UK public research investment underpinning the Bioeconomy 2012/13

An indicative high-level analysis

Prepared by BBSRC for the Chairs of the Agri-tech, Industrial Biotechnology and Synthetic Biology Leadership Councils
Headline messages

• Public funders spent around £610M on research underpinning the Bioeconomy in 2012/13, predominantly (84%) through the Research Councils and Innovate UK

• MRC (£203M) and BBSRC (£194M) were the main public funders, followed by DEFRA (£51M) and Scottish Government (£38M)

• Health (£265M) and Food (£162M) were the themes with the largest associated underpinning public sector bioeconomy research, together accounting for 70% of all investment

• BBSRC was the largest investor in research underpinning the food (47%), chemicals & materials (46%), energy (62%) and enabling technologies (54%) sectors

• Of the larger non-governmental funders, BBSRC, EPSRC, STFC and Innovate UK had the greatest diversity of investment across Bioeconomy themes

Note: this high-level analysis should be taken as indicative only
Background

On behalf of the chairs of the three Bioscience-associated Leadership Councils (Agri-tech, Industrial Biotechnology and Synthetic Biology), BBSRC has coordinated the collection and analysis of data from public sector funders outlining their support for research underpinning the Bioeconomy.

Through a snap-shot of funded research and training over the financial year 2012/13, this analysis provides a high-level map of the bioeconomy public sector research landscape.

The analysis is categorised according to bioeconomy themes identified by the three Bioscience-associated Leadership Councils. This does not effectively capture the interconnected nature of the bioeconomy, but provides a high-level indication of research areas.

Note: this high-level analysis should be taken as indicative only
Definitions

The analysis is based on the Leadership Council Chairs’ definition of the Bioeconomy:

“All economic activity derived from bio-based products and processes which contributes to sustainable and resource-efficient solutions to the challenges we face in food, chemicals, materials, energy production, health and environmental protection.”

Research investment is classified according to the following themes:

- Food (including agricultural research)
- Chemicals and materials
- Energy Production
- Health (human)
- Environmental Protection
- Enabling Technologies
- Understanding successful Bioeconomies (Social)

The multi-disciplinary nature of research means that investments may contribute to more than one theme.

In the overall and funder analyses, grant values are divided by theme number to avoid double counting.

In the Bioeconomy theme analysis, full grant values are counted under every theme to fully capture investment.

Note: this high-level analysis should be taken as indicative only
Public funders

Data from the following funders are included in this analysis:

- BBSRC
- MRC
- EPSRC
- NERC
- Science & Technology Facilities Council
- Arts & Humanities Research Council
- ESRC
- Innovate UK
- Department for Environment Food & Rural Affairs
- Food Standards Agency
- Department of Energy & Climate Change
- Northern Ireland Executive
- The Scottish Government

No data were received from Welsh Government, Department of Health & Department of Transport
NI response from Department of Agriculture and Rural Development (DARD) only

Note: this high-level analysis should be taken as indicative only
Main Caveats

Data analysis

- Selection and categorisation of investment by bioeconomy theme was completed by each funder and has not been systematically harmonised.
- In the overall and funder analyses, grant values are divided across relevant themes (an approximation to avoid double counting). In the bioeconomy theme analysis, full grant values are counted under every theme to effectively capture investment (resulting in double counting across bioeconomy themes).

Exclusions

- The analysis does not include capital spend.
- Further funding and expertise is leveraged through international collaboration.
- Some significant investments are missed by the FY 2012/13 analysis window. These include:
  - Synthetic Biology for Growth Programme (£101M: RCUK capital, BBSRC, EPSRC & MRC)
  - Innovation and Knowledge Centre for Synthetic Biology (£10M: BBSRC, EPSRC & Innovate UK)
  - Industrial Biotechnology Catalyst (£41.5M: BBSRC, EPSRC and Innovate UK), Networks in Industrial Biotechnology and Bioenergy (£17M: BBSRC) and other significant BBSRC investment in Bioenergy and Industrial Biotechnology
  - Investment in later years by Department for Transport and STFC

Note: this high-level analysis should be taken as indicative only
Overall investment

Total investment by public funders in research underpinning the Bioeconomy

<table>
<thead>
<tr>
<th>Funder</th>
<th>Investment (£M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRC</td>
<td>202.8</td>
</tr>
<tr>
<td>BBSRC</td>
<td>193.5</td>
</tr>
<tr>
<td>DEFRA</td>
<td>51.0</td>
</tr>
<tr>
<td>Scottish Government</td>
<td>37.7</td>
</tr>
<tr>
<td>STFC</td>
<td>29.1</td>
</tr>
<tr>
<td>NERC</td>
<td>27.0</td>
</tr>
<tr>
<td>EPSRC</td>
<td>25.9</td>
</tr>
<tr>
<td>ESRC</td>
<td>19.5</td>
</tr>
<tr>
<td>Innovate UK</td>
<td>12.6</td>
</tr>
<tr>
<td>FSA</td>
<td>7.6</td>
</tr>
<tr>
<td>AHRC</td>
<td>1.5</td>
</tr>
<tr>
<td>DARD</td>
<td>1.4</td>
</tr>
<tr>
<td>DECC</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>610</strong></td>
</tr>
</tbody>
</table>

*Source: BIS allocation of science and research funding 2011/12 to 2014/15

Note: this high-level analysis should be taken as indicative only
Overall investment by public funders: Commentary

- Public funders spent around £610M on research underpinning the Bioeconomy in 2012/13
- MRC (£203M) and BBSRC (£194M) were the main public funders, followed by DEFRA (£51M) and Scottish Government (£38M)
- The Research Councils and Innovate UK collectively spent £512M
- Government Departments and Devolved Administrations spent collectively £98M

Note: this high-level analysis should be taken as indicative only
Overall investment in Bioeconomy themes

Total investment by public funders in research underpinning seven Bioeconomy themes

<table>
<thead>
<tr>
<th>Bioeconomy Theme</th>
<th>Investment (£M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>264.7</td>
</tr>
<tr>
<td>Food</td>
<td>162.4</td>
</tr>
<tr>
<td>Enabling technologies</td>
<td>91.1</td>
</tr>
<tr>
<td>Environmental protection</td>
<td>55.6</td>
</tr>
<tr>
<td>Chemicals &amp; Materials</td>
<td>21.1</td>
</tr>
<tr>
<td>Energy</td>
<td>11.9</td>
</tr>
<tr>
<td>Social</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>610</strong></td>
</tr>
</tbody>
</table>

Where an investment is classified into more than one theme, grant values are divided across relevant themes.

Note: this high-level analysis should be taken as indicative only
Overall investment in bioeconomy themes: commentary

- *Health* (£265M) and *Food* (£162M) were the themes with the largest associated underpinning public sector bioeconomy research, together accounting for 70% of all investment.

- The *Environmental Protection* (£56M) and *Enabling Technologies* (£91M) themes together account for 24% of investment.

- The remaining 6% of investment is shared between the *Chemicals & Materials* (£21M), *Energy* (£12M) and *Understanding Successful Bioeconomies* (£3M) themes.

- There has been significant additional investment in the *Chemicals & Materials* and *Energy* themes since 2012/13.

*Note: this high-level analysis should be taken as indicative only.*
Funder analysis: Research Councils & Innovate UK

MRC (total £202.8M)

- Food: 79%
- Chem & Mat: 11%
- Energy: 10%

BBSRC (total £193.5M)

- Food: 26%
- Chem & Mat: 37%
- Energy: 4%

NERC (total £27.0M)

- Food: 69%
- Chem & Mat: 23%
- Energy: 3%

EPSRC (total £25.9M)

- Food: 41%
- Chem & Mat: 28%
- Energy: 17%

ESRC (total £19.5M)

- Food: 86%
- Chem & Mat: 3%
- Energy: 2%

AHRC (total £1.5M)

- Food: 17%
- Chem & Mat: 7%
- Energy: 5%

STFC (total £29.1M)

- Food: 47%
- Chem & Mat: 32%
- Energy: 16%

Innovate UK (total £12.6M)

- Food: 54%
- Chem & Mat: 10%
- Energy: 3%

Where an investment is classified into more than one theme, grant values are divided across relevant themes.

Note: this high-level analysis should be taken as indicative only.
Funder analysis: Government Depts & Devolved Admins

DEFRA (total £51.0M)

DECC (total £0.6M)

FSA (total £7.6M)

Scot Gov (total £37.7M)

DARD (total £1.4M)

Note: this high-level analysis should be taken as indicative only

Where an investment is classified into more than one theme, grant values are divided across relevant themes.
Funder analysis: Commentary

• Of the larger non-governmental funders, BBSRC, EPSRC, STFC and Innovate UK had the greatest diversity of investment across Bioeconomy themes. BBSRC (37%) and Innovate UK (54%) invested most heavily in research underpinning the food sector; STFC in enabling technologies (47%) and EPSRC in health (41%)

• MRC (79%) and ESRC’s (86%) investment was heavily weighted towards research underpinning the health sector; NERC’s was weighted toward research underpinning environmental protection (69%).

• DEFRA (65%) FSA (69%), Scottish (65%) and NI* (71%) Governments invested most heavily in research underpinning the food sector.

• DECC’s investment was split between research underpinning the energy (53%) and environmental protection (47%) sectors. DEFRA also invested substantially in research underpinning environmental protection (25%)

*NI data return from DARD only. Other relevant investment may be made by other departments

Note: this high-level analysis should be taken as indicative only
Bioeconomy theme analysis 1

Full grant values are counted under every assigned theme (i.e. double counted) to effectively capture investment. Total investment values are therefore larger than those in slide 9 (where grant values were split)

Note: this high-level analysis should be taken as indicative only
Bioeconomy theme analysis 2

Environmental protection (total £90.3M)
Enabling technologies (total £126.6M)
Social (total £6.9M)

Full grant values are counted under every assigned theme (i.e. double counted) to effectively capture investment. Total investment values are therefore larger than those in slide 9 (where grant values were split)

Note: this high-level analysis should be taken as indicative only
Bioeconomy theme analysis

Commentary

- BBSRC was the largest investor in research underpinning the *food* (47%), *chemicals & materials* (46%), *energy* (62%) and *enabling technologies* (54%) themes.

- The *food* sector also received substantial underpinning research investment from DEFRA (19%), MRC (12%) and the Scottish Government (12%).

- MRC was the largest investor in research underpinning the *health* sector (63%), with 21% investment from BBSRC.

- BBSRC, EPSRC and STFC together made the majority of investment in research underpinning the *chemicals & materials* (96%) sector. BBSRC and EPSRC together accounted for 88% of research underpinning the *energy* sector.

- Investment in research underpinning *Environmental protection* was relatively mixed, with substantial investment from DEFRA (26%), BBSRC (32%), NERC (24%) and the Scottish Government (13%).

- The largest investors in research for *understanding successful bioeconomies* were ESRC (38%), FSA (33%), and NERC (24%).

*Note:* this high-level analysis should be taken as indicative only.
## Definition detail

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong></td>
<td>Research contributing to the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the challenges we face in providing sufficient, affordable healthy and safe food. Including agricultural (animal and plant) research</td>
</tr>
<tr>
<td><strong>Chemicals and Materials</strong></td>
<td>Research contributing to the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the challenges we face in producing chemicals and materials</td>
</tr>
<tr>
<td><strong>Energy Production</strong></td>
<td>Research contributing to the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the challenges we face in producing energy and energy carriers</td>
</tr>
<tr>
<td><strong>Health</strong></td>
<td>Research contributing to the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the challenges we face in maintaining health across the human and companion animal lifecourse</td>
</tr>
<tr>
<td><strong>Environmental Protection</strong></td>
<td>Research contributing to the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the challenges we face in environmental protection</td>
</tr>
<tr>
<td><strong>Enabling technologies</strong></td>
<td>Development of technologies which will aid the development and refinement of bio-based products and processes which contribute to sustainable and resource-efficient solutions to the grand challenges outlined above</td>
</tr>
<tr>
<td><strong>Understanding successful bioeconomies</strong></td>
<td>Economic, social and policy-focussed research which seeks to understand the challenges and opportunities associated with bioeconomies</td>
</tr>
</tbody>
</table>

**Note:** this high-level analysis should be taken as indicative only
Funder notes: AHRC

Key Role in relation to the Bioeconomy
• Offering overarching contributions to legal and ethical considerations, community engagement and participatory approaches, cultural and historical perspectives, design-based interventions, technological developments for the arts sector with transferability to the bioeconomy, applications of bio-based products and processes in the creative economy, and an integrated interdisciplinary approach to archaeology and heritage science which helps support a successful bioeconomy.
• Across the themes, looking at expenditure in 2012/13, the three key themes were: Enabling technologies (37%), Environmental protection (32%) and Understanding successful bioeconomies (17%).

Key Projects
• PARNASSUS: Ensuring integrity, preserving significance: value based flood resilience for protection of cultural heritage from climate change impact (University of Bath)
• The Next Generation of Optical Coherence Tomography (OCT) for Art Conservation - in situ non-invasive imaging of subsurface microstructure of objects (Nottingham Trent University)
• Laser Enhanced Biotechnology for Textile Design (De Montfort University)

Selected relevant investments since 2012/13
• AHRC’s Science in Culture Theme e.g. understanding epigenetics within 21st century culture, research on the ‘Lived Environment’, exploring new ways of raising awareness and promoting soil health, research relating to flavour and taste, and interdisciplinary studies of skincare products.
• Involvement in the NERC-led Droughts and Water Scarcity programme exploring historic drought and water scarcity (Lancaster University) and drought risk management (Loughborough University).
• Other projects include: Comparing ways of valuing and managing biological and cultural diversity in indigenous landscape management, seed banks, herbaria and frozen zoos (UCL); exploring soil-oriented approach to monitoring and modelling soil based processes that may affect cultural preservation (University of Stirling); research on tree health and the structure of rural tree populations in England c.1550-2015 (University of East Anglia; co-funded with DEFRA); regulation and law of human enhancement technologies (University of Oxford); new approaches to nature conservation law (University of Dundee); Archaeological evidence of sustainable farming practices (The British Museum).
BBSRC invests in world-class bioscience research, innovation and training which underpins sectors across the bioeconomy - reflected in the diversity of BBSRC’s investment across analysis themes.

The investment included in this analysis is underpinned and enabled by frontier bioscience research, capital investment and partnership working across BBSRC’s remit. Significant further investments, particularly in synthetic biology, bioenergy and industrial biotechnology have been made since 2012/13.

BBSRC was the largest investor in enabling technologies and research underpinning the food, chemicals and materials and energy themes. Significant investments were made underpinning the health and environmental protection themes.

BBSRC’s commitment to building the bioeconomy is focused on five themes:
• Driving bioscience discovery and innovation
• Building a more resilient and secure future
• Transforming and creating bio-based businesses
• Developing and attracting talent
• Securing the UK as the global partner of choice

By investing in the science that drives the bioeconomy, BBSRC is contributing to UK economic growth, improving existing industries and creating new, more sustainable products and services.
The UK has set an ambitious legally binding target in the 2008 Climate Change Act to reduce our emissions of greenhouse gases by 80% from 1990 to 2050. We have also a clear pathway towards decarbonisation in the period to 2028 set by the Climate Change Acts carbon budgets and the Government in 2016 will set the level of the 5th carbon budget for the period 2028-2032. There are also stretching targets for 2020 for the share that renewable energy provides for transport, electricity and heat set by the Renewable Energy Directive.

In Financial Year 2012/13, DECC had a small research programme on bioenergy and – although not included in this analysis of research investment – bought consultancy and market intelligence to assist with the development of policy. However, significant support to the development of the sector was provided by;

- a targeted programme of Innovation to bring forward to the market promising ideas which has included support to bioenergy projects,
- payments for small generators under the Feed in Tariff which have pulled forward the development of the anaerobic digestion industry, along with other renewable energy sources.
- the Renewable Obligation which has encouraged a range of renewable energy technologies to develop and mature including advanced conversion technologies.
- the world’s first Renewable Heat Incentive which has delivered substantial innovation and cost reduction in the delivery of biomass heat in Great Britain.

These measures have led to a dramatic increase in the deployment of renewable energy technologies, including a substantial growth in the use of bioenergy.
**Funder notes: DEFRA**

**Key Role in relation to the Bioeconomy**
- Defra’s investment in bioeconomy research (51M) includes agriculture, food, plant and animal health (12/13 figures) with investment spread across these areas
- Evidence and research is delivered in partnership with industry, research councils, Innovate UK BIS Defra network; EU and international partners

**Key Projects and investments**
- **Agri-Food**: £4.5M Sustainable Intensification Platform, 11M GHG Platform; Agri-tech Strategy (£160M BIS/DFID funded); Sustainable Agriculture and Food Innovation Platform (£90M); Greenhouse Gas Research Alliance (international)

- **Plant & Bee Health**: £10m (£2.5m from Defra) Insect Pollinator Initiative, co-funded with BBSRC, NERC, Scottish Government and Wellcome Trust; Future Proofing Plant Health – interdisciplinary research on prevention and management of plant pests and diseases, transnational research funded with EUPHRESCO network on shared areas of interest

- **Animal health**: prevention and control of animal diseases, mitigating against known and new and emerging threats/issues. addressing cross-cutting issues e.g. Antimicrobial resistance/improved vaccines; international collaboration (with other funding organisations) to address common issues.

- Investment to support policy to enable the bioeconomy
Funder notes: EPSRC

Key Role in relation to the Bioeconomy

- EPSRC has developed a significant portfolio underpinning the bioeconomy, with the area especially relevant to a number of themes across EPSRC (e.g. Manufacturing, Physical Sciences, Energy, Engineering).

Key Investments since 2012/13

- **EPSRCs CDT call supported a variety of doctoral training centres that feed the bioeconomy skills pipeline:**
  - Seven centres have been highlighted with significant relevance (e.g. Physical Sciences innovation in Chemical Biology for Bioindustry and Healthcare - Imperial), with investment in these totalling ca. £34.5m. Specific CDTs include co-funding from other RCs

- **RCUK Energy: Bioenergy is one of the core renewable generation technologies, investments of interest include:**
  - Supergen Bioenergy Hub which aims to connect Industry, Academia & other Stakeholders (Supergen Bioenergy Challenge II was issued in March 2014)
  - EPSRC Energy also work closely with BBSRC and NERC on projects (e.g. BioProNET project)

- **Manufacturing Technologies have provided significant investment in related areas:**
  - Calls in ‘Materials Substitution’; ‘Energy Resilient Manufacturing’; ‘Sustainable Chemical Feedstocks’ have invested in 13 grants totalling £19.25m
  - Co-funding with IUK connecting to Bioeconomy ca. £270k; EPSRC has provided co-funding to the IB Catalyst (£11.2m) working in collaboration with BBSRC

- **Engineering support a series of investments particularly across Synthetic Biology and Process Engineering**
  - EPSRC co-funded the SBRCs under the RCUK Synthetic Biology for growth initiative led by BBSRC, plus resource for the centres of £20m
  - Frontier Engineering awards at Newcastle, Imperial and Glasgow (ca. £16m); Synthetic Biology IKC (£10m) co-funded by BBSRC and IUK; Flowers consortium for Synthetic Biology platform technologies (£5m)
  - EPSRC leadership fellows: Newcastle & Edinburgh & Fellowships for Growth: Imperial & Oxford ca. £5.5m
Funder notes: ESRC

Key Role in relation to the Bioeconomy

- ESRC’s total investment in bioeconomy research in FY 2012/13 was £19.5M
- This is heavily weighted towards the ‘Health’ (86%) theme
- Of all themes, ESRC provides the highest contribution in the ‘Understanding successful Bioeconomies’ (38%) theme

Key Projects - Health

- Centre for social and economic research on Innovation in Genomics and life sciences – Innogen
- Centre for study of life sciences – Egenis
- Centre for Economics and Social Aspects of Genomics – Cesagen

Key Projects - Understanding successful Bioeconomies

- ESRC Centre for Social, Technological and Environmental Pathways to Sustainability
- Social and Environmental Economic Research (SEER) into Multi-Objective Land Use Decision Making and Pathway
- ESRC National Centre for Research Methods Node

Although investments were selected with respect to best fit for each theme definition, definitions have been interpreted to credit deeper social and economic implications.
The FSA funded work included in this analysis relates to provision of evidence intended to ultimately underpin consumer confidence in the safety and integrity of the foodchain, which is an important factor in supporting a thriving bioeconomy.
Funder notes: **Innovate UK**

**Key Role in relation to the Bioeconomy**

- Agrifood, Bioscience, Energy, Industrial Biotechnology and Health+Care strategic programmes
- Responsive Innovation Voucher, Smart and KTP programmes open to Bioeconomy projects
- Bioeconomy supply chain support provided through Enabling Technologies, Digital, Transport, Space and Emerging Industries Teams

**Key investments since 2012/13**

- AgriTech Catalyst
- Industrial Biotechnology Catalyst
- Biomedical Catalyst
- Energy Catalyst
- Synthetic Biology Investment Portfolio
- Cell Therapy Catapult
- Biologics Centre (as part of the High Value Manufacturing Catapult)
- Medical Technologies Catapult
- AgriTech Centres
- Precision Medicine Catapult
Funder notes: MRC

Key Role in relation to the Bioeconomy

- To work in partnership to speed up the exploitation of the best ideas in medical science, from fundamental discovery science to innovative, preventative and therapeutic interventions with the aim of tackling the health challenges of the 21st century and encouraging inward investment that drives sustainable growth.
- The MRC’s total investment in this area in FY 2012/13 was £203M across three themes, Health, Food and Enabling Technology, with overlaps in the portfolios across all three areas.
- The MRC had major investments in Health (£160M) and Food (£22M), the themes with the largest associated underpinning public sector bioeconomy research.
- MRC funding for food related research is focused on the effect of diet and nutrition on health, rather than the direct development of food-related products or food-processing research.

Key investments

- The Wellcome Trust - Medical Research Council Cambridge Stem Cell Institute - an international centre of excellence for research into stem cell biology and medicine.
- MRC Centre for Drug Safety Science, Liverpool - brings together a critical mass of knowledge and technologies in order to advance understanding of Adverse Drug Reactions.
- MRC-NIHR Phenome Centre, Imperial College London - a world leading high-throughput metabolic phenotyping centre for human population disease-risk biomarker discovery and response to treatment.
Funder notes: NERC

Key Role in relation to the Bioeconomy

- NERC’s total investment in bioeconomy research in FY 2012/13 was £27M
- This was weighted towards the Environmental Protection theme (69%)

Since 2012/13 NERC has invested or pledged investment in the following areas:

Environmental Protection

- Valuing Nature: £7m+, 5 year interdisciplinary research programme co-funded by ESRC, AHRC, BBSRC and Defra.
- UPGro: £12m over 7 years
- UK Droughts & Water Scarcity: £12M over 5 years, co-funded by BBSRC, EPSRC, ESRC and AHRC.
- Future Climate for Africa: £20M over 5 years, co-funded by DfID
- Science for Humanitarian Emergencies & Resilience: £19M over 5 years, co-funded by ESRC and DfID
- Probability, Uncertainty & Risk in the Environment: £6.8M over 4 years
- Security of Supply of Mineral Resources: £8M over 7 years, co-funded by EPSRC
- Environmental Microbiology & Human Health: £5.15M over 4 years, co-funded by Dstl and FSA
- Flooding from Intense Rainfall: £5.2M over 5 years
- Drivers of Variability in Atmospheric Circulation: £2.5M over 4 years
- Drivers of Variability in the South Asian Monsoon: £3M over 4 years
Funder notes: NERC continued

Energy Production
• £2.67M on biofuel related projects
• £ 3.39M on biomass related projects

Chemical and materials
• Resource Recovery from Waste: £7.3M over 5 years

Food
• Soil Security research programme: £8M over 5 years, co-funded by BBSRC, Defra and Scottish Government
• Sustainable Agriculture Research and Innovation Club: £10M over 3 years, co-funded by BBSRC
• Sustainable Aquaculture capacity-building research call: £6M (co-funded by BBSRC, Cefas and Marine Scotland Science). Further funding to be announced in 2016
• Sustaining Water Resources for Food, Energy & Ecosystem Services (SWR): £3M over 4 years, co-funded by the Ministry of Earth Sciences, India
• Using Critical Zone Science to Understand Sustaining the Ecosystem Service of Soil & Water (CZO): £3M over 3 years, co-funded by the National Natural Science Foundation of China
Funder notes: STFC

Key Role in relation to the Bioeconomy

- STFC’s total investment in bioeconomy research in FY 2012/13 was £29.1M
- The vast majority of STFC’s investment is through the provision of large experimental facilities (ISIS Neutron and Muon Source, Central Laser Facility and Diamond Light Source) to the research community, who work collaboratively on projects with our facility scientists
- The majority of this investment falls within the ‘Enabling Technologies’ (47%) and ‘Health’ (32%) themes

Example projects in Health and Enabling Technologies

- An accurate *in vitro* model of the e. coli envelope for a deeper understanding of this barrier to antibiotic function to enable the design of new drugs to combat antimicrobial resistance (ISIS)
- Studying viruses to build up a bigger picture of virus family groups, to design novel vaccines and small molecule drugs that provide better treatment against a range of viruses including polio, influenza and HIV (Diamond Light Source)
- Study of the wheat seed defence protein puroindoline-a, which has a broad spectrum of antifungal and antibacterial activity with potential applications such as novel antibiotics or targeted drug delivery systems (ISIS)
- Developing new approaches to drug discovery by analysing how potential drugs bind to protein targets at the molecular level (Diamond Light Source)
- Understanding how airborne pharmaceutical particles, expelled by medical inhalers, behave with increasing humidity and temperature conditions to improve drug delivery for respiratory problems (Central Laser Facility)