It is just over two years since the Business Secretary, Vince Cable, officially opened the Biorenewables Development Centre (BDC) on the York Science Park.

In that time we have grown from a nucleus of just four staff to an international team of 40, with clients and partners across the UK, Europe, Latin America, Australia and the Far East.

From the start, our mission has been to grow the bioeconomy by providing industry with access to world-leading biologists and chemists in flexible facilities that can scale-up their latest innovations to industrial and commercial demonstration level.

Crucial to our work to date has been the creation and commissioning of a £13 million open-access facility that has been used to support more than 150 clients – from small to medium-sized businesses (SMEs) to multinationals – in a diverse range of projects.

These collaborations with business include the novel growth trials for non-food crops; the extraction of valuable chemicals from waste; and the use of smart enzymes and microbes to develop more efficient ways of turning woody waste into a valuable energy source.

I am pleased to report that our early work with local and regional SMEs – providing them with support through European funding – resulted in us securing a substantial second phase of EU finance. This is now being used to help our local clients invest in innovative new equipment to improve their performance and market share.

In addition, we have also helped establish the BioVale innovation cluster and developed plans for a £25M BioVale Centre. Long-term, BioVale has been set up to stimulate the bioeconomy, create new jobs, train the workforce of tomorrow, and attract inward investment.

In two years, I believe we have achieved the vision set out for us by Vince Cable at our official opening – that of becoming a centre of “national significance and unique capability”. I would like to thank all those who have helped us turn that aspiration into a reality and look forward to working with you all on the next chapter of the BDC.

Joe Ross
Director, Biorenewables Development Centre
The Biorenewables Development Centre (BDC) grew out of the desire of biologists and chemists at the University of York to make an impact on the most pressing environmental and economic issues of our time: how to harness research and innovation to make the transition to a low carbon, sustainable future.

Set up as a not-for-profit company in 2012, the BDC has assembled an international team of 40 researchers and business development specialists. Our team now helps business of all sizes access equipment and expertise to make the most of cutting-edge research in industrial biotechnology and green chemistry.

We work with industry – whether multinationals, government bodies or SMEs - in a range of projects from advisory services, funded support and trials through to full-blown demonstration pilots. This includes:

- Developing feedstocks to deliver new products or improve yields
- Improving performance and eliminating waste
- Extracting high-value chemicals from existing feedstocks or by-products
- Adding new products and services to a company’s existing offer
- Evaluating new processes for incorporation into business activities
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- Improving performance and eliminating waste

To support industry to the fullest extent, we stay true to our roots and maintain close ties with the University of York. We believe that our access to its world-leading institutes – the Centre for Novel Agricultural Products and the Green Chemistry Centre of Excellence – truly sets us apart from any competitors.
The big picture

Our reliance on petrochemicals will only be a short period in our history. Harnessing the latest multi-disciplinary developments in industrial biotechnology and green chemistry will allow us to develop bio-based materials to transition to a low carbon economy, or “bioeconomy”.

To support industry to make this leap, we use our expertise and facilities to develop and scale-up new sustainable processes and products using bio-based – or biorenewable – materials. In brief, this is any organic matter available on a renewable or recurring basis (including wood, forest residues, crops, agricultural by-products and food waste).

Although often associated solely with energy, biorenewables are much more versatile, with applications in packaging, cosmetics, pharmaceuticals, transportation, textiles, biodegradable plastics, and flavours and fragrances.

Despite common misconceptions, competitive pricing and great performance compared to their fossil-based counterparts are central to the viability of bio-based products. Today, already 10% of chemical products are made using biorenewables\(^1\), and this is just the beginning of the journey.

In Europe alone, the bioeconomy is estimated to be worth €200 billion by 2020\(^2\); and has been declared a priority in the US, South America, South East Asia and Europe with ambitious policies in place to support it.

The overarching vision for 2030 is of a world-leading and competitive Bio-Based European Economy. The European bioindustry sector in 2030 is innovative and competitive, with cooperation between research institutes and the industrial, forestry and agriculture sectors whilst enjoying the support of civil society.  

Joint European BioRefinery Vision for 2030\(^3\)

Sustainability and renewables have become well established and widely accepted in the industry. Few if any companies will not be involved within a very short time.

2014 ICIS Industry survey on sustainability\(^4\)

The 25% of producers envisage a long-term economic advantage to switching to renewable feedstocks\(^5\).

~50% of respondents require sustainability information from their suppliers\(^6\).

25% transport energy needs supplied by biofuels\(^5\).

30% heat and power from biomass\(^5\).

30% overall chemical production bio-based\(^5\).

\(^1\) European Commission (2011) Bioeconomy – A Key for Europe’s Sustainable Development.

\(^2\) EUR 200 billion by 2020.

\(^3\) Joint European BioRefinery Vision for 2030.

\(^4\) 2014 ICIS Industry survey on sustainability.

\(^5\) \(~\) 2013 International Bioenergy Conference.

\(^6\) 2014 ICIS Industry survey on sustainability.
Making an impact

Within the first year of operations the BDC went from a standing start to providing research and development support to more than 150 companies. While most of these are in the Yorkshire and Humber region, the BDC’s collaborations also include clients as far afield as Brazil, Vietnam and Australia.

Scale-up capabilities

Access to our specialists is proving to be a powerful tool for businesses to grow. One of the BDC’s core strengths is helping businesses scale up their processes e.g. by quickly progressing from proof-of-concept to developing processes at an industrial scale.

Funded support for Yorkshire SMEs

Economic growth is predicted to come from small to medium-sized enterprises (SMEs) and evidence shows that the fastest growing are those that are driven by innovation. Stimulating innovations is exactly what the BDC is able to help SMEs with through its funded European Regional Development Fund (ERDF) business assist programme. This support is invaluable for helping SMEs to address their bio-based challenges – and we are well on track to support 190 SMEs by summer 2015.

Capital grants for innovation

Our early success supporting regional SMEs led to the award of a second round of European funding – the Biorenewables Capital Grant Scheme – to help Yorkshire businesses invest in innovative new equipment for new product development. This £1 million initiative is on target to benefit around 20 companies across the region by 2015 with an average project spend of £50,000.

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We will drive growth, exports and innovation across all aspects of the bioeconomy, building on and further enhancing our global reputation and connections. In 2014, BioVale was recognised as a springboard for the local economy and allocated £8M from local government. Part of this funding is pledged towards a new building for the BDC, which will also provide additional, much-needed incubation space for growing businesses.

The leadership team at the BDC was also instrumental in helping forge partnerships with: one of Europe’s most successful biorenewable clusters – the Industries & Agro-Resources (IAR) in Northern France; the Brazilian national bioethanol research institute (CTBE); and is involved in similar discussions with potential partners in the Netherlands and Germany. These partnerships are crucial collaborations in responding to the challenges presented by our reliance on fossil resources, changing legislations and an increased demand for plant-based products.

Working with the BDC is a fantastic opportunity for us, rather than sourcing investors and lab-space we are able to focus on rapidly developing our patented PhotoBioreactor, which combines solar-powered LED lights and specialised reactors for rapid growth of algae. British Algoil Ltd.

The BioVale cluster will be a huge draw for international businesses. As an Australian company with a unique process to convert waste cellulose to high-value speciality chemicals, we committed to establish a base in York, UK, to better access both market opportunities and world leading expertise in bio-based research. Circa Renewable Chemicals.

Dedicated plug & play facility

New processes & products

International biorenewable hub

Knowledge & technology transfer

Open-access facilities

Global partnerships

28,000 new jobs by 2025

Inward Investment

The BDC has played a pivotal part in the formation of BioVale, a public/private sector partnership aimed at putting Yorkshire and the Humber on the map as an international hub for the knowledge-based bioeconomy. In 2014, BioVale was recognised as a springboard for the local economy and allocated £8M from local government. Part of this funding is pledged towards a new building for the BDC, which will also provide additional, much-needed incubation space for growing businesses.

The BDC’s open-access facilities are set up to demonstrate the commercial potential of novel technologies at any point in the bio-based supply chain, and are centred on the following areas: plant and microbial molecular analysis, pre-processing, processing, microbiology and analytical assessments. Beyond our own equipment, we also have space to accommodate some of our clients’ developing technologies, which helps de-risk their innovation processes.

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British Algoil Ltd.

2014 Strategic Plans, York, North Yorkshire and East Riding Local Enterprise Partnership.

Circa Renewable Chemicals.
Over the last two years the BDC has supported more than 150 companies, from SMEs to household names such as Quorn, Drax and Unilever, to develop innovative processes that convert plants, microbes and bio-wastes into commercially viable products. As a result the BDC’s client base has expanded to cover the spectrum of commercial sectors from specialty chemicals, food and feed, biofuel, plant breeding and pharmaceuticals, through to paint and surface coatings, personal care, bioenergy and fast moving consumer goods.

The following projects illustrate the kind of support the BDC offers, from sophisticated technological interventions to financial assistance through the £1 million Biorenewables Capital Grant Scheme.

**Novel processing technologies to develop naturally-derived insect repellents**

**Company: Citrefine**  
**Established in: 1994**  
**Location: Leeds, UK**  
**Activity: Production and supply of naturally-derived repellents**

Citrefine International extracts and uses oil from the eucalyptus citriodora tree in naturally-derived insect repellents. Their active ingredient, Citriodioal®, is now recognised by leading authorities worldwide for its first-rate efficacy - making it the only plant-based repellent with this level of accreditation.

Citrefine is now trialling the processed ingredient in their insect repellents and has won a BDC grant to invest in equipment that will help them analyse their materials in-house and further improve the quality of their raw materials and products.

We’re thrilled to be collaborating on technologies that are helping commercialise naturally-derived products. Working with the BDC has given us access to processing expertise and advanced equipment we would not have been able to find elsewhere.  

Citrefine

**BioElements**  
**Established in: 2013**  
**Location: York, UK**  
**Activity: Production of bacterial products for agriculture**

BioElements are a manufacturer of natural products that stimulate plant development in commercially grown crops. They are a knowledge-based, research-intensive business that has the capacity to expand to new markets, strengthen the region's reputation for novel agricultural products, and help tackle the issue of food scarcity.

The BDC was approached to provide rigorous scientific analysis to evaluate whether the product delivered on its promise to improve crop yield and vigour in a continuous cropping system. So, we evaluated the potential germination and seedling performance of wheat with and without this innovative treatment in soil sampled from different locations.

Our research revealed that the BioElements product had a significant impact on germination and the early stages of seedling growth: the product positively stimulated shoot growth of the selected wheat variety in the different soil samples.

BioElements are now exploring opportunities for taking this a step further to full field trials. If successful, this product is expected to reduce the cost and environmental stresses associated with continuous crop growth, so contributing to food security.

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**Company: BioElements**  
**Established in: 2013**  
**Location: York, UK**  
**Activity: Production of bacterial products for agriculture**

**Growth trials for crop stimulants**

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**Location: York, UK**  
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NibNibs is an award-winning baker of premium quality ‘nibbles’ produced using locally-sourced ingredients. They supply more than 300 outlets in the UK and recently begun exporting into Europe. Their ambitious vision is to grow the company while maintaining their artisan quality.

In order to increase the locally-sourced ingredients in their breadsticks, NibNibs has been trialling rapeseed oil as a Yorkshire-grown alternative to the Mediterranean-grown olive oil. This trial presented some issues with shortened product shelf-life, causing a suspension in production and potential losses to the business.

The BDC was able to help with analysis of the oils used and in this we identified the olive oil is far more stable than the premium rapeseed oil, which oxidises more readily in the baking process.

This led to a search for new sources of rapeseed oil which are stabilised through the use of natural antioxidants, like rosemary.

NibNibs is now in the process of re-testing their breadsticks with new sources of rapeseed oil with natural antioxidants, so that they can, in time, maintain the local credentials of their products, while also maintaining the shelf-life.
What our clients say

Making sure that our clients have a great experience working with us is crucial. Building on our clients’ feedback we are constantly evolving and improving our services to reflect this.

In a 2014 independent survey we asked our clients about their experience of working with us.

We like to think these results reflect our core work to help businesses access technologies and de-risk their innovation process. We are pleased to be supporting the bioeconomy in this way and all the more determined to increase our capabilities to continue to help develop sustainable plants, processes and products.

We would not have progressed with innovation products
Progress in our new area of work on biofuel and renewable chemicals would have been very much slowed
They clearly understood our requirements from the very first meeting
“We could not have hoped for a better service”
We would not have developed and entered the biomass fuel supply business

What would have happened without BDC support?

The project would have carried a very high level of risk
Increased costs and reduced opportunities in the specific market
The specific projects would have been put on hold and therefore negatively impacted on the development of the business
“A technically proficient helpful team with promoting your business in mind. What more could a business ask for?”
Very helpful professional team with real commitment and enthusiasm for projects and helping businesses reach their potential
BDC staff couple technical expertise with enthusiasm to help growing SMEs
“We would have discontinued the product line”
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How did you find working with the BDC?

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93.5% of our clients have said they would recommend us
80% said they would access any future BDC support packages
55% have already passed us on to others
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The future

If the UK bioeconomy is to achieve its full potential – and lead the transition to a low carbon economy – it will need easy access to the research capabilities of the nation’s universities.

As demonstrated throughout this report, the BDC, in close collaboration with the University of York, is ideally placed to deliver that support and access, and we were thrilled that our efforts were recognised in 2014 through the UK Science Park Association 30th Anniversary Award for Innovation Partnership.

Beyond our own work, we are excited to be instrumental in the BioVale initiative, which could add over £1 billion in additional direct GVA and generate around 28,000 new jobs to the regional economy by 2025.

With 10% of the UK bioeconomy in Yorkshire and the Humber – which represents only 6% of UK landmass – and the great reception our efforts have had since our launch two years ago, we are certain that the businesses, scientists and resources in our region will pull together to put Yorkshire on the map as leaders in the innovative transition to a low carbon economy.

BDC’s SME goals to reach by June 2015

- Support 190 companies across the Yorkshire and Humber region
- Result in £14 m growth in regional GVA
- Support 19 innovative new start-up companies
- Support 172 new jobs and a further 45 protected

The transition from a dependence on fossil fuels to the full use of renewable raw materials can only be achieved if science, industry, governments and civil society work together constructively and effectively.

The European bioeconomy in 2023: Delivering Sustainable Growth by Addressing the Grand Societal Challenges.

References
