this level of funding would actually support more than 250,000 apprentice starts, but less than 250,000 completions. Funding should not be lost or re-allocated away from the programme when apprentices do not complete their apprenticeships.

²¹⁰ The average duration of a Green Apprenticeship is estimated to be 2.5 years (see "Duration of Green Apprenticeships" below). Therefore, wage costs continue in 2024-5 and 2025-6 as young people complete their apprenticeships, even though there are no new starts.

²¹¹ There are no projected training costs budgeted in the second half of the five-year programme due to the proposed ring-fencing of the apprenticeship levy (See 'Source of funds' below.)



A breakdown of the costs and apprentice starts targets by region and country is in Table 14.

Table 14. Green Apprentice starts and costs of programme by region and country

Source: Transition Economics estimates

Region or country	Target Green Apprentice starts over 3 years	Estimated annual cost of programme (£ million, over 5 years)	
		(min)	(max)
North East	13,310	66	113
North West	32,320	159	275
Yorkshire and The Humber	24,060	119	205
East Midlands	19,700	97	167
West Midlands	30,020	148	255
East	22,710	112	193
London	44,220	218	376
South East	30,720	151	261
South West	20,410	101	174
Wales	12,520	62	106
England and Wales total	250,000	1,232	2,125

Table 15 presents the estimated programme costs and targets by Combined Authority area.

Table 15. Green Apprentice starts and costs of programme by Combined Authority

Source: Transition Economics estimates

Combined Authority	Target Green Apprentice starts over 3 years	Estimated annual cost of programme (£ million, over 5 years)	
		(min)	(max)
Greater Manchester	14,140	70	120
Sheffield City Region	6,400	32	54
West Yorkshire	11,750	58	100
Liverpool City Region	7,550	37	64
Tees Valley	3,680	18	31
West Midlands	19,430	96	165
Cambridgeshire and Peterborough	2,890	14	25
West of England	3,490	17	30
North East	5,800	29	49
North of Tyne	3,790	19	32
London	44,220	218	376



Appendix 3 presents target numbers of Green Apprentice starts by Local Authority area. The costing methodology is explained below.

Duration of Green Apprenticeships

Transition Economics' analysis of existing apprenticeship standards in England identified 161 standards that are important for the climate transition – see Appendix 2. The typical duration of these apprenticeships varied between

- 12 months for a “Countryside Worker”
- 24 months for a “Community Energy Specialist”
- 36 months for a “Refrigeration air conditioning and heat pump engineering technician”
- 60 months for a “Transport Planner”

The mean duration across the 161 existing “green” apprenticeship standards was 29.8 months. We have therefore assumed that that average duration of the proposed Green Apprenticeships is 30 months.

Average training costs for Green Apprentices

Existing apprenticeship standards each have a funding band allocated, which sets in place the maximum government-supported spend on training and assessment for that apprenticeship. For example, maximum training spends include

- £9,000 for a “Smart home Technician”
- £15,000 for a “Tramway Construction Operative”
- £27,000 (the maximum spend) for a “Marine Engineer”

Our analysis of the 161 existing climate transition-relevant apprenticeship standards in England identified in Appendix 2 revealed a mean Maximum Funding level of £14,851.

Funding bands are intended as an upper band when negotiating the price of training and assessment, and actual spend is less than the maximum. Additionally, Green Apprenticeships will benefit from significant economies of scale, given the large-scale numbers of apprentices required. We therefore assumed that on average, actual training costs per Green Apprenticeship are 80% of the maximum funding.

Combined with the mean duration, we estimate the average training cost for a Green Apprenticeship as £4,752 per year.

As described above in the “How to train Green Apprentices” section, additional funding support will be required for FE Colleges to scale up and prepare for Green Apprentices, as part of a long-term funding settlement.



Source of funds to cover Green Apprentice training costs

Currently, large employers (with a pay bill over £3 million) source the funds for training apprentices from their Apprenticeship Levy payments, which sit in an apprenticeship service account for two years. Smaller employers who do not pay the levy contribute 10% of the costs of training directly, or none in the case of 16-18 year old apprentices.²¹² Apprenticeship Levy funds cannot cover overheads, supervision costs and apprentices' wages.

In the immediate term, the training costs for Green Apprenticeships will in large part need to be funded directly by government, as large employers able to rapidly scale up the hiring of Green Apprentices will not have appropriate levels of funds in their apprenticeship service accounts, and small employers already largely rely on government funds to cover the cost of training

Longer-term (potentially from 2023) ringfencing 33% of the apprenticeship levy towards training spend specifically on Green Apprenticeships would cover much of the costs and help direct UK employers towards developing skills required for the climate and environmental emergencies.

Alongside this, the £1.5 billion apprenticeship budget previously available to SMEs before the Levy was introduced should be restored, as called for by many SMEs and the Association of Employment and Learning Providers.²¹³ 50-75% of the SME budget should be reserved for Green Apprenticeships in SMEs. This will protect SME apprenticeship funding while enabling SMEs to deliver much of the backbone of green skills growth.

Green Apprentice wages

To achieve a rapid scale-up of Green Apprenticeships in a context where employers are already struggling to pay existing wage bills, government will need to cover a large part if not the entirety of the wages of Green Apprentices. London Councils, the Lords Economic Affairs Committee, the Labour Party and the Association of Learning and Employment Providers have all recently called for greater government subsidies for apprenticeships, sometimes including wage support.²¹⁴

This report proposes that the government directly covers between 50% and 100% of Green Apprentice wages. This would total £4.5 - £8.9 billion for 250,000 apprentices.

The legally required minimum for all apprentices in their first year starts at the lowest minimum wage level of £4.15 per hour.²¹⁵ To strengthen job quality, the attractiveness of Green Apprenticeships and commitment to them, and to boost the economy further, wages levels for Green Apprentices should be set higher.

As a guide, we have used the Apprentice Rates of Pay negotiated by the Construction Industry

²¹² On 6 April 2017, the apprenticeship levy came into effect with all UK employers with a pay bill of over £3 million per year paying the levy. The levy is set at 0.5% of the value of the employer's pay bill, minus an apprenticeship levy allowance of £15,000 per financial year. The levy is paid into an apprenticeship service account, and funds in this account have to be spent on apprenticeship training and assessment. Employers who do not pay the levy will pay 10% of the cost of training and assessment with the government contributing the remaining 90% (up to the upper limit of the funding band).

"Apprenticeships and skills policy in England", House of Commons Library, 7 September 2020
<https://commonslibrary.parliament.uk/research-briefings/sn03052/>

²¹³ <https://feweek.co.uk/2020/01/09/apprenticeship-providers-turning-away-up-to-40000-small-employers-due-to-levy-shortage-survey-finds/>

²¹⁴ "3rd Report - Employment and Covid-19: time for a new deal", Lords Economic Affairs Committee
<https://committees.parliament.uk/publications/3958/documents/39777/default/>
<https://www.aelp.org.uk/news/news/press-releases/86bn-skills-package-needed-to-boost-the-post-pandemic-economy/>
<https://feweek.co.uk/2021/01/08/labour-party-calls-for-apprentice-wage-subsidy/>

²¹⁵ The Apprentice minimum rate is £4.15 per hour, until they are both over 19 and have completed the first year of their apprenticeship. After this they are entitled to the minimum wage for their age. <https://www.gov.uk/national-minimum-wage-rates>



Joint Council, in effect from June 2019. The minimum hourly rates are £5.70 for Year 1, £6.80 for Year 2, and between £7.93 and £12.67 in Year 3, the latter dependent on qualifications.²¹⁶ However, a 21-24 year old in their second or third year would earn at least £8.20, as this is the minimum rate for that age bracket for apprentices who have completed their first year.²¹⁷ There are no employer Class 1 National Insurance contributions to pay, as the rate is set at 0% for apprentices under 25 earning less than £43,000 per year.²¹⁸

Additional support to increase access and diversity

Green Apprenticeship bursaries for disadvantaged groups (including disabled people, BAME people, women and people from highly-deprived wards, depending on the apprenticeship) were modelled on the care-leavers bursary for 16–24 year-old care-leavers becoming apprentices.²¹⁹

We estimated that up to 33% of Green Apprenticeships would be accompanied by a £1,500 bursary.

Alongside this, a Diversity Bonus to encourage employers to recruit apprentices from disadvantaged backgrounds with a payment of £1,000. This is modelled on the £1,000 payment the government already provides to employers recruiting new apprentices aged under 25 with an Education, Health and Care Plan.²²⁰

The Diversity Bursaries and Diversity Bonuses would be paid in instalments in the apprentice's first year.

What impacts will Green Apprenticeships have on apprenticeship provision in other sectors?

The Green Apprenticeship programme can act as a lever to encourage employers who can refocus business models for decarbonisation (e.g. ports) to develop the skills bases to do so. However, there are other sectors, notably health and social care, that are not included within this proposal and where apprenticeships could also provide a crucial part of the solution to skills gaps and shortages. The government should consider offering similar support and incentives for key sectors outside of the Green Apprenticeship agenda.

²¹⁶ <https://builduk.org/wp-content/uploads/2018/06/Working-Rule-Agreement-CIJC-May-2018.pdf>

²¹⁷ <https://www.gov.uk/national-minimum-wage-rates>

²¹⁸ <https://www.gov.uk/government/publications/national-insurance-contributions-for-under-25s-employer-guide/paying-employer-national-insurance-contributions-for-apprentices-under-25>

²¹⁹ <https://www.gov.uk/government/news/new-support-for-young-care-leavers-starting-an-apprenticeship>

²²⁰ "Apprenticeships and skills policy in England", House of Commons Library, 7 September 2020
<https://commonslibrary.parliament.uk/research-briefings/sn03052/>



Chapter 4. Recommendations

Recommendations to the UK government

- A Green Opportunity Guarantee for young people, ensuring every young person has access to a high-quality job or training

Green Apprenticeships

- Rapid roll-out of a Green Apprenticeship programme, creating 250,000 apprenticeship starts over 3 years, backed up by £6.2 - £10.6 billion in total funding over 5 years. Total Year 1 funding for the programme should be at least £1.1 - £1.7 billion. This covers wages subsidies, training costs and diversity funding.²²¹
- Green Apprentices should be employed in activities directly confronting the climate and environmental emergencies – ranging from energy-efficiency retrofits to constructing train lines, restoring wetlands to installing cycle lanes. Green Apprenticeship training gives young people the skills for a career in delivering the zero-carbon transition.
- Government to introduce a formal Apprentice Guarantee – ensuring that every young person can train as an apprentice if they want.
- The Green Apprenticeship programme should be developed through dialogue between central government, local authorities, employers, trade unions, training bodies and civil society. A formal oversight board composed of all these different groups should monitor implementation and delivery of the Green Apprenticeship programme, ensuring high quality of learning and work, and contribution to the climate transition.
- A public awareness campaign about the availability of Green Apprenticeships and the process to apply should include public announcements by government and local authorities, outreach by schools, colleges and job centre coaches, public engagement involving influencers trusted by young people, media adverts and targeted social media.
- The government should consider offering similar incentives and support to apprenticeship provision in key sectors outside of the proposed Green Apprenticeship agenda, e.g. health and social care.

Employing Green Apprentices

- Wage subsidies of between 50% and 100% should apply to the first 250,000 Green Apprentices hired within the next three years. The wage subsidies should apply to the full length of the apprenticeship (estimated to average 2.5 years).
- Target public bodies (e.g. local authorities, Forestry England, Environment Agency) should be set temporarily higher targets (than the existing 2.3%) for Green Apprenticeship starts.
- A significantly expanded Green Homes Grant Local Authority Delivery scheme should include requirements for hiring apprentices, in return for large-scale funding for wider

²²¹ See the section on “How to finance the Green Apprenticeship Programme” for detailed breakdown and calculations.



delivery in the community, including beyond social-rent homes.

- Government funding to private sector contractors should be made conditional on the creation of Green Apprenticeships.
- Framework agreements should be developed with employers and trade unions to ensure the creation of specific numbers of high-quality apprenticeships (and jobs) at a decent wage rate in the delivery of larger-scale green infrastructure by private companies.
- The existing cap of 10 apprenticeship starts for non-levy paying employers should be lifted for Green Apprenticeships.

Training Green Apprentices

- Training costs for Green Apprentices should initially be funded directly by government, with an average total of £11,900 in training costs over the length of each apprenticeship.
- From 2023, 33% of the apprenticeship levy should be ringfenced towards training spend specifically on Green Apprenticeships.
- Upfront funding should be made available to colleges to support recruitment and training of staff, specialist equipment and infrastructure required for Green Apprenticeships.
- Common base curricula for Green Apprenticeships should be developed by Further Education institutions with input from employers, academia, skills bodies, and trade unions, initially through shared modules to be retrofitted into existing relevant apprenticeship standards.
- Depending on the sector, Green Apprenticeships should include a greater proportion of time spent in “off-the-job” workshop or college-based learning than the current 20% requirement. This is particularly necessary where current working practices and skills within the sector do not match those required to decarbonise – e.g. energy efficiency retrofits.
- Green Apprenticeships should provide a broad base of training and education, preparing apprentices not only for one job, but a career in delivering the climate and environmental transition.
- In the Covid pandemic context, initial off-the-job training for Green Apprenticeships will need to be online. This could enable a more rapid scale-up, and make training more geographically accessible.
- Gaps in apprenticeship standards that need to be plugged in the immediate term include covering whole-house retrofits, energy assessments and domestic thermal insulation in buildings-based apprenticeships, environmental restoration and sustainable farming in land-based apprenticeships, and remanufacturing and circular economy approaches in manufacturing apprenticeships.

Diversity of Green Apprentices

- Diversity Bursaries of £1,500 should be introduced for Green Apprentices from historically disadvantaged groups, to improve access and participation.
- Diversity Bonus payments of £1,000 should encourage employers to recruit Green Apprentices from historically disadvantaged groups.



- The government should introduce race equality requirements into Apprenticeship funding, potentially including monitoring of equalities data (for larger employers), anonymised application forms in recruitment, recruitment promotion targeted at underrepresented groups, BAME representation in hiring panels, and equal opportunities training for staff involved in running the apprenticeships programme.
- Green Apprenticeships should enable flexible working hours, especially part-time apprenticeships to meet the needs of specific groups (e.g. carers, parents, disabled people).
- Green Apprenticeships should be promoted particularly to women, BAME and disabled people, with proactive outreach activities and active engagement of unions to negotiate with employers on this agenda.
- The Institute for Apprenticeships and Technical Education should improve its own diversity, particularly in relation to its all-white board.

Job quality of Green Apprentices

- Safeguards need to ensure that the Green Apprenticeships are “new” jobs, and that financial incentives are not used for job substitution as a way to save on wage costs.
- Set pay rates for Green Apprenticeships above the minimum wage, to strengthen job quality, the attractiveness of Green Apprenticeships and commitment to them, and to boost the economy. This could be done by mirroring apprentice pay rates already negotiated by the Construction Industry Joint Council, or through a new pay negotiation.
- Trade union membership of Green Apprentices should be proactively encouraged.
- Green Apprenticeships should be expected to meet the TUC Charter’s guidelines for apprenticeship quality.
- The Institute for Apprenticeships and Technical Education should include a trade union representative on its board and its Green Apprenticeships Advisory Panel.
- An oversight board should monitor implementation and delivery of the Green Apprenticeship programme, ensuring high quality of learning and work, and contribution to the climate transition. This should include trade unions representing relevant sectors, environmental organisations and bodies engaged in the climate transition, and training standards bodies, in balance with employers, central and local government.

Green infrastructure

- Public investment on the scale of £85 billion over two years should be directed towards shovel-ready green infrastructure programmes, including energy-efficiency retrofits, electrification of transport (railways, buses, private vehicles), new social homes, cycling and pedestrian infrastructure, broadband, environmental restoration and reforestation, and clean manufacturing.
- Local authorities should be funded to take a leadership role in delivering green infrastructure, including energy-efficiency retrofits, more sustainable local transport including cycling, walking and public transport, EV charge networks, and urban greening. Councils should be funded to significantly expand in-house building maintenance and building assessment teams to plan and carry out retrofit works of all



social housing to reach EPC level C and higher within three years.

- Non-ministerial departments and non-departmental public bodies with existing responsibilities for land, the environment and forests in England and Wales should be tasked and appropriately funded to take leadership roles as part of the Green Industrial Revolution and Covid recovery in repairing and expanding flood defences, restoring environments like peatlands, saltmarshes and coastlines, and reforesting our landscapes.
- Decisions on infrastructure spending should be subject to a job creation test, including numbers of jobs created, numbers of jobs appropriate for young people / education leavers, and job quality metrics.

Further education, traineeships and the National Skills Fund

- A substantial increase in green courses and traineeships provided by FE Colleges, supported by dedicated Strategic Development Funding from government.
- Strategic Development Funding should cover accelerated training and professional development support to create Green Apprenticeship training programmes, and support students to identify green apprenticeships as meaningful progression routes.
- A long-term funding settlement covering the next 10 years (an essential period for delivering green skills) should be brought forward, and not left until the Autumn 2021 Spending Review.
- A network of National and Regional Centres of Excellence for Zero Carbon Skills should be created at Further Education colleges, serving as hubs for Green Apprenticeship and Traineeship training, and professional development for FE teaching staff. The Centres of Excellence should be geographically spread to help with the levelling-up agenda, based on regional hubs that integrate with local industry. The Centres should be tasked with developing updates to existing vocational training and new courses where this is needed to support the climate transition.
- The existing Skills Bootcamp programme should be expanded, targeting provision of green skills to unemployed young people.

Long-term Green Skills planning

- The Climate Change Committee – working from its Carbon Budgets – should develop long range Green Skills Requirement Plans for the UK.
- Detailed audits of the present green skills base should be conducted, broken down by local authority. The Skills and Productivity Board should be tasked with considering green skills gaps and shortages as one of its priority areas.
- The government should commit to setting a clear policy steer on the skills required to deliver the climate transition. Working from the Climate Change Committee’s Green Skills Requirement Plans and the skills audits, the government should create long-term Green Skills Development Plans. These should guide funding decisions and shape how education providers, public bodies and industry invest into skills over the coming decades.
- Local Skills Improvement Plans development or updates (as proposed in the Skills for Jobs white paper) should be guided by the Green Skills Requirement Plans with respect to decarbonisation, and be developed in collaboration with trade unions and local growing green employers.



Recommendations to local authorities

- Apply pressure to Westminster to allocate funding for an ambitious Green Infrastructure and Green Apprenticeship programme.
- Utilise borrowing powers, and work with Combined Authorities and/or devolved governments to invest into local green infrastructure.
- In-source operations and the labour to deliver the climate transition, including energy-efficiency retrofits, EV charging installation, public transport and urban greening.
- Promote high standards of job quality for apprentices and other workers delivering the green transition.
- Introduce stronger measures to promote diversity amongst local authority-employed workers and apprentices delivering the green transition.
- Collaborate closer with trade unions, skills bodies and environmental organisations to develop ambitious green transformation policies to boost the local economy, skills and environment.
- Make full use of government funding to accelerate local action on the climate and environmental emergencies.

Recommendations to Combined Authorities

- Apply pressure to Westminster to allocate funding for an ambitious Green Infrastructure and Green Apprenticeship programme (see Table 16 and Table 17).
- Leverage existing skills funding and programmes to develop and grow Green Apprenticeships.
- Utilise borrowing powers, and work with local authorities to invest into local green infrastructure.
- In-source operations and the labour to deliver the climate transition, including energy-efficiency retrofits, EV charging installation, public transport and urban greening.
- Promote high standards of job quality for apprentices and other workers delivering the green transition.
- Introduce stronger measures to promote diversity amongst local authority-employed apprentices and other workers and apprentices delivering the green transition.
- Collaborate closer with trade unions, skills bodies and environmental organisations to develop ambitious green transformation policies to boost the Combined Authorities' economy, skills and environment.
- Commission Green Skills Audits to assess the current levels of green skills amongst local residents.
- Develop Green Skills Development Plans in line with climate targets, utilising existing skills budgets and policy powers.



Table 16 and Table 17 summarise the estimated spending required for green infrastructure upgrades and the Green Apprenticeship programme by Combined Authority area.

Table 16. Green infrastructure stimulus investment by Combined Authority (£ million)

Combined Authority	Build cycle lanes and pedestrianisation	Build social housing (using domestic offsite manufacture)	Retrofit social housing	Domestic energy efficiency assessments
Cambridgeshire and Peterborough	42	167	232	78
Greater Manchester	468	1062	1011	261
Liverpool City Region	274	404	584	152
London	0	2542	3166	767
North East	182	195	502	115
North of Tyne	124	223	326	83
Sheffield City Region	228	504	502	131
Tees Valley	116	146	232	66
West Midlands	413	571	1052	251
West of England	128	215	208	68
West Yorkshire	Insufficient data	784	816	265

Table 17. Target Green Apprentice starts and costs of programme by Combined Authority

Source: Transition Economics estimates

Combined Authority	Target Green Apprentice starts over 3 years	Estimated annual cost of programme (£ million, over 5 years)	
		(min)	(max)
Greater Manchester	14,140	70	120
Sheffield City Region	6,400	32	54
West Yorkshire	11,750	58	100
Liverpool City Region	7,550	37	64
Tees Valley	3,680	18	31
West Midlands	19,430	96	165
Cambridgeshire and Peterborough	2,890	14	25
West of England	3,490	17	30
North East	5,800	29	49
North of Tyne	3,790	19	32
London	44,220	218	376



Recommendations to Welsh government

- Commit to a Green Opportunity Guarantee for young people, ensuring every young person in the devolved nation has access to a high-quality job or training.
- Apply pressure to Westminster to allocate funding for an ambitious Green Infrastructure and Green Apprenticeship programme.
- Expand training and employment opportunities for young people. Implement policies to reduce the long-term economic scarring caused by Covid-driven youth unemployment, by expanding training and employment opportunities for unemployed young people.
- Utilise borrowing powers, and work with local authorities to invest into local green infrastructure.
- In-source operations and the labour to deliver the climate transition, including energy-efficiency retrofits, EV charging installation, public transport and urban greening.
- Promote high standards of job quality for apprentices and other workers delivering the green transition.
- Introduce stronger measures to promote diversity amongst local authority-employed workers and apprentices delivering the green transition.
- Collaborate closer with trade unions, skills bodies and environmental organisations to develop ambitious green transformation policies to boost the devolved nation's economy, skills and environment.
- Apprenticeships are a devolved matter. Devolved governments such as Wales should use an equivalent proportion to Green Apprenticeship funding allocated by Westminster, to develop their own national Green Apprenticeship schemes.
- In the absence of additional funding from Westminster, the devolved governments should seek to ringfence 33% of existing apprenticeship funding towards Green Apprenticeships.
- An audit of existing Welsh Apprenticeship Frameworks to identify which are contributing to the climate transition, and identify how to fill gaps.
- Commission Green Skills Audits to assess the current levels of green skills within devolved nations.
- Request that the Climate Change Committee – working from its Carbon Budgets – develop long-range Green Skills Requirement Plans for devolved nations.
- Develop Green Skills Development Plans in line with climate targets and Skills plans laid out by the Climate Change Committee, utilising existing skills budgets and policy powers.



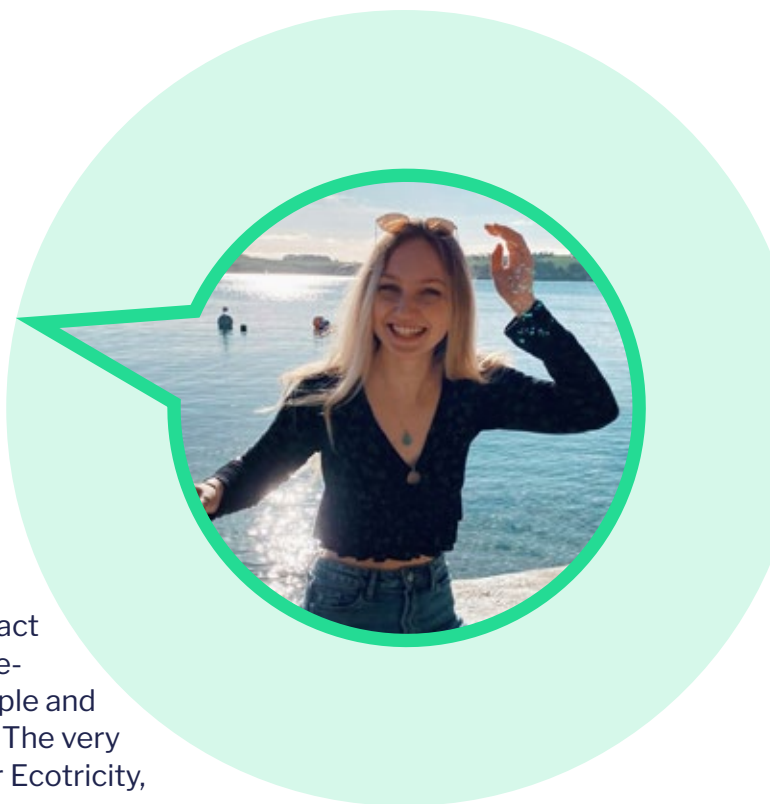
These case studies primarily show graduate routes into jobs, partly because the UK's apprenticeship system to date has not worked well enough. Our report presents a solution that would allow more young people who did not attend university to enter jobs like these via an apprenticeship. Friends of the Earth produced these case studies through interviews with the young workers featured.

Case studies

Amelia Crews, 21, is a CRM Marketing Assistant at renewable energy company Ecotricity.

How did you get into your role?

I've always been interested in sustainability but started out studying business and digital marketing at university. I was lucky enough to meet a Sustainable Consultant and ended up doing some work for her. It was through this contact that I was put in touch with Catalyse Change, a life-changing group aimed at empowering young people and young women who want careers in sustainability. The very same contact ended up sending me the job ad for Ecotricity, and that was that.



What appealed to you about a career in a green company?

I always wanted to try and make a difference with what I do and make a change. I don't see the point in fully investing yourself in a job if you're not invested in the outcome.

Apart from some freelance work, this is my first green job. I love the sense of community that arises from everyone reaching for the same goal of a greener planet. I feel like I'm doing the right thing and I'm where I'm meant to be. It's been really beneficial to work in a green job as it allows me to have the experience to get a green job in the future.

What's your experience been like working in a green job?

There aren't enough green jobs available for young people, especially graduates. It was because I was involved in the Catalyse Change network that I managed to hear about the roles. I applied for so many and had a driving passion to secure a green job. I was disheartened to think that I might not have the opportunity to work in a green job and just have to do something to pay the bills.

What would your advice be to anyone reading this and thinking about a green job?

If you want a green job, look into the sustainability reports of companies you're researching. You can if a company is truly green.

It's quite difficult to research for a green job as some of the keywords don't come up. I made a



list of green companies that I liked and wanted to be a part of and followed them on LinkedIn, regularly checking their job boards for updates. I'd also recommend connecting with people at preferred companies via LinkedIn to find out what they're looking for and scope out whether you're a suitable candidate.

Something that has been fundamental to my career so far has been finding a group such as Catalyse Change, they were a pivotal point in my professional development. It was amazing to hear from green professionals and I'd 100% recommend finding a similar group.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

A lot of graduate schemes are very corporate, and some require environmental science degrees. I think a green grad scheme would be extremely beneficial and open more doors to young people.

The government is prioritising the economy, but you can't have a strong economy without the environment. We must start somewhere.

There should be more investment in young people's groups in order to build a nice network and sense of community, which would help young people find jobs, as well as offering a support network.

It's important for sustainable companies to realise young people are really driven to work for green companies – they've just got to give young people a chance.

The education system doesn't teach sustainability, and they need to instil that sense of urgency to prepare people for green careers. This will also push the government to invest in this area more.

Bridie Salmon, 22, is studying for a Level 3 BTEC National in Engineering through Ørsted, a Danish renewable energy company.

How did you get into your studies?

I'm in my first year of a three-year paid internship with Ørsted. The first year is spent at college, learning the basics in electrical engineering, mechanics and maintenance. Then in my second year I'll work at Ørsted, and I'll go onto work there when the internship is completed.

I sort of fell into the industry after I realised I didn't want to go into hospitality. I spoke to people who were on apprenticeships and realised it was a good way of learning new skills and being able to get work experience and employment at the end of the course, rather than going to university to do more studying.



What appealed to you about your course?

I grew up caring about sustainability and the environment. My dad used to make me litter pick on the Lincolnshire Wolds where we live when I was young. That, together with witnessing how much we consume and waste through my previous work in the hospitality industry, has inspired me to look for green jobs.

Money was also a factor. I needed to keep earning, and this was the best opportunity I could find, as the apprenticeship offers the chance to learn and earn at the same time.

Getting a job in a green industry was definitely a priority. After travelling, climate issues really hit home – especially after seeing tourist attractions that have been destroyed, such as the Great Barrier Reef.

What's your experience been like working in a green job?

My experience has been quite straightforward. I didn't encounter any barriers getting on to the BTEC – Ørsted welcomes everyone, and their focus is being sustainable and green. The company has done so much for Grimsby and it's really nice to work at a company that gives back to the community. There's also a certain level of security – it's not a career you go into and think, "the industry might not be here in 10 years."

The pandemic has made us reassess which jobs are important, and the younger generation is more aware of climate issues. Personally, I love thinking that I'm saving the planet everyday by studying and doing what I'm doing.

What would your advice be to anyone reading this and thinking about a green job?

It would be great to get into green jobs now while we are on the cusp of change, so you can see real-time growth. If you want longevity, a green company is the best option unlike oil which won't be around for much longer.

I follow some government apprenticeship accounts on Twitter, as well as following Ørsted and other companies I'm interested in on LinkedIn. If you follow people on LinkedIn, it's a really good way of seeing what roles are out there and networking.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

If employers want to entice younger people, they should shout about their sustainability credentials – that's what young people are interested in. The green industry is the industry we should all be getting into, and if a company is not yet green, it needs to change its ways.

When I was at school, green jobs and apprenticeships just weren't mentioned, and I didn't know that apprenticeships were so accessible, beneficial and available. Schools should promote more options and make sure green jobs are promoted.

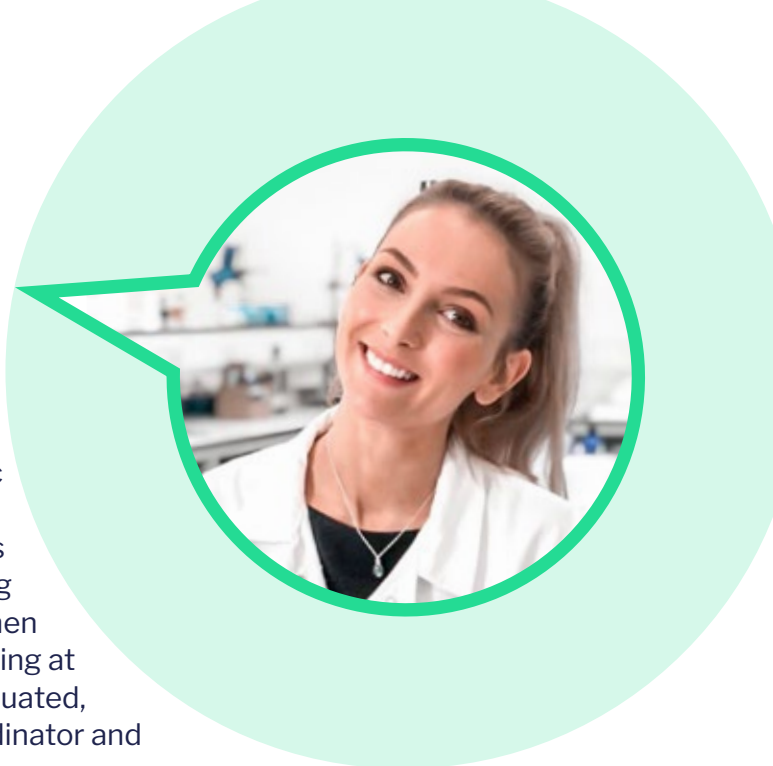
The biggest thing the government can do is to increase awareness and provide grants. Most apprenticeships offer half of the minimum wage. The government should offer grants to support companies to offer minimum wage for apprenticeships. They also need to advocate for green jobs.



Briony Batchelor, 25, is a Formulation Co-ordinator and Cosmetics Regulatory Officer at Neal's Yard Remedies.

How did you get into your role?

In 2015, I started my master's degree in cosmetic science course and two years in, I opted for a placement year at Neal's Yard Remedies (NYR) as Formulation Intern. I was based in the lab, working on innovation and new product development. When I went back to finish my degree, I continued working at their London office part-time. Then, once I'd graduated, I returned full-time to NYR as Formulation Co-ordinator and took on a new role of Cosmetics Regulatory Officer.



What appealed to you about a career in sustainable cosmetics?

What initially drew me to NYR was the amazing eco-factory and our iconic blue bottles. However, in the last 3 years I have learnt so much about our ingredients and the consideration that goes into the sustainability of the brand.

Initially I wasn't looking for a green job. But in the ever-growing cosmetic industry, it became obvious to me that there is certainly a need for greater ethics and sustainability. Studying at London College of Fashion made me aware of the fast-fashion industry and vast day-to-day consumerism. Since working for NYR, I now consider sustainability daily and I would always continue to do so in every aspect of my life.

What's your experience been like working in a green job?

There are certainly more obstacles, especially with our raw materials – being meticulous about every detail of a manufacturing process really takes time and is often more expensive. There are lots of cosmetic ingredients that we just won't use because they don't fit in with the precautionary principle that our formulation policies are based on, and they wouldn't get accredited as COSMOS natural or organic. The cosmetic industry is certainly not a green one in its entirety, but it feels good to be part of a community who are conscientiously sustainable.

What would your advice be to anyone reading this and thinking about a green job?

Firstly, the job needs to be the right one for you. If you are fortunate to have the opportunity to choose, I'd really recommend the green option – generally, I believe that it will be the more rewarding choice. I would hope that the more people that choose ethical and sustainable jobs, the more it encourages other businesses to strengthen that side of how they operate.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

Simply put, there needs to be more businesses that take a green and ethical approach in everything they do, until it becomes the norm. It does have many cost implications to



ensure that sustainable considerations are carried out to the highest degree within a business, and more of those could potentially be subsidised or regulated by the government to encourage this.

Clare Linton, 32, from Leeds is a Policy and Research Advisor at Urban Transport Group.

How did you get into your role?

I work for Urban Transport Group, a membership organisation that represents transport authorities like TfL (Transport for London). I did an undergraduate degree in Geography, and then a master's degree in Climate Change Policy. I graduated in 2010, and there weren't that many jobs about. I took a paid internship at IPPR in climate change, energy and transport to gain policy experience, before going on to study a PhD in low carbon technology. Although a PhD wasn't required for the role, it helped prepare me for the role.



What appealed to you about a career in sustainable transport?

I've always been interested in sustainability and policy. I have a deep interest in where the human and physical intersect and how people are influenced by and influence the environment and climate change. I think studying geography probably stoked that interest. I've also been involved in environmental campaigning and am quite active in building networks for young people.

As for transport, it's just so interesting. It touches so many different sustainability issues and what people care about. Almost everyone uses transport, and transport systems are a great opportunity to change and influence behaviours, especially in cities.

What's your experience been like working in a green job?

Climate wasn't really on the public agenda when I first started my job – not as much as it is now anyway – and it was a bit of a challenge trying to make the case for more climate-friendly systems.

That's changed completely since parliament declared a climate emergency and government announced targets for achieving net zero emissions. It's easier to make the case for investing in good practice, though the pandemic has made progress difficult.

Although my role is quite niche, it has given me transferable skills to use in future jobs, such as strategic thinking.



What would your advice be to anyone reading this and thinking about a green job?

If you're interested in transport, there are lots of opportunities and different routes in. If you don't fancy studying for a degree, you could look at available apprenticeships and search for schemes related to the sector. For example, TfL runs a career-switch scheme and Leeds University host a transport planning apprenticeship scheme, now in its third year.

I always think the definition of green jobs is quite interesting, because we think of green jobs as doing something specifically around sustainability. But if you think about it, there are lots of "green" jobs that are green because they have a smaller carbon footprint and aren't in a polluting or damaging sector, like librarians for instance. So, we need to broaden our idea of what a green job entails.

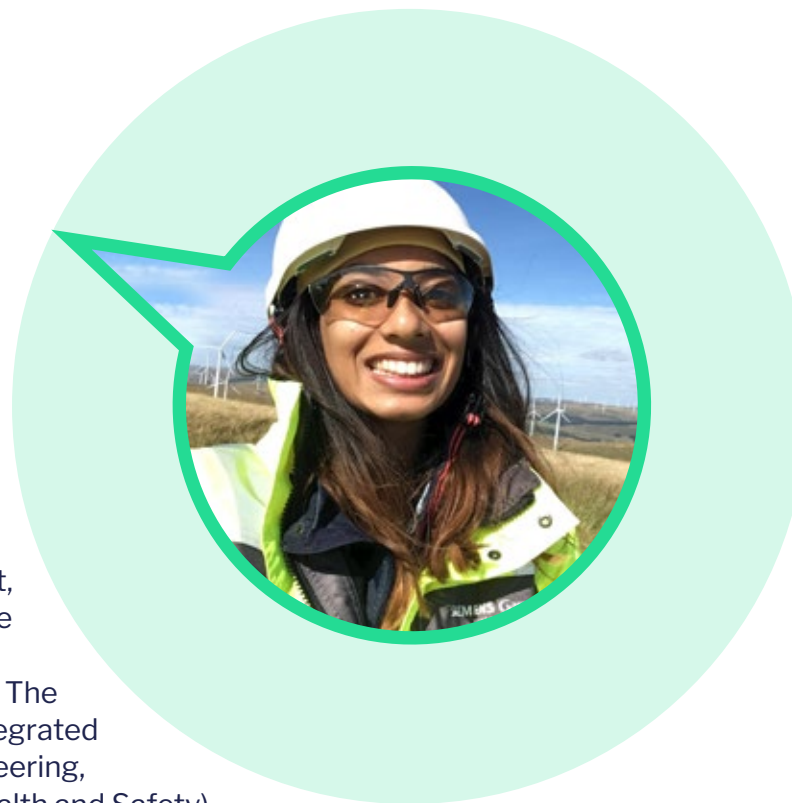
How can employers, educators and government make it easier for young people to access good green jobs like yours?

Transport has done quite a lot on apprenticeships, but there's scope for it to keep growing. However, my current big bugbear is the fact that the government's transport decarbonisation plan, which should be published soon, doesn't mention skills or jobs at all. It's a surprisingly good plan, but there's not a single mention of jobs needed to deliver the strategy, which is ludicrous. So that's my one big ask – that government acknowledge the need for jobs and reskilling in their plan.

Eishar Bassan, 23, is a Graduate Support Engineer at Siemens Gamesa – a renewable energy company.

How did you get into your role?

I did an undergraduate degree in mechanical engineering, which included a placement year with Siemens Gas Turbines. From my placement, I found out about the Siemens Gamesa graduate scheme, a new, government-funded scheme designed in collaboration with Aston University. The scheme is 3-years long and comprises of an integrated master's degree and three placements in engineering, operations and QEHS (Quality, Environment, Health and Safety). These placements facilitate the learning of new skills and competencies, which I believe produce well-rounded graduates. I'm looking forward to my final placement, where I will be working on the construction side of things and get the opportunity to design a windfarm. Once we complete our placements, we have the opportunity to look for a job within Siemens Gamesa which is exciting as the company is international, so we have the chance to work abroad in places like Taiwan or the US.



What appealed to you about a career in engineering and renewable energy?

My uncle suggested I study mechanical engineering after noticing I liked the mechanics side of further maths during my A-Level studies. Before my placement year, I had heard about renewable energy, but I was open to getting a job in any sector. Once I had completed my placement year and experienced full-time work in a sustainable, good company, I realised I wanted to do the job I love as ethically as possible. That's why I pursued my interest in renewables and sustainability during my final year and applied for the graduate scheme I'm now on.

What's your experience been like working in a green job?

Personally, I haven't found too many barriers to working in a green job due to my academic background. Since working, I've realised there is a gender gap and unconscious bias. For example, lots of adjustments are needed for things like the size of safety equipment or the provision of on-site toilets in order to make the sector more accessible to women. These small barriers cumulatively are off-putting for women entering the sector.

What would your advice be to anyone reading this and thinking about a green job?

For women in particular, the sector is increasingly acknowledging and talking about the gender gap in engineering. This needs to begin early on, selecting the right GCSE and A-Level courses is necessary, and not doing so can exclude people from accessing the relevant skills to pursue a career in engineering. There are many factors to contend with when accessing a career in engineering, including systemic and ingrained stereotyping of women, as well as cultural and unconscious bias.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

Schools should help students who have an interest and/or aptitude to choose the relevant GCSE and A-Level subjects. I believe there is a responsibility for industries to go into schools and promote the opportunities, using female role models if possible. If you only see men in the engineering roles, you can't imagine it's for you. You struggle to be what you can't see.

Matthew Snelling, 26, is a Peatland Restoration Officer at the Yorkshire Wildlife Trust.

How did you get into your role?

Like most people who do what I do, my interest started by visiting nature reserves at an early age. I didn't know exactly what I wanted to do, but I knew I wanted to work outside so I studied biology and ecology at Newcastle University. Following university, I volunteered at the RSPB and



the Yorkshire Wildlife Trust while working an office job to get by. I also did an internship with the Yorkshire Wildlife Trust.

What appealed to you about a career in nature restoration?

I really love being outdoors, and this was the main driver to wanting a green job and being involved in a job that is increasing nature in the world. I couldn't imagine working in a role that wasn't in nature, and I was way more motivated to do a green job, even though there was no guarantee of a permanent role. I want to stay in this line of work, and I've learnt so many skills, from project management to technical skills. There are huge opportunities in sustainable and green jobs.

What's your experience been like working in a green job?

There's an expectation with these types of role that you will have a degree but going to university is a big luxury.

There's also an expectation that you should work for free for a while, which I did, but I felt this was really valuable as it allowed me to upskill and learn about different roles. It's tough finding volunteering opportunities that fit your schedule, so you have to sacrifice by working in jobs you don't particularly like. I was lucky that I didn't have to rent, and my family could support me.

What would your advice be to anyone reading this and thinking about a green job?

My advice is to keep going and keep trying. Look for alternative experiences, such as mentoring and volunteer opportunities, so you can build up your confidence and skill base. Environmental jobs list volunteering and internships, so you can look there to start off with. But there are so many young people not even waiting for jobs to be advertised, and just going for it; I recently spoke at a youth conference in Manchester, and it was really inspiring to see lots of young people making their own opportunities.

There's huge demand and appetite for environmental jobs from young people, and they'll be basing their decisions on future jobs around the environment.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

We should be doing more to educate people on the different job opportunities that are out there – I would've loved to have volunteered while studying to help prepare me for future roles if I'd known that was an option.

Investment now can lead to a huge amount of delivery in the future; there's massive demand across Wales and Scotland to restore peatland, but we need the people to do that job.

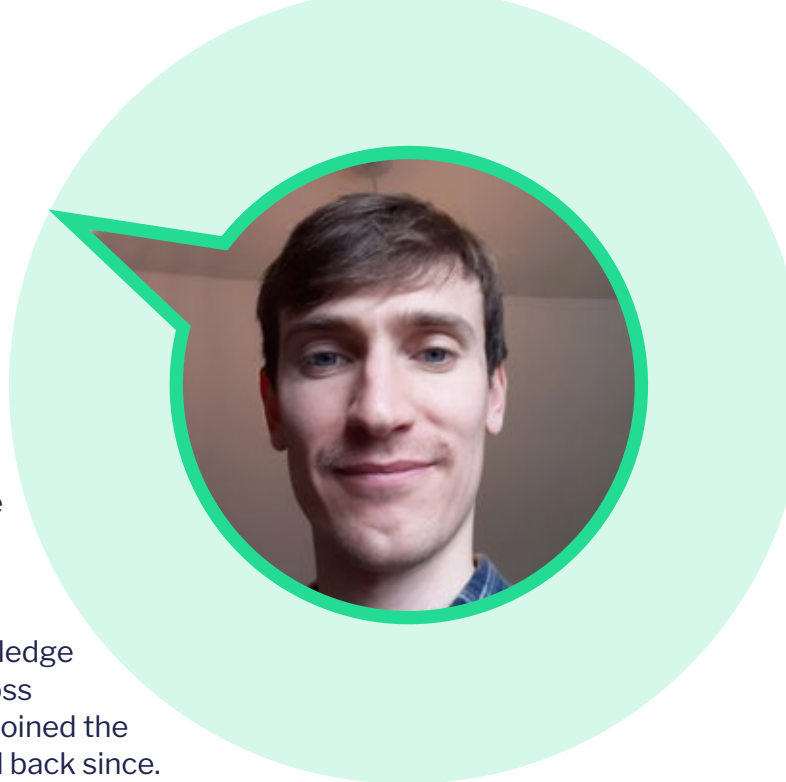
It's up to the government to invest in green jobs and in organisations to fund habitat restoration and teach young people how to do that job. Investing in organisations to ensure people can attend courses and train young people would be very worthwhile.



Nick Sheward, 29, is a Product Manager at sustainable bank Triodos.

How did you get into your role?

I studied economics and geography at university, and after a brief stint volunteering at a local recycling centre, I found a job at a finance company. This gave me professional experience in the sector, but the company didn't really align with my values – it was mainly focused on maximising profit. I started building up my knowledge of ethical investment, which is when I came across Triodos Bank UK. After a successful interview, I joined the team. That was 5 years ago, and I haven't looked back since.



What appealed to you about a career in sustainable finance?

I wanted a job that aligned with my values and wanted to achieve something that I felt was more socially valuable. When I left university, I was actively looking for a job in sustainability but found it very difficult. Fresh from studying and with no experience, I discovered there were very few entry level jobs in sustainable sectors. I tried out for jobs in environmental consultancy, project management and waste management, but it's a very small pool and very competitive. That's why I went for a job with a finance company – so I could gain relevant experience and work towards my goal of a green job.

What's your experience been like working in a green industry?

Triodos are specialists in all kinds of sustainable finance, so it felt like my background was a natural fit with their ethos. They provide opportunities to gain a wider understanding of what you're working towards and the impact it's having, and it helps you build a better understanding of environmental and social challenges.

We face some challenges of our own – funding things like customer and co-worker services that you'd get in a big bank are harder, as it's a niche area. Although Triodos is good at tracking and reporting positive impact, it's hard to benchmark as there isn't an agreed industry standard and transparency is one of the big challenges in the big banking sector.

What would your advice be to anyone reading this and thinking about a green job?

No experience is bad experience. Participate in projects, volunteer work and wider activities that you're interested in and passionate about.

Imagine the different job roles you take on as stepping stones, and get as many qualifications and as much experience out of them as possible. These jobs will equip you with key skills and help you transition to the job you really want.

Research what you're interested in and passionate about and think about the underlying core skills, and how you might acquire those skills in a professional capacity in order to help achieve your goal.



How can employers, educators and government make it easier for young people to access green jobs?

There's a shortage of jobs in the green sector, and neither government nor business are doing enough to right the imbalance between the aspiration for green jobs and what's actually available.

We're not short on educated and highly motivated young people, instead it's a shortage of employers and jobs. Government should fund programmes and initiatives that encourage more companies working in green sectors, which would then generate more jobs.

More should be done to provide work placements and apprenticeships to help kids get an understanding of what's out there and what the roles are like.

Pete Statham is a Sustainability Manager at Carlsberg Marston's Brewing Company and Carlsberg Group.

How did you get into your role?

I've been interested since school about issues like the climate crisis and sustainability, so studied geography, followed by an MSc in sustainable development. It was during my MSc that I learned how businesses can make a significant impact on green and sustainable futures. I started an internship at a sustainability consultancy where I worked my way up the ranks for 6 years. From there I got my role as Sustainability Manager at Carlsberg, where I lead on the implementation of Carlsberg's sustainability plan in the UK, as well as communications for the Carlsberg Group.



What appealed to you about a career in sustainable business?

My geography degree had a strong environmental focus and helped me to understand the crisis we're facing. I wanted to do something about it and saw the huge opportunity for business to make an impact through its ability to invest and innovate. Although sustainability has been discussed for a long time, it's only really become mainstream in the last few years. I'm fortunate to be working in this sector while it's rising in prominence and it's an exciting place to be. It's also a good career move with long-term prospects and the opportunity to do something that makes an impact.

What's your experience been like working in a green job?

Working in sustainability comes with its challenges. You're constantly balancing priorities like budgets, resource and time. And despite working all the hours in the day, there's always more



you could do. It also takes strong negotiation skills – getting people on board with your ideas isn't always easy, but there's huge satisfaction when you do.

What would your advice be to anyone reading this and thinking about a green job?

Look for advertised jobs on platforms like LinkedIn but be aware that there are lots of entry level jobs that aren't advertised. Get in touch with people who have the job that you want in the future and find out how they got there and any advice they can share. The green jobs sector is so wide-ranging, and people often ask whether you need a degree or even a masters. But personally, I think work experience is incredibly valuable. Think outside of what you're directly aiming for and whether there's an alternative route to it. For example, after graduating I found a job doing door-to-door surveys on sustainable travel. While not what I wanted to do long-term, it showed my eagerness to work in the sector which definitely helped with the next step. Most importantly of all, read around the topic. Sustainability encompasses lots of issues and employers will want the candidates who have a passion and understanding for the issues and a point of view to share.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

I'm very fortunate to have done both an undergraduate and a postgraduate degree. Investment in education is key. But first we need the demand for employment in this space. There's huge opportunity in the recovery from the pandemic for businesses and governments to invest in a better, more sustainable and low-carbon economy. The measures we've seen so far are a start, but there's much more to be done.

Sam David, 26, is Technical Account Manager for Product Experience at Demand Logic, a software tool for property managers and building contractors.

How did you get into your role?

I studied Astrophysics at university but didn't want to go down the traditional academic route. So I took a chance and followed a lead from someone I knew who worked in software development for a small company, and ended up learning on the job. I was inspired by how tech can be used to solve problems and started looking for companies that worked with disruptive tech and solved problems.

Demand Logic are a company that provide an intelligence platform based on collected data, which enables users to run their building(s) more efficiently. I work on the customer facing end helping people to use the tech as well as suggesting ideas to make their company more efficient.



What appealed to you about a career at Demand Logic?

I wanted to work at a job that made a difference, so I tagged “sustainability” or “green tech” on to job searches. You get more from it than purely the salary package, and I couldn’t imagine doing anything else. Everyone in this company is passionate about sustainability – to be honest, I don’t think I’d work in a role that wasn’t a green job. It’s refreshing to work in a place that wants to fix problems and being part of this community will make it easier to get a green role in the future.

What’s your experience been like working in a green job?

I love that everyone in the company is passionate about working in a sustainable way. It’s inspiring to learn about some of the great stuff our team is doing, including in their own time. Working at Demand Logic, where all the founders are still a part of the company, it feels very personal – so everyone is heavily invested in the work they are doing. I can’t think of anything else I would rather be doing. Working in a green job has really made me aware of the problems we are facing, and it’s really refreshing being part of fixing some of those things.

What would your advice be to anyone reading this and thinking about a green job?

The company is almost as important as the role. There are all sorts of roles within green companies, it’s important that you are enthusiastic about what they do. I’ve found learning how to link up with people on LinkedIn and build a network is very useful.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

The government can help by improving further education options. Apprenticeships have mainly been manual jobs, but I think this can be widened by offering young people more advice on different job options. It would be great to be able to search for a company based on sustainability so people can choose who they want to work for. Lots of companies would love to be more sustainable but could be finding it difficult especially during the COVID crisis so it would be good to get government support to help.

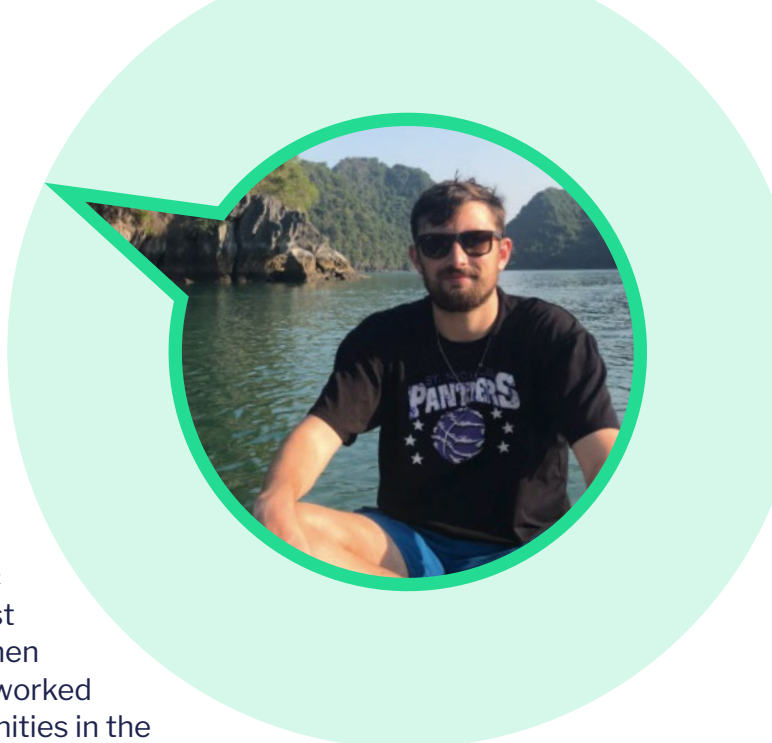
There is a real appetite from young people to want to go into the green jobs. I don’t feel like we were really taught about the climate crisis at school, and its impact on jobs. I’d like to see apprenticeships improve and to see a mailing list to update on policy and changes. Sustainability will become a bigger part of everyone’s lives and with the current changes to remote working which allows people to pick and choose where they work. I think if you’re a company and you don’t have a sustainability policy, you’ll struggle to attract young people to your roles.



Will Bickerton, 24, is a Clean Energy Specialist (Customer Service) at Good Energy.

How did you get into your role?

I studied Environmental Sciences at Bristol University, where I became really interested in renewable energy. I made the most of university support, attending workshops on CV writing and interview prep. To complement my academic background, I undertook some volunteering – first in Uganda, looking at water contamination, and then at a water charity. I wanted to stay in Bristol, so I worked full time in a restaurant while looking for opportunities in the green economy. I think my determination to work for a green company helped keep me motivated. Seven months after graduating, I secured my role at Good Energy, which I came across through a recruiter on LinkedIn.



What appealed to you about a career in green energy?

I've always had a connection with nature and enjoy walks and being outside. Studying Environmental Sciences at university fostered my interest in a green role and introduced me to a breadth of issues, including sustainable development, green energy and pollution and climate change modelling. I became aware of global issues and how CO2 emissions limit our future. I wanted to be part of a company actively combatting climate change – an organisation committed to fighting the good fight. I find the work is rewarding – if Good Energy performs well, I have made a personal contribution to tackling CO2 emissions.

What's your experience been like working at Good Energy?

I find working at Good Energy like being in a collective of like-minded people – everyone has the same mindset and values. Good Energy walks the walk— when looking for a new HQ, they wanted to maximise efficiency and preserve trees. Another positive is that there's a big push to develop talent. Good Energy have hired a lot of graduates who want to harness their passions and develop a career. There's a lot of opportunity for growth in learning and development, which is rewarding.

Working during a pandemic has been difficult because of the barriers to casual conversation and connecting with your colleagues within an office setting, but Good Energy has instituted connectivity sessions which has really helped.

What would your advice be to anyone reading this and thinking about a green job?

Make the most out of the resources available to you: use free resources at university, including workshops, placement years and alumni services. Network – use LinkedIn and keep your profile developed and keep marketing yourself. Build a rapport with a recruiter; I googled “green recruiters in the South West” and attended networking events to build my list of contacts.

Be resilient and believe you'll get the job you want. Passion is the biggest thing employers look for, and you can't fake it.



And I recommend practising 5 seconds of courage — try something you find daunting and just throw your hat in the ring.

How can employers, educators and government make it easier for young people to access good green jobs like yours?

It'd be good if students received more practical support from academic institutions, such as free courses, good alumni services and employability workshops. If companies linked with colleges then that might open up more apprenticeships and work experience, allowing students to have experiences that they can refer to during job interviews. And finally, funding. We need government funding for jobs with companies with green credentials to promote a more inclusive and diverse workforce.



Appendices

Appendix 1. Methodology for modelling future wage scarring from youth unemployment by area

Our analysis focuses on unemployed 16-24 year olds.

Each data point representing the scarring effect reflects:

- Current (December 2020) youth unemployment by local authority (by gender and age bracket);
- Local salary levels (by gender) in each local authority;
- Regional projected trajectory of median earnings over time, by gender;
- Scarring projection (following one of three sets of estimates) over 20 years, specific to gender, age bracket at unemployment, and optionally length of unemployment.

The model does not account for migration (between UK areas or in and out of the UK), future economic shifts (such as the levelling-off of the gender pay gap), or future economic crises that may result in other mass unemployment spells.

The calculations and sources behind the variables are explained in further detail below.

Unemployment for 18-24 year olds for each local authority by gender was estimated using the Claimant Count for December 2020, published on 26 January 2021. The Claimant Count reflects the number of people claiming Jobseeker's Allowance plus the number of Universal Credit claimants who are required to look for work.¹

For 16-17 year olds, the Claimant Count significantly underestimates unemployment due to unavailability of JSA / Universal Credit to 16-17 year olds. Therefore, unemployment for 16-17 year olds in each local authority was estimated by scaling up the local authority's Claimant Count, in proportion to the regional Claimant Count to regional unemployment for 16-17 year olds as represented in ONS's Regional labour market statistics (using an average coefficient calculated from regional Claimant Count and ONS unemployment data points for this age bracket from the 8 months from March - October 2020).

Future earnings trajectories (unscarred) were modelled following the current distribution of both median and mean wages by age, by gender and by region in the ONS 2020 Annual Survey of Hours and Earnings. (Data on wage distribution by age is not available at a local authority level.) It is assumed that future wages follow current patterns by age and gender, and that wages keep up pace with price inflation (in other words, the calculation reflects future lost wages in today's currency). In order to model the scarring effect, average (median) wages for each age category were expressed as a proportion to the overall median wage for all workers in a given region.

¹ <https://commonslibrary.parliament.uk/research-briefings/cbp-7927/>

² <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.397.6821&rep=rep1&type=pdf>



Scarring effect: We reviewed eight studies estimating the effect of unemployment spells on future wages. Studies were excluded from modelling for a number of reasons, including not reflecting UK data, or focusing on people in one continuous employment following unemployment. For the three remaining studies (Gregg and Tominey 2005², Gregg and Tominey 2004³, and de Fraja et al 2017⁴), coefficients that represented scarring effects on wages over 20 years by gender, length of unemployment, and age were calculated from the results marked as statistically significant in each study.

The three separate estimates presented in our model are based on 1) the lower-end coefficients for scarring for men in Gregg and Tominey 2004b, alongside coefficients for women from Gregg and Tominey 2004a; 2) the higher coefficients for scarring for men in Gregg and Tominey 2004b, alongside the coefficients for women from Gregg and Tominey 2004a; 3) the coefficients for scarring from de Fraja et al 2017. For example, a man who was unemployed for a year at age 18-20, is projected to experience wage scarring at age 33 (comparative to his potential “un-scarred” wage) of 14.9% in estimate 1, 19.7% in estimate 2, and 26% in estimate 3.

The coefficients were extrapolated to cover gaps in ages where those existed (e.g. if data only covered the ages of 23, 33 and 42, then assuming that the scarring effect follows a linear regression from age 23 to age 33, and age 33 to age 42).

Where no data was given for scarring effects affecting unemployed 16-17 year olds, a conservatively smaller scarring effect was assumed proportionate to unemployed 18-19 year olds. The de Fraja et al 2017 study reports no scarring effect for unemployed 24 year olds, and no scarring effect beyond the age 40. This is included in our model.

Based on the projected scarring coefficients covering the ages 16-42, alongside the projected future earnings trajectories by region (as above), region-specific 20-year scarring multipliers on the average salary were calculated for three age groups – those currently experiencing unemployment at age 16-17, those at age 18-21, and those at age 22-24 (to match age groups represented in Claimant Count data).

Earnings by Local Authority and by region were sourced from the 2020 Annual Survey of Hours and Earnings. Our modelling uses the 30th percentile of earnings by area, to ensure a conservative estimate and reflect the fact that youth unemployment disproportionately affects people without university degrees, who are likely to have lower earnings later in life.⁵ To compare, if calculations are based on mean wages, the estimate of scarring across England and Wales is a much higher £44 billion - £53 billion.

Multiplying the region-specific 20-year scarring multipliers with the unemployment estimates by age bracket for each area and with the median salary for each area, we derive the estimate for scarring by local authority.

³ <https://www.bristol.ac.uk/cmpo/publications/papers/2004/wp97.pdf>

⁴ <https://www.york.ac.uk/media/economics/documents/seminars/2016-17/The%20Wounds%20That%20Do%20Not%20Heal.pdf>

⁵ Thanks to Paul Gregg for commentary on this point.



Appendix 2. Existing apprenticeship standards that can help deliver the zero-carbon transition, by sector

Agriculture, environmental and animal care	Transport	Engineering and manufacturing
<p>Countryside ranger Agriculture or horticulture professional adviser Water environment worker Arborist Forest operative Fencing installer Land-based service engineering technician Sustainability business specialist (integrated degree) Countryside worker Environmental practitioner (degree) Landscape or horticulture supervisor Crop technician Horticulture or landscape operative Land-based service engineer Ecologist</p>	<p>Bicycle mechanic High speed rail and infrastructure technician Passenger transport driver - bus, coach and tram Passenger transport onboard and station team member Passenger transport operations manager Rail and rail systems engineer Rail and rail systems principal engineer (integrated degree) Rail and rail systems senior engineer (degree) Rail engineering operative Rail engineering technician Rail infrastructure operator Railway engineering design technician Road surfacing operative Train driver Tramway construction operative Transport planner (degree) Transport planning technician</p>	<p>Automation and controls engineering technician Automotive glazing technician Composites technician Compressed air and vacuum technician Construction equipment maintenance mechanic Electrical or electronic technical support engineer (degree) Electronic systems principal engineer Engineer surveyor Engineering design and draughtsperson Engineering fitter Engineering manufacturing technician Engineering operative Engineering technician Fenestration fabricator General welder (arc processes) Lifting equipment technician Maintenance and operations engineering technician Manufacturing engineer (degree) Manufacturing manager (integrated degree) Material cutter Materials process engineer (degree) Materials science technologist (degree) Metal casting, foundry and patternmaking technician Metal fabricator</p>
Digital	Health and science	Business and administration, and procurement
<p>Network engineer Data technician Network cable installer</p>	<p>Environmental health practitioner (integrated degree) Research scientist Regulatory affairs specialist Technician scientist Metrology technician Food industry technical professional (integrated degree)</p>	<p>Sustainability business specialist (integrated degree) Quality practitioner Operational research specialist Systems thinking practitioner Regulatory compliance officer Supply chain leadership professional (integrated degree) Procurement and supply assistant</p>
Energy	Marine and offshore	Buildings and retrofitting
<p>Community energy specialist Electrical power networks engineer Electrical power protection and plant commissioning engineer Gas network operative Junior energy manager Power network craftsperson</p>	<p>Able seafarer (deck) Boatmaster First officer pilot Harbour master Marina and boatyard operative Marine engineer Marine Pilot Marine surveyor (degree) Marine technical superintendent (degree) Maritime mechanical and electrical mechanic Port marine operations officer Port operative Workboat crewmember</p>	<p>Asbestos removal operative BEMS (building energy management systems) controls engineer Bricklayer Building control surveyor (degree) Building services design technician Building services engineering craftsperson Building services engineering installer Building services engineering site management (degree) Building services engineering technician Commercial thermal insulation operative Dual fuel smart meter installer Facilities management supervisor Fenestration installer Floorlayer Industrial thermal insulation technician Installation electrician and maintenance electrician</p>



		Painter and decorator Plasterer Plumbing and domestic heating technician Refrigeration air conditioning and heat pump engineering technician Roofer Scaffolder Smart home technician
Other construction	Protective Services	Circular economy and recycling
Construction plant operative Construction design and build technician Construction site management (degree) Construction site supervisor Construction assembly and installation operative Groundworker Hire controller (plant, tools and equipment) Structural steelwork erector Engineering construction erector rigger Industrial coatings applicator Structural steelwork fabricator Formworker Piling attendant Construction site engineering technician Geospatial survey technician Electrical, electronic product service and installation engineer Engineering construction pipefitter Building services design engineer (degree) Civil engineer (degree) Civil engineering technician Steel fixer	Fire safety inspector Safety, health and environment technician Water network operative Water process operative Water process technician Water treatment technician	Waste resource operative Metal recycling technical manager (MRTM) Metal recycling general operative Digital device repair technician



Appendix 3. Future wage scarring impacts by Local Authority; Green Apprenticeships targets by Local Authority

Table 18. Future wage scarring impacts by Local Authority, if long-term youth unemployment equals current youth unemployment level, and Green Apprenticeship starts targets.

Area	Unemployed young people (estimate, Dec 2020)	Economic scarring estimate (£ lost wages over 20 years)		After 1 year's unemployment, over the next 20 years an average 18-21 year old loses... (£)		Green Apprenticeship starts target over 3 years
		(min)	(max)	(min)	(max)	
Darlington	1263	76,479,811	83,893,581	58,984	77,816	590
County Durham	5405	299,935,982	348,802,772	57,348	75,279	2530
Hartlepool	1184	58,143,794	70,661,004	50,329	67,754	550
Middlesbrough	2109	98,140,029	122,736,968	50,931	65,838	990
Northumberland	2952	160,876,384	188,854,492	53,712	70,148	1380
Redcar and Cleveland	1449	70,683,457	85,209,144	49,534	65,368	680
Stockton-on-Tees	2093	114,176,330	140,433,981	56,414	73,532	980
Gateshead	2149	105,062,907	129,890,279	53,867	69,513	1010
Newcastle upon Tyne	3214	149,755,840	196,079,519	54,504	71,616	1500
North Tyneside	1849	101,837,719	126,145,307	58,197	76,859	870
South Tyneside	1719	82,570,928	105,122,537	53,399	71,262	800
Sunderland	3114	153,344,569	191,036,509	54,259	71,861	1460
Blackburn with Darwen	1696	73,725,876	95,177,201	50,573	66,104	790
Blackpool	2176	98,791,852	114,667,987	46,033	64,033	1020
Cheshire East	2051	107,899,905	143,327,575	59,389	78,978	960
Cheshire West and Chester	2301	116,562,425	152,427,149	58,671	77,715	1080
Halton	1205	62,975,356	80,051,246	57,537	76,941	560
Warrington	1411	73,983,733	88,118,450	55,557	73,717	660
Allerdale	550	26,075,245	36,642,954	58,796	75,952	260
Barrow-in-Furness	635	44,004,154	54,101,437	76,602	97,698	300
Carlisle	751	41,163,313	47,312,822	57,027	76,007	350
Copeland	350	No data	No data	No data	No data	160
Eden	180	7,474,861	11,571,234	56,444	72,262	80
South Lakeland	335	18,917,475	23,067,334	61,074	78,770	160
Bolton	3628	184,652,366	217,197,268	55,192	71,526	1700
Bury	1801	99,138,535	116,263,226	57,116	77,785	840
Manchester	7307	307,185,994	419,805,753	50,154	67,478	3420
Oldham	3126	147,002,590	185,954,732	51,825	70,355	1460
Rochdale	2326	102,309,113	129,588,384	48,498	65,882	1090
Salford	2946	135,165,482	173,159,083	51,596	68,409	1380
Stockport	2246	111,449,925	143,527,852	55,137	73,700	1050
Tameside	2476	115,675,639	141,780,273	51,730	68,746	1160



Trafford	1555	76,217,228	104,384,500	57,631	77,814	730
Wigan	2951	152,873,777	190,535,107	54,460	72,942	1380
Burnley	1181	59,769,014	67,619,773	52,571	70,068	550
Chorley	655	32,625,765	39,646,483	54,825	74,539	310
Fylde	570	35,032,813	43,760,919	68,542	89,233	270
Hyndburn	1021	52,399,315	59,927,215	52,332	68,828	480
Lancaster	1040	48,117,853	65,732,769	54,616	70,226	490
Pendle	790	No data	No data	No data	No data	370
Preston	1451	69,935,049	84,709,832	52,836	70,659	680
Ribble Valley	245	12,047,660	16,730,073	61,300	81,284	110
Rossendale	615	No data	No data	No data	No data	290
South Ribble	715	34,926,938	42,429,660	52,952	70,653	330
West Lancashire	916	46,889,374	58,150,578	52,767	70,917	430
Wyre	881	44,871,527	52,842,437	53,047	71,295	410
Knowsley	1921	93,750,222	112,865,680	52,957	71,725	900
Liverpool	5937	286,027,196	380,564,493	54,928	73,457	2780
Sefton	2461	No data	No data	No data	No data	1150
St. Helens	1675	85,931,487	109,065,165	56,542	74,685	780
Wirral	2986	143,179,549	181,242,195	53,727	72,086	1400
East Riding of Yorkshire	1905	102,079,621	124,253,910	57,592	75,723	890
Kingston upon Hull, City of	3625	170,492,806	212,279,566	51,149	67,939	1700
North East Lincolnshire	1538	82,275,528	103,690,493	60,096	77,670	720
North Lincolnshire	1451	82,156,150	93,935,283	57,322	75,387	680
York	1158	52,626,033	69,179,568	53,356	69,932	540
Craven	200	9,991,446	13,116,166	58,174	77,454	90
Hambleton	387	20,680,740	23,499,377	55,726	73,410	180
Harrogate	769	39,817,941	45,640,904	54,573	72,394	360
Richmondshire	311	No data	No data	No data	No data	150
Ryedale	190	No data	No data	No data	No data	90
Scarborough	787	41,086,961	50,056,773	55,552	74,234	370
Selby	405	18,888,288	25,973,879	56,431	73,856	190
Barnsley	2240	107,694,247	135,189,896	52,486	69,972	1050
Doncaster	3325	170,803,361	214,155,959	58,552	74,742	1560
Rotherham	2634	121,578,177	152,598,942	51,754	67,368	1230
Sheffield	5426	253,343,276	331,792,479	54,797	70,741	2540
Bradford	7302	349,508,347	434,975,874	53,787	70,392	3420
Calderdale	2196	122,376,008	145,403,762	59,461	81,073	1030
Kirklees	4154	204,424,338	258,180,422	56,220	73,691	1940
Leeds	8609	463,365,768	569,573,783	59,030	78,386	4030
Wakefield	2941	145,825,724	175,592,084	51,653	69,814	1380
Derby	3662	227,897,331	252,254,732	59,942	78,227	1710
Leicester	4524	227,205,070	251,715,666	51,900	69,987	2120
Nottingham	4544	231,332,031	259,682,555	52,505	71,465	2130



Rutland	125	No data	No data	No data	No data	60
Amber Valley	675	32,848,296	42,100,112	57,578	75,118	320
Bolsover	673	31,658,645	34,379,710	50,735	65,567	310
Chesterfield	983	54,055,050	65,190,080	56,498	74,133	460
Derbyshire Dales	270	No data	No data	No data	No data	130
Erewash	958	56,430,208	68,898,303	60,804	79,930	450
High Peak	515	24,212,477	32,822,928	58,233	73,873	240
North East Derbyshire	698	39,982,088	44,879,761	56,333	74,228	330
South Derbyshire	876	58,721,204	64,919,148	67,932	89,194	410
Blaby	836	55,132,219	61,653,875	68,145	88,419	390
Charnwood	1281	72,772,610	80,577,289	57,580	75,494	600
Harborough	365	18,307,500	24,761,415	61,878	83,289	170
Hinckley and Bosworth	520	26,373,167	34,766,123	62,518	82,002	240
Melton	220	9,115,463	12,379,312	No data	No data	100
North West Leicestershire	515	23,879,472	33,221,691	55,491	73,639	240
Oadby and Wigston	285	15,261,214	20,679,679	66,964	86,165	130
Boston	485	18,655,454	25,410,770	47,676	62,159	230
East Lindsey	1291	66,336,502	72,829,552	49,341	66,111	600
Lincoln	1444	74,538,045	82,235,276	50,980	67,173	680
North Kesteven	610	33,857,258	45,203,900	62,628	84,097	290
South Holland	778	46,463,238	50,315,631	62,826	82,699	360
South Kesteven	1156	65,096,620	71,025,117	56,919	75,647	540
West Lindsey	896	56,643,544	62,248,824	62,748	82,294	420
Corby	535	26,544,671	35,196,641	58,965	76,606	250
Daventry	440	No data	No data	No data	No data	210
East Northamptonshire	400	23,382,001	31,784,813	72,222	93,211	190
Kettering	971	No data	No data	No data	No data	450
Northampton	2026	114,555,861	137,220,940	61,012	80,316	950
South Northamptonshire	310	No data	No data	No data	No data	150
Wellingborough	693	No data	No data	No data	No data	320
Ashfield	1133	61,443,190	67,344,877	54,425	71,371	530
Bassetlaw	943	49,046,889	54,893,186	52,842	68,651	440
Broxtowe	610	27,631,121	40,686,517	59,576	77,305	290
Gedling	958	51,697,028	59,151,309	51,146	68,138	450
Mansfield	1126	60,150,233	66,289,059	49,916	67,719	530
Newark and Sherwood	839	43,624,887	52,904,710	51,397	66,845	390
Rushcliffe	435	20,181,069	31,057,439	63,231	82,683	200
Herefordshire, County of	1078	56,581,960	63,333,967	51,911	68,898	500
Shropshire	1928	86,255,633	108,072,785	49,458	64,819	900
Stoke-on-Trent	2890	150,943,921	181,182,989	56,335	75,364	1350



Telford and Wrekin	2238	123,322,141	136,741,682	51,177	66,690	1050
Cannock Chase	879	44,979,670	51,479,953	55,212	71,859	410
East Staffordshire	799	43,408,756	50,323,357	59,486	78,981	370
Lichfield	545	32,688,977	44,145,320	68,981	91,628	260
Newcastle-under-Lyme	1141	64,154,269	70,844,447	54,484	71,544	530
South Staffordshire	714	40,422,606	50,583,318	67,443	86,751	330
Stafford	724	38,752,469	48,314,730	58,496	75,904	340
Staffordshire Moorlands	509	31,974,859	38,309,814	No data	No data	240
Tamworth	868	49,177,021	53,622,836	59,670	76,940	410
North Warwickshire	395	22,014,675	29,460,433	63,793	83,296	180
Nuneaton and Bedworth	1109	55,080,663	66,469,607	53,444	70,000	520
Rugby	753	46,067,444	49,965,200	62,645	85,570	350
Stratford-on-Avon	728	45,994,580	50,527,862	64,334	84,481	340
Warwick	774	41,492,628	50,967,265	62,005	81,134	360
Birmingham	19411	944,464,466	1,136,571,832	53,186	69,976	9080
Coventry	3710	184,231,993	230,558,674	56,089	75,615	1740
Dudley	3778	220,649,616	250,266,837	60,846	78,700	1770
Sandwell	4733	225,564,119	270,309,542	51,730	68,379	2220
Solihull	2076	No data	No data	No data	No data	970
Walsall	3878	206,246,404	235,432,568	55,154	73,354	1810
Wolverhampton	3948	203,822,994	239,221,676	55,673	73,818	1850
Bromsgrove	639	32,737,068	41,807,847	59,194	78,094	300
Malvern Hills	534	25,226,294	30,534,276	46,872	61,768	250
Redditch	808	41,748,840	46,027,310	52,276	68,506	380
Worcester	988	49,322,097	56,619,515	52,401	68,969	460
Wychavon	655	30,327,591	39,641,683	53,875	70,470	310
Wyre Forest	923	55,590,091	61,195,719	No data	No data	430
Bedford	1526	91,086,032	107,767,993	66,586	86,022	710
Central Bedfordshire	1821	119,785,724	133,479,886	66,074	87,477	850
Luton	2206	111,189,181	140,400,617	56,324	76,034	1030
Peterborough	2131	101,157,145	123,351,701	50,802	66,977	1000
Southend-on-Sea	2006	105,789,516	127,355,840	55,411	73,306	940
Thurrock	1596	No data	No data	No data	No data	750
Cambridge	1026	68,959,747	74,517,937	69,350	93,831	480
East Cambridgeshire	310	16,868,754	22,721,373	63,625	83,670	150
Fenland	850	48,075,147	58,207,423	56,898	73,913	400
Huntingdonshire	1021	67,572,916	73,452,514	67,605	90,343	480
South Cambridgeshire	720	46,762,635	55,882,225	71,326	93,666	340
Basildon	1876	92,114,150	106,485,426	51,967	68,223	880
Braintree	1106	60,291,387	70,694,755	55,320	72,880	520



Brentwood	445	No data	No data	No data	No data	210
Castle Point	690	37,021,313	45,678,634	55,377	73,479	320
Chelmsford	1181	65,163,085	78,867,383	58,374	76,332	550
Colchester	1481	74,077,440	93,295,212	55,052	71,257	690
Epping Forest	1166	67,351,209	81,223,693	59,471	79,424	550
Harlow	790	38,032,899	51,831,100	58,854	77,190	370
Maldon	350	19,151,967	25,017,432	63,275	82,587	160
Rochford	515	No data	No data	No data	No data	240
Tendring	1987	No data	No data	No data	No data	930
Uttlesford	480	29,077,776	31,998,021	66,797	87,935	220
Broxbourne	835	No data	No data	No data	No data	390
Dacorum	1121	69,413,149	84,239,814	65,706	85,531	520
East Hertfordshire	815	52,069,515	66,565,972	69,700	91,257	380
Hertsmere	810	51,597,249	60,040,322	67,465	91,519	380
North Hertfordshire	800	51,222,999	64,918,698	71,626	92,025	370
St Albans	730	44,243,751	58,701,656	75,504	97,497	340
Stevenage	645	36,210,307	47,372,242	64,704	84,262	300
Three Rivers	680	39,990,973	52,532,368	69,588	89,265	320
Watford	805	48,898,110	59,301,730	70,027	93,993	380
Welwyn Hatfield	1081	67,763,307	73,248,189	63,695	87,355	510
Breckland	981	49,262,626	54,173,347	49,094	64,688	460
Broadland	610	No data	No data	No data	No data	290
Great Yarmouth	1256	61,173,868	67,554,354	46,893	61,561	590
King's Lynn and West Norfolk	1161	58,389,302	69,621,250	51,710	66,867	540
North Norfolk	425	18,640,021	25,581,396	51,214	65,941	200
Norwich	1445	66,937,247	85,143,348	54,877	72,633	680
South Norfolk	675	34,417,634	41,585,650	57,744	75,535	320
Babergh	610	30,567,058	36,867,779	54,011	70,474	290
Ipswich	1376	65,617,349	81,444,829	50,666	65,196	640
Mid Suffolk	565	No data	No data	No data	No data	260
East Suffolk	1841	103,502,957	124,289,837	58,050	74,055	860
West Suffolk	1061	62,668,035	70,229,544	58,377	77,637	500
Camden	2083	No data	No data	No data	No data	970
City of London	30	No data	No data	No data	No data	10
Hackney	3188	146,026,952	203,258,347	59,417	81,214	1490
Hammersmith and Fulham	1530	92,938,699	149,739,511	89,784	121,719	720
Haringey	3556	177,155,820	245,478,619	62,348	84,422	1660
Islington	2626	183,227,998	233,962,028	83,629	113,226	1230
Kensington and Chelsea	850	No data	No data	No data	No data	400
Lambeth	4182	285,824,874	345,284,752	77,730	104,871	1960
Lewisham	4584	311,412,584	357,276,654	73,371	102,641	2150
Newham	4936	No data	No data	No data	No data	2310
Southwark	3957	253,602,887	321,559,490	74,468	99,961	1850



Tower Hamlets	4196	298,657,524	409,783,507	89,829	121,424	1960
Wandsworth	2571	195,125,056	250,159,558	92,712	132,552	1200
Westminster	1560	102,027,844	155,215,671	94,047	127,697	730
Barking and Dagenham	3076	160,593,402	209,380,326	60,205	79,990	1440
Barnet	3148	151,315,137	220,007,581	63,107	86,550	1470
Bexley	2409	162,966,026	183,287,026	68,431	92,927	1130
Brent	3678	158,485,503	231,748,440	57,480	78,115	1720
Bromley	2561	176,452,812	222,146,734	77,341	103,946	1200
Croydon	5542	324,799,052	380,364,127	60,489	81,929	2590
Ealing	3498	181,391,797	263,155,821	68,464	92,905	1640
Enfield	4232	212,946,472	255,854,438	56,725	76,922	1980
Greenwich	3737	244,029,137	287,755,378	70,686	97,212	1750
Harrow	2093	112,067,703	155,696,289	69,898	94,456	980
Havering	2526	154,698,782	193,397,005	67,385	88,717	1180
Hillingdon	3006	169,663,921	216,368,423	63,540	87,523	1410
Hounslow	3219	186,547,886	232,797,551	66,869	89,897	1510
Kingston upon Thames	1010	No data	No data	No data	No data	470
Merton	1966	125,845,731	154,798,486	71,505	97,993	920
Redbridge	2968	153,605,912	220,596,068	66,991	90,029	1390
Richmond upon Thames	960	61,862,538	93,667,869	89,354	120,905	450
Sutton	1438	76,100,322	99,199,686	60,043	78,743	670
Waltham Forest	3188	170,024,954	232,260,407	67,933	90,570	1490
Bracknell Forest	815	52,432,029	58,911,702	65,682	87,328	380
Brighton and Hove	3120	143,000,262	199,758,337	57,774	76,739	1460
Isle of Wight	1250	64,017,875	76,859,435	53,785	70,846	580
Medway	2820	166,365,257	200,575,799	66,048	86,304	1320
Milton Keynes	2181	137,998,365	150,848,873	63,729	85,278	1020
Portsmouth	2055	110,831,598	138,488,378	60,165	83,626	960
Reading	1370	68,578,992	86,404,814	60,381	78,723	640
Slough	1435	90,271,266	113,848,252	71,420	93,885	670
Southampton	2951	159,056,399	189,055,774	58,345	75,908	1380
West Berkshire	760	39,018,421	55,022,315	61,311	82,898	360
Windsor and Maidenhead	810	52,611,688	71,071,372	73,317	98,465	380
Wokingham	705	35,729,886	53,129,532	65,508	87,383	330
Buckinghamshire	2775	149,136,443	204,526,580	63,944	85,652	1300
Eastbourne	1100	58,678,399	68,861,503	56,097	73,508	510
Hastings	1205	56,776,244	63,194,978	47,811	64,182	560
Lewes	910	55,032,566	62,476,158	60,420	80,961	430
Rother	930	39,114,234	42,708,040	42,479	56,539	440
Wealden	995	58,635,587	69,835,820	61,636	81,514	470
Basingstoke and Deane	1150	78,527,388	87,494,498	72,894	96,880	540
East Hampshire	515	No data	No data	No data	No data	240



Eastleigh	725	43,862,180	53,159,476	60,487	80,062	340
Fareham	610	No data	No data	No data	No data	290
Gosport	615	35,404,414	44,920,821	60,516	80,576	290
Hart	440	27,696,976	31,792,771	70,750	91,628	210
Havant	985	48,766,520	60,984,918	54,808	73,496	460
New Forest	970	58,202,705	67,675,378	58,669	77,820	450
Rushmoor	660	40,176,769	48,032,906	63,558	85,758	310
Test Valley	745	47,043,027	52,820,405	60,183	78,787	350
Winchester	760	53,835,434	62,702,781	74,902	99,365	360
Ashford	1200	75,499,652	88,142,213	67,583	87,329	560
Canterbury	1410	72,402,906	91,392,626	54,156	72,956	660
Dartford	870	52,575,369	65,292,502	69,531	91,939	410
Dover	1210	65,898,063	79,876,283	56,218	73,733	570
Gravesham	1155	69,705,414	82,680,481	64,023	84,154	540
Maidstone	1140	No data	No data	No data	No data	530
Sevenoaks	800	No data	No data	No data	No data	370
Folkestone and Hythe	1170	62,507,590	72,851,805	57,281	73,875	550
Swale	1575	76,530,977	89,804,492	51,214	67,128	740
Thanet	1985	100,756,756	115,763,828	52,333	70,760	930
Tonbridge and Malling	700	No data	No data	No data	No data	330
Tunbridge Wells	570	No data	No data	No data	No data	270
Cherwell	925	56,401,791	61,531,552	63,971	85,385	430
Oxford	950	46,129,661	62,299,167	57,768	76,706	440
South Oxfordshire	510	26,890,177	40,915,673	69,178	93,616	240
Vale of White Horse	695	44,471,862	49,893,248	67,717	87,599	330
West Oxfordshire	565	31,848,228	39,772,292	59,014	79,011	260
Elmbridge	650	37,946,213	49,977,197	65,013	85,733	300
Epsom and Ewell	335	No data	No data	No data	No data	160
Guildford	615	No data	No data	No data	No data	290
Mole Valley	345	16,004,686	22,677,512	53,447	74,659	160
Reigate and Banstead	830	51,103,528	67,333,301	72,350	97,276	390
Runnymede	550	No data	No data	No data	No data	260
Spelthorne	745	No data	No data	No data	No data	350
Surrey Heath	425	24,535,381	38,273,354	78,812	103,867	200
Tandridge	470	24,259,177	34,027,919	64,958	86,195	220
Waverley	575	34,370,623	44,952,041	67,551	87,304	270
Woking	450	25,007,625	35,722,643	69,088	90,339	210
Adur	425	No data	No data	No data	No data	200
Arun	1098	56,204,887	66,661,538	53,579	71,061	510
Chichester	545	22,124,771	32,840,625	53,359	70,675	260
Crawley	1164	70,557,355	85,563,497	69,954	90,727	540
Horsham	670	27,312,746	40,041,095	54,704	70,502	310
Mid Sussex	595	30,454,386	43,703,305	65,744	86,123	280



Worthing	730	37,228,418	52,301,643	61,916	80,766	340
Bath and North East Somerset	1333	No data	No data	No data	No data	620
Bristol, City of	4435	241,872,504	306,822,118	62,588	83,423	2080
Cornwall	5721	276,413,152	303,283,275	47,471	63,646	2680
Isles of Scilly	10	No data	No data	No data	No data	0
North Somerset	1691	103,188,045	113,295,295	62,417	80,518	790
Plymouth	3193	168,804,978	184,383,062	52,360	71,170	1490
South Gloucestershire	1693	90,429,605	111,190,884	60,272	78,647	790
Swindon	2200	136,470,992	149,307,017	64,638	83,608	1030
Torbay	1392	66,473,476	72,275,883	48,329	65,161	650
Wiltshire	3194	171,009,472	194,544,255	53,384	69,684	1490
East Devon	749	46,824,212	56,358,619	62,530	83,266	350
Exeter	1152	57,083,263	62,268,286	50,534	66,832	540
Mid Devon	529	28,248,567	32,996,506	51,068	67,512	250
North Devon	734	34,859,488	38,142,058	47,083	64,293	340
South Hams	380	16,086,283	21,592,552	47,201	63,934	180
Teignbridge	1077	54,695,720	60,197,201	50,131	66,642	500
Torridge	400	18,218,304	24,931,672	49,206	64,360	190
West Devon	394	21,344,561	23,869,592	52,915	68,145	180
Bournemouth, Christchurch and Poole	3270	178,388,150	204,421,509	58,289	76,683	1530
Dorset	2028	103,512,400	128,498,658	55,403	72,137	950
Cheltenham	864	48,696,497	61,330,320	64,512	83,528	400
Cotswold	350	18,338,594	25,293,211	63,598	84,110	160
Forest of Dean	450	17,140,410	23,219,302	46,674	59,946	210
Gloucester	1084	52,603,276	62,608,170	52,185	68,612	510
Stroud	659	No data	No data	No data	No data	310
Tewkesbury	559	28,839,996	31,282,111	56,016	72,287	260
Mendip	749	31,360,374	38,046,101	44,529	59,847	350
Sedgemoor	804	39,137,511	48,811,192	49,078	64,205	380
South Somerset	1078	57,713,104	65,500,760	53,283	69,139	500
Somerset West and Taunton	1023	55,664,296	60,904,207	54,015	72,353	480
Isle of Anglesey	537	25,316,259	29,462,349	47,211	66,305	250
Gwynedd	1033	46,632,279	54,460,588	46,394	61,288	480
Conwy	966	46,129,836	54,993,741	49,767	68,453	450
Denbighshire	946	43,227,756	51,716,003	47,182	66,210	440
Flintshire	1091	52,713,438	65,370,428	51,598	70,135	510
Wrexham	972	48,125,768	61,627,979	54,992	73,028	450
Powys	677	32,171,797	39,676,065	48,749	65,888	320
Ceredigion	531	No data	No data	No data	No data	250
Pembrokeshire	1004	52,122,501	60,904,560	52,716	72,617	470
Carmarthenshire	1540	81,477,851	94,538,332	53,015	74,940	720
Swansea	2035	92,026,897	114,203,577	50,250	67,703	950



Neath Port Talbot	1233	68,651,602	77,477,952	56,639	76,854	580
Bridgend	1196	59,484,362	74,854,843	55,468	74,717	560
Vale of Glamorgan	1096	55,995,035	67,968,645	55,875	78,244	510
Cardiff	3535	160,854,091	212,298,430	53,068	72,293	1650
Rhondda Cynon Taff	2296	108,971,406	139,219,553	52,494	70,893	1070
Merthyr Tydfil	565	28,376,628	36,405,963	57,013	78,136	260
Caerphilly	1617	77,832,352	97,665,828	54,444	72,010	760
Blaenau Gwent	722	No data	No data	No data	No data	340
Torfaen	926	45,881,880	56,580,449	55,641	73,154	430
Monmouthshire	582	33,299,679	40,093,854	61,369	82,006	270
Newport	1702	86,547,956	106,057,254	53,455	71,196	800

