Visit to The University of Strathclyde, 4-5th June 2015

EPSRC Physical Sciences

EPSRC
Investing in research for discovery and innovation

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Presentation Overview

EPSRC introduction:

- Strategy & current position

Physical Sciences Theme:

- Top level strategy
- Portfolio statistics
- Research and training funding schemes
- Current areas of focus (Advanced Materials, Analytical Science review, Formulation Science, Grand Challenges, Technology Touching Life etc.)

Wider EPSRC approach:

- Impact and Pathways to Impact
- Responsible Innovation
- Public Engagement
- Diversity
- International working
- Building Leadership
- Capital, Equipment and Facilities

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EPSRC Overview

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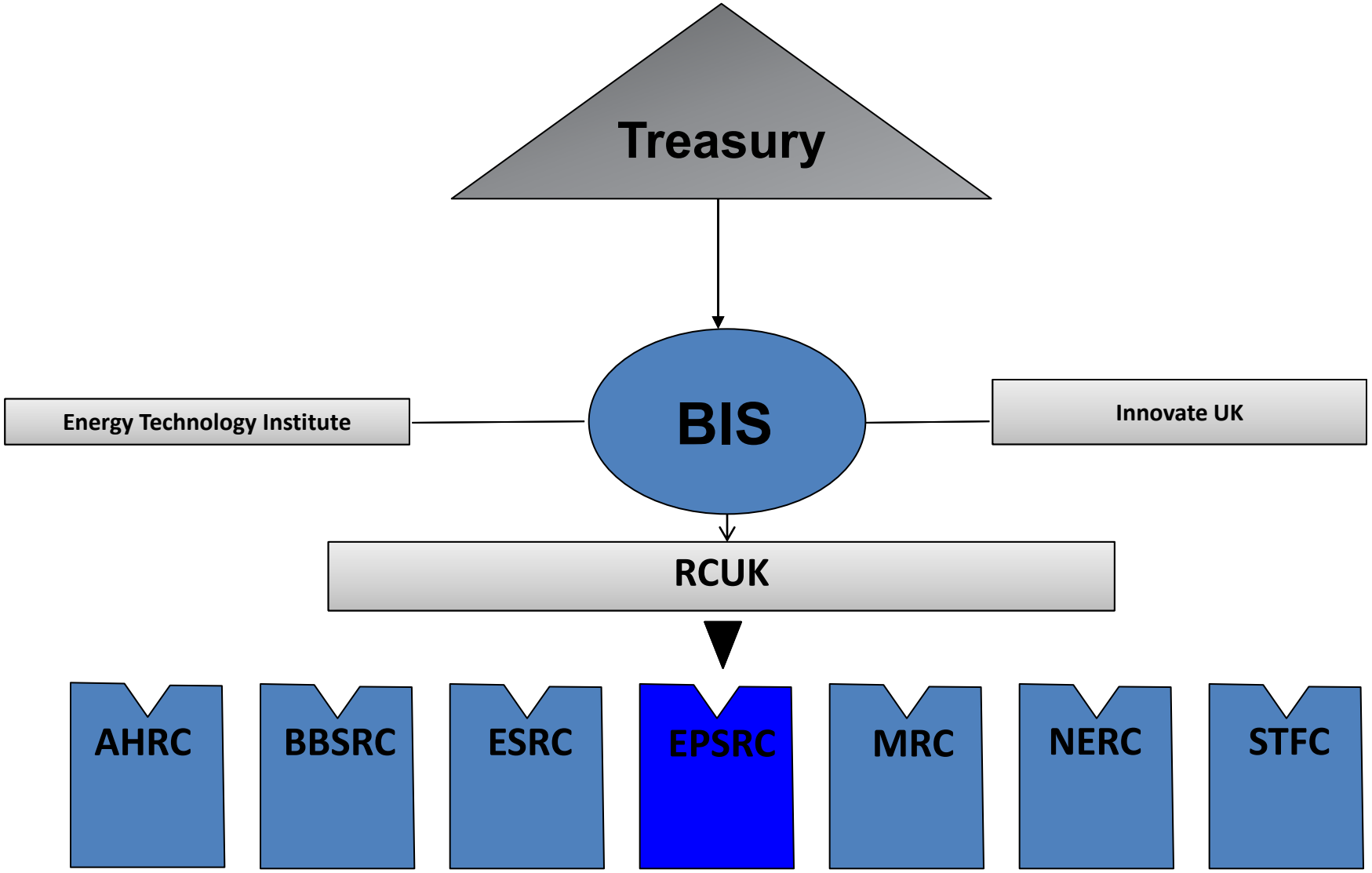

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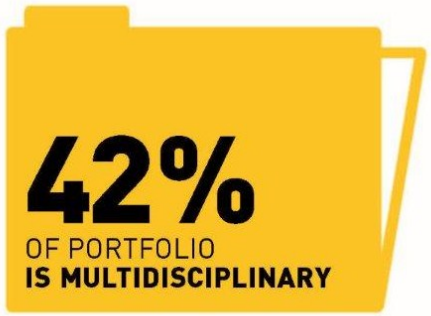
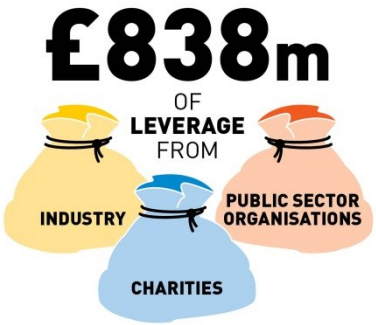
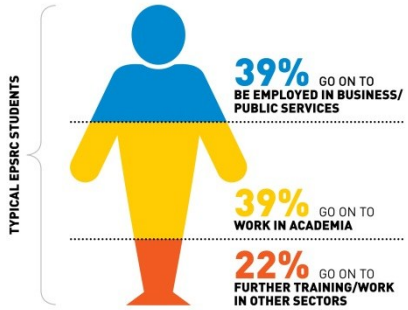
KEY FACTS







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The Global Landscape

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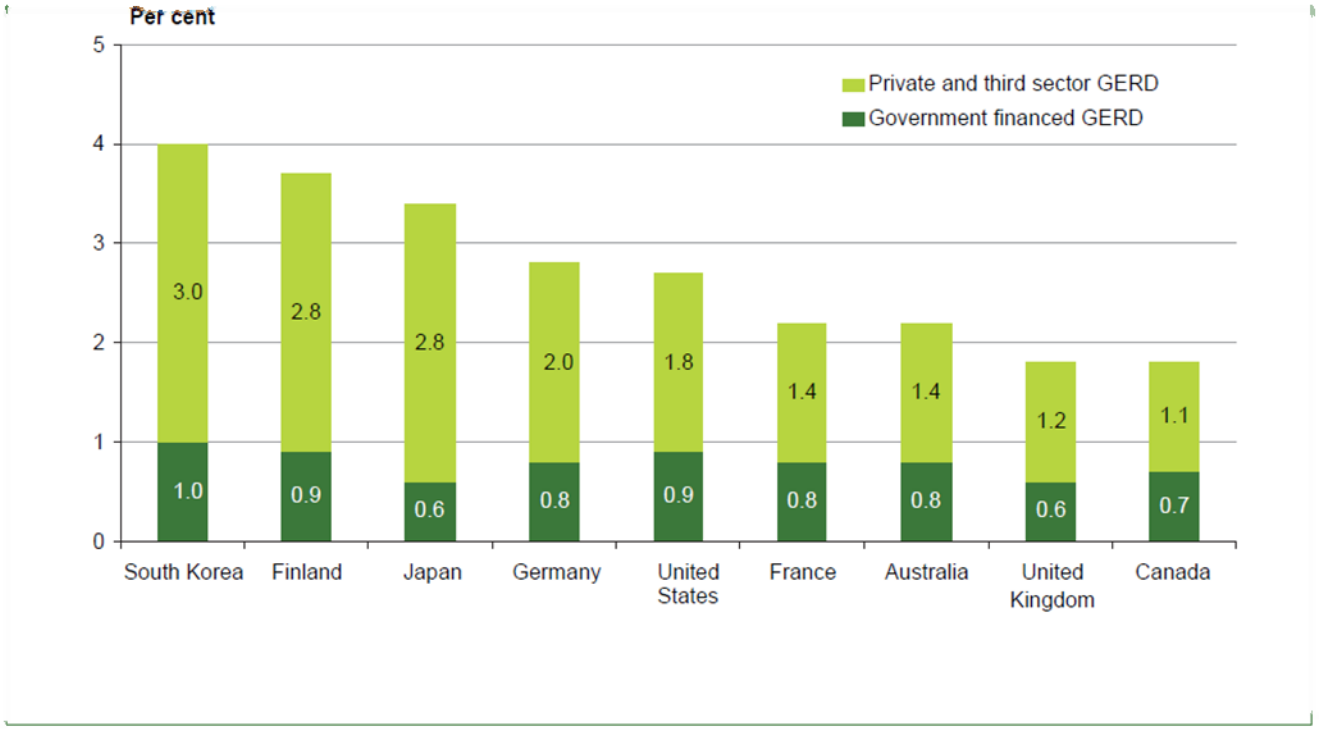
Gross Expenditure on R&D Worldwide

Total Gross Expenditure on Research and Development (GERD) as % of GDP in 2011



Note: ** Private and third sector GERD = Total R&D expenditure (GERD) minus government financed GERD*
Source: *OECD; BIS analysis*

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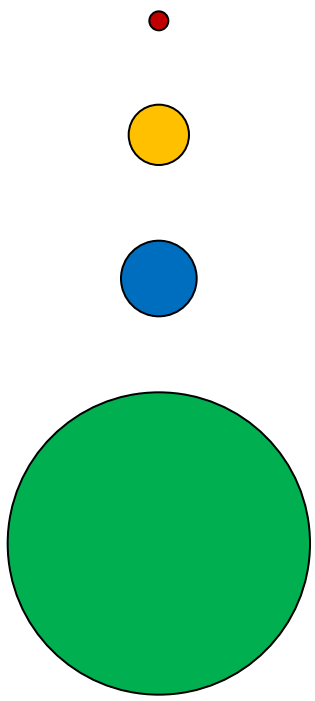
Performance of the UK research base

UK punches above its weight



0.9% of global population

3.2% of R&D expenditure

4.1% of researchers

15.9% of most highly-cited articles

Source: International Comparative Performance of the UK Research Base – 2013, Elsevier.

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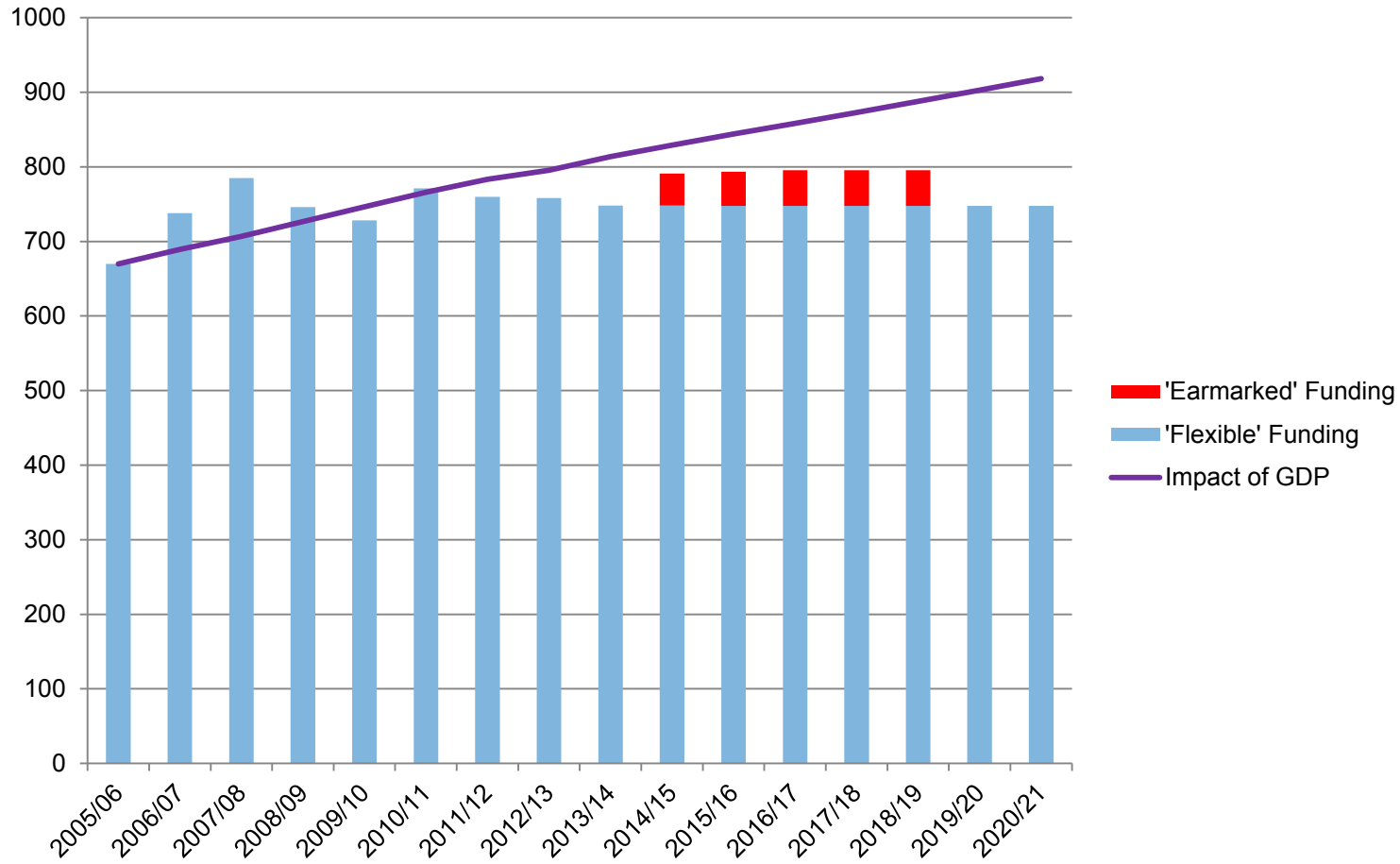
Resource Funding, showing Impact of GDP Inflation



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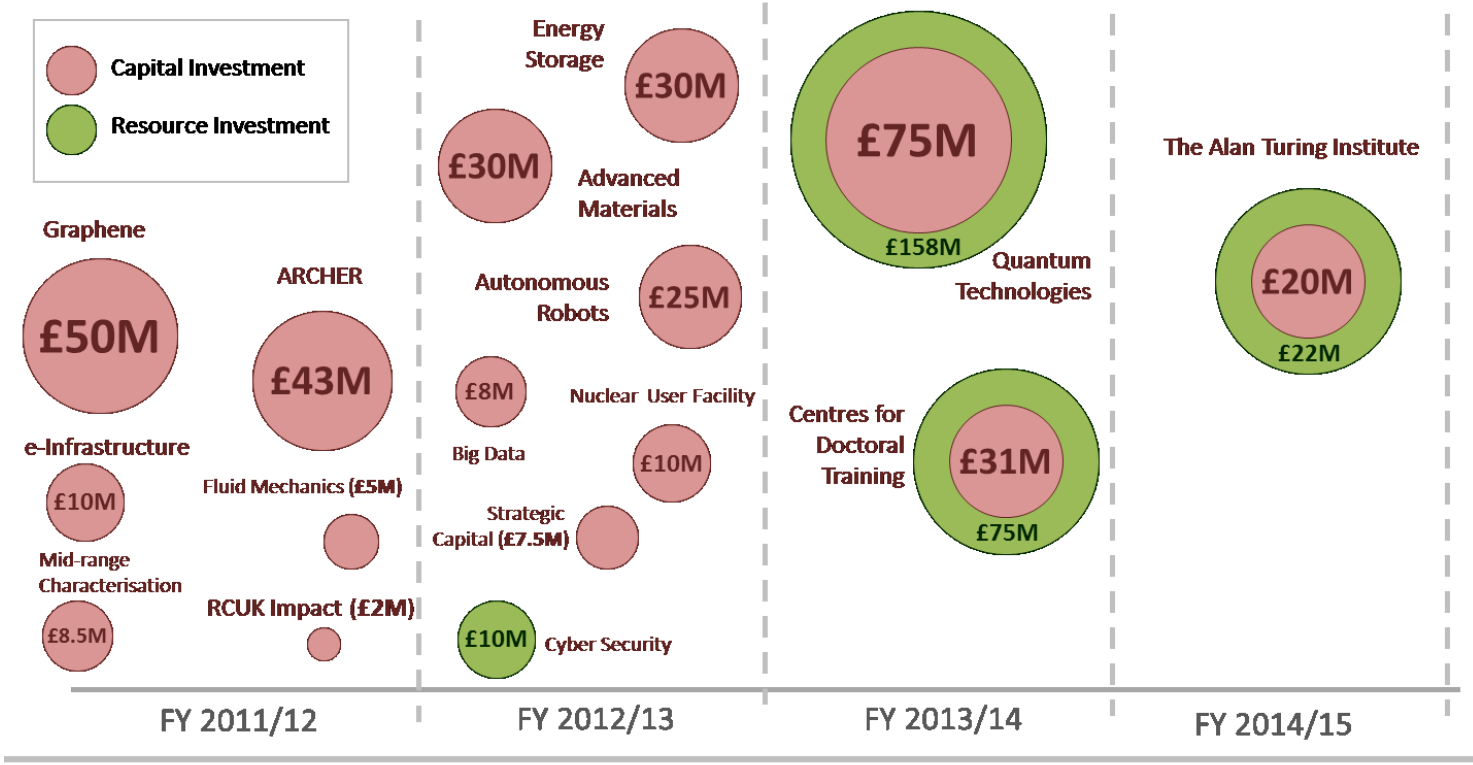
Extra Capital EPSRC has received

Additional EPSRC budget allocations from 2011



Allocation values represent announced budget from BIS. Actual spend against these projects cover more than one financial year.

Further capital investment under discussion

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EPSRC in 2015

- New conservative government priorities?
- New ministers:

Sajid Javid

Business Secretary

Jo Johnson

Minister for Universities and Science

What we know:

- "Emergency" budget 8th July 2015
- Focus on economic growth
- Focus on efficiency of public funds
- Comprehensive spending review commencing summer 2015

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EPSRC AS AN INVESTOR

EPSRC provides national and international leadership while working in close partnership with others

- UK universities – 33 Framework, Strategic and Corresponding University partnerships
- Industry – 19 Strategic Partnerships and over 2,800 collaborations
- Government Departments – BIS, DfT, DH, MoD
- Other Research Councils – Cross Council programmes
- Other Funding Agencies – Innovate UK
- Other Public Sector organisations – Science Museum, National Gallery

Innovate UK
Technology Strategy Board

CANCER RESEARCH UK

UNIVERSITY OF CAMBRIDGE

UNIVERSITY OF OXFORD

Rolls-Royce

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OUR STRATEGY

One vision

Our vision is for the UK to be the best place in the world to research innovate

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Two goals

RESEARCH and DISCOVER

For the UK to be positioned as an international research leader, where discovery thrives and our support generates the highest quality research in engineering and physical sciences

RESEARCH and INNOVATE

For the UK's excellent research base and talented researchers to work with us to accelerate innovation for the benefit of society and the economy

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Three Strategies

Balancing capability

To maintain the UK's reputation for excellence and keep it at the heart of global research and innovation

Building leadership

To nurture the next generation of skilled researchers and innovators and provide the knowledge and skills vital to a healthy, sustainable and prosperous society

Accelerating impact

To support more extensive and rapid exploitation of research outcomes

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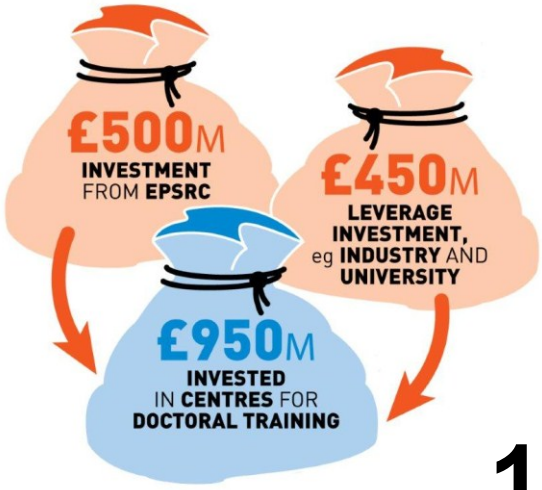
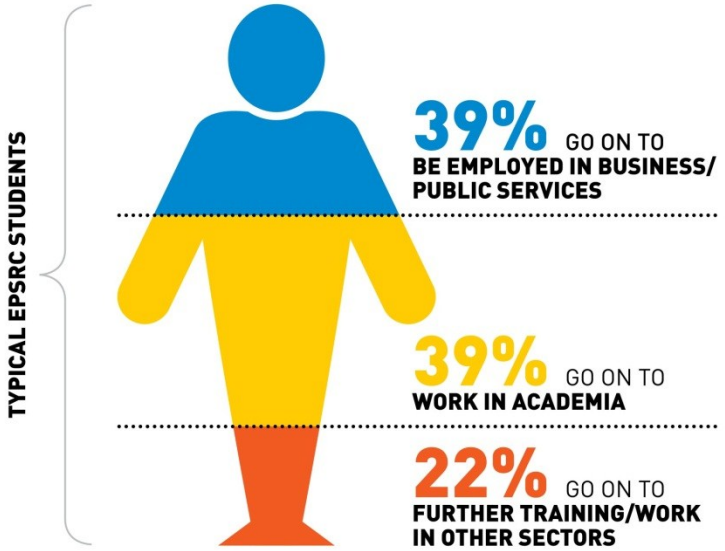
Building Leadership

5,500
RESEARCHERS SUPPORTED

9,000
DOCTORAL STUDENTS SUPPORTED





115
CENTRES FOR DOCTORAL TRAINING

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The Research Excellence Framework (REF)

For the first time, a detailed evaluation of the impact of UK research during the period 2008-2013*

- Across the exercise, over 250 research users judged the impacts, jointly with academic panel members
- Across the exercise, 44% of impacts were judged outstanding (4*) and a further 40% were judged very considerable (3*)
- Impressive impacts were found from research in all subjects
- REF shows many ways in which research has fuelled economic prosperity, influenced public policy and services, enhanced communities and civic society, enriched cultural life, improved health and wellbeing, and tackled environmental challenges

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*Higher Education Funding Council for England (HEFCE), REF Panel Chairs Briefing

Delivering excellence with impact

85% of case studies in EPS involved EPSRC funded research/researchers

£16 billion of cost savings in the public and private sectors

£1 billion of EPSRC funding coupled with a similar level of funding from government, EU and industry

£60 billion of economic activity

400 new businesses created, employing 50,000 people and contributing **£4 billion** to the economy in revenue

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EPS underpins growth and productivity

- The UK is **first** in the world in terms of productivity, **second** in the world in terms of research excellence and yet well behind in terms of R&D spend
- Maths research alone was worth over **£200 billion** to the UK economy in 2010
- Engineering is pervasive and highly dynamic, with engineering research underpinning almost every economic sector and contributing an estimated **£280 billion** in GVA to the UK economy in 2011
- Physics-based businesses account for more than one million jobs in the UK and contribute **£77 billion** to the UK economy directly (with high-value physics-based manufacturing accounting for 500,000 jobs and £20 billion).
- The UK's 'upstream' chemicals industry and downstream' chemistry-using sectors contributed a combined total of **£258 billion** in value-added in 2007, equivalent to **21% of UK GDP**, and supported over **6 million** UK jobs

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Physical Sciences Strategy

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PHYSICAL SCIENCES STRATEGY

PHYSICAL SCIENCES ENABLES THE ENABLERS

- Physical Sciences enables research and development across all of EPS, other RCs, industry and beyond
- Our key priority is ensuring that this enabling capability is maintained, balanced and fully integrated across EPSRC
- This is managed at three levels…….

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Theme Level

- Balancing between key investments:
  - Responsive Mode
  - Critical Mass
  - Fellowships
  - Infrastructure
- Strategic Advice
- Integrating across EPSRC

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Discipline Level

- Working closely with Learned Societies
- Diversity
- Grand Challenges

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Research Area Level

- Early identification of emerging areas
- Review and work with the research community to ensure health of discipline
- Working with other areas or countries in specific challenges or research areas

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Portfolio Statistics

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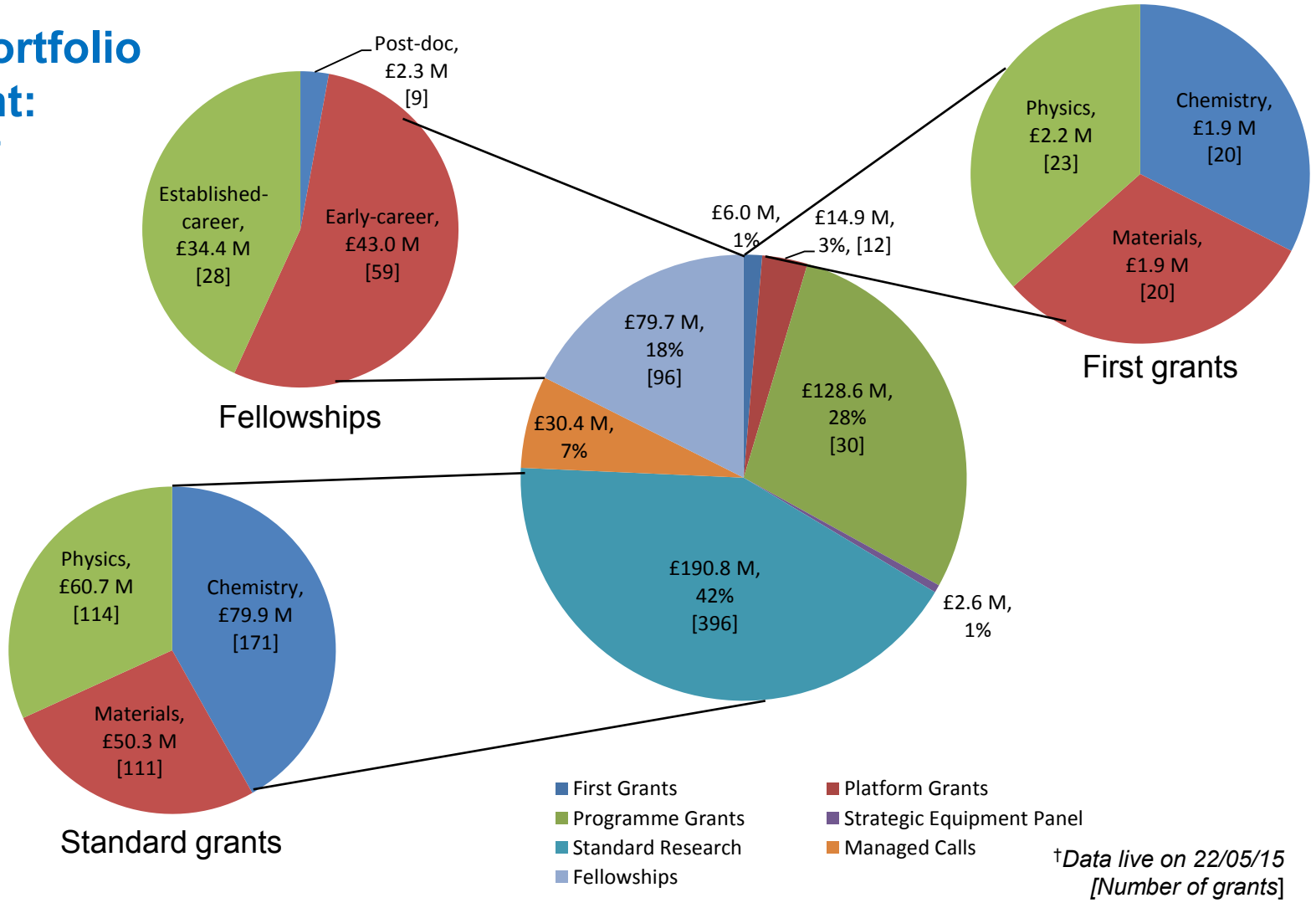
Funding landscape in Physical Sciences

Current portfolio investment: £453.1 M.†



†*Data live on 22/05/15*
[Number of grants]

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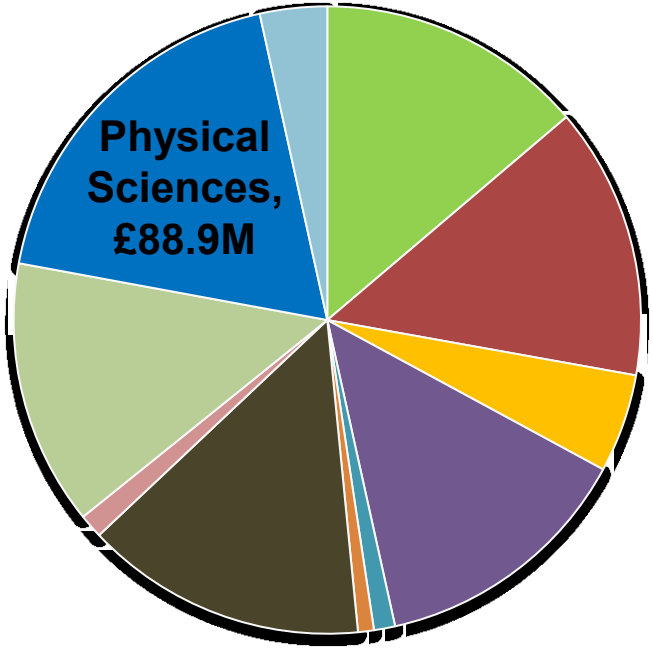
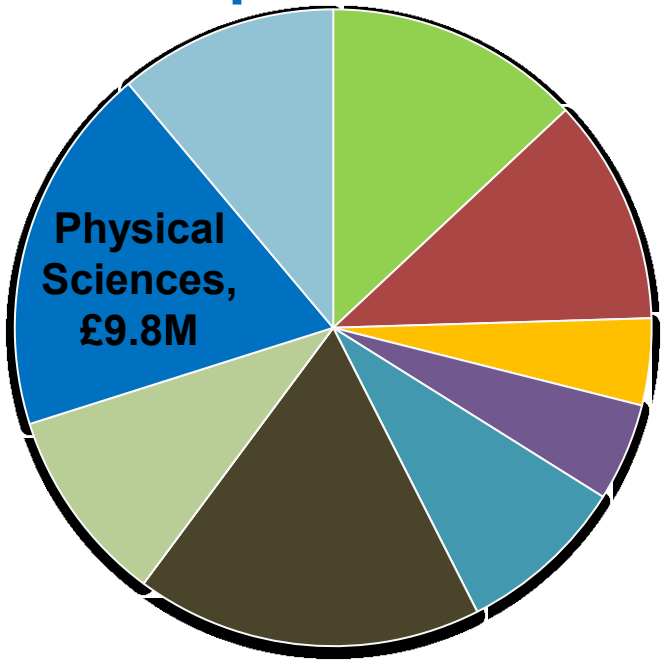
Commitment forecast 2015/16

Research total: £476.9M



Fellowship total: £52.2M



- Energy
- Manufacturing the Future
- Digital Economy
- Healthcare Technologies
- Living with Environmental Change
- Partnership for Conflict, Crime & Security
- Engineering
- Research Infrastructure
- ICT
- Physical Sciences
- Maths

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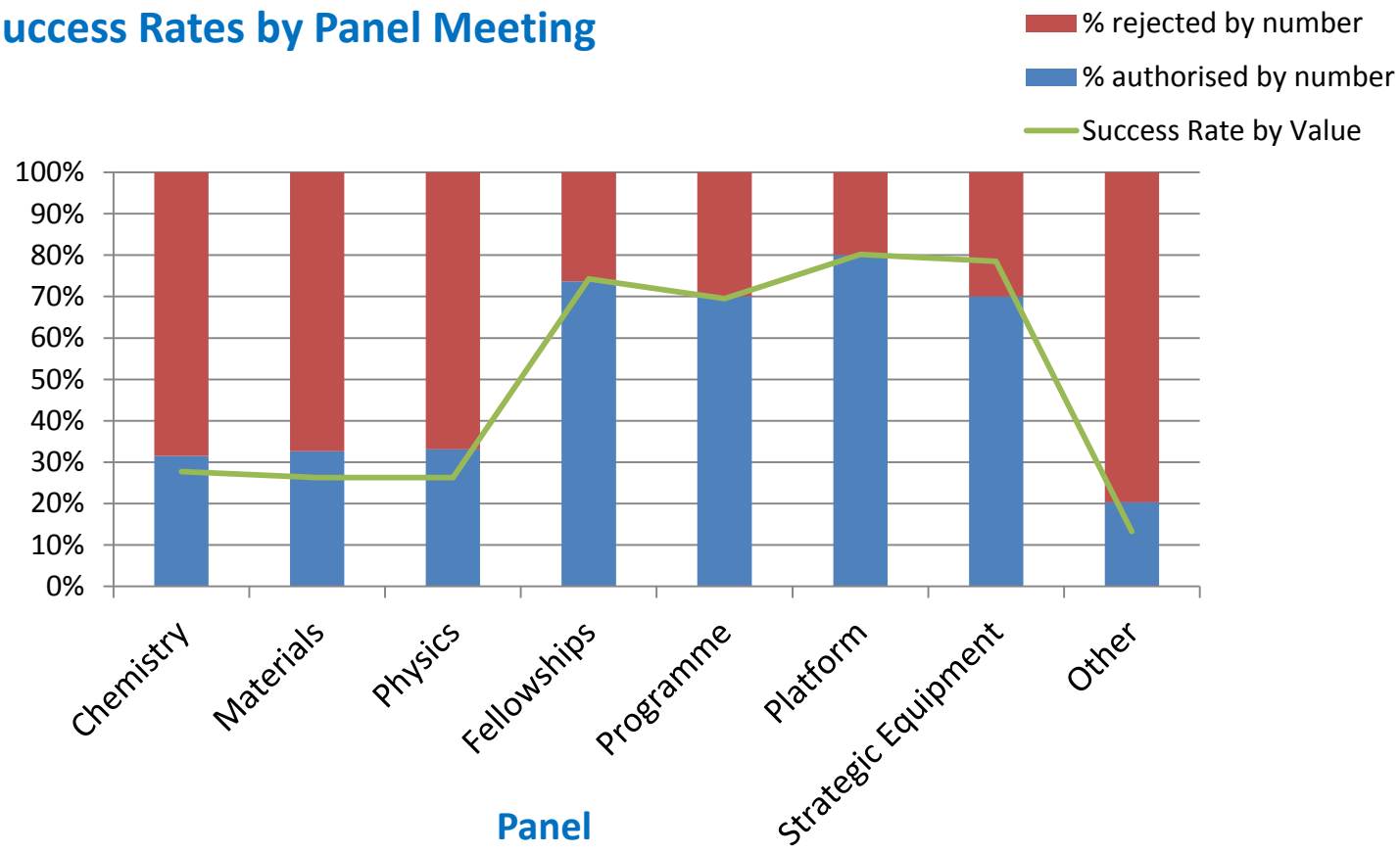
Physical Sciences Success Rates (FY 2014/15)



- 'Fellowships' success rate is for EPSRC interview panels only

- 'Other' includes joint funding with other themes, Research Councils, Organisations, e.g Royal Society fellowships

- This shows success rates by panel meeting, showing only the final meeting (from which a decision is made). Fellowships, Programme, Platform and Strategic Equipment all have earlier sift/outline stages which are not accounted for in this graph.

- Strategic Equipment – this is not the success rate for the whole meeting, only those applications led by Physical Sciences.

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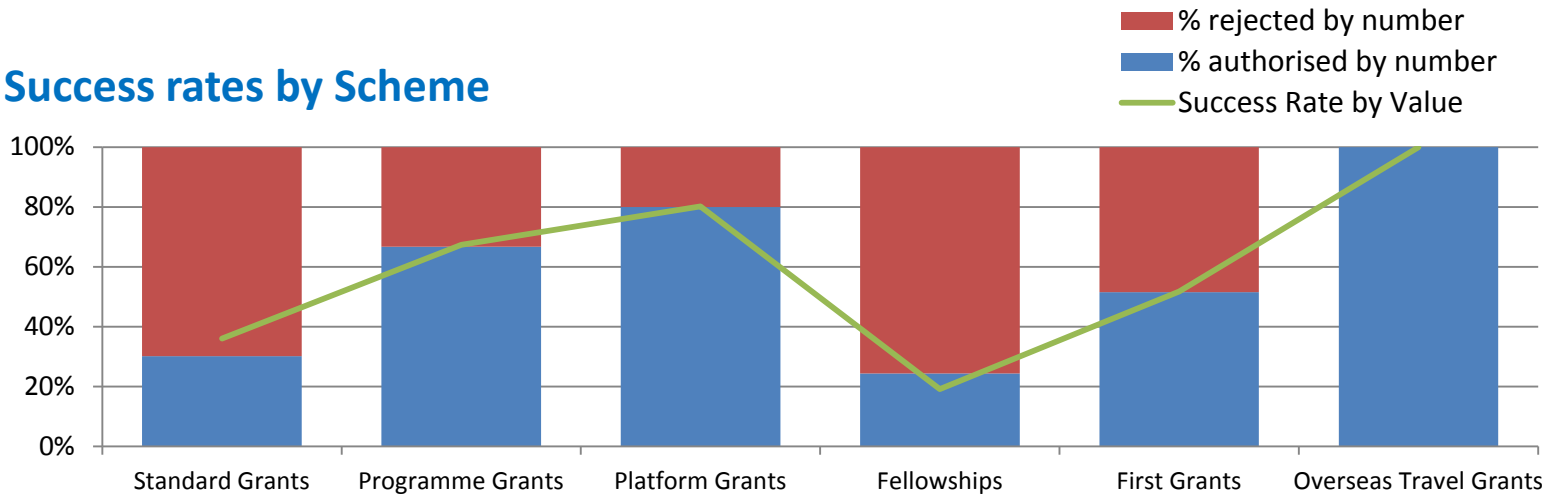
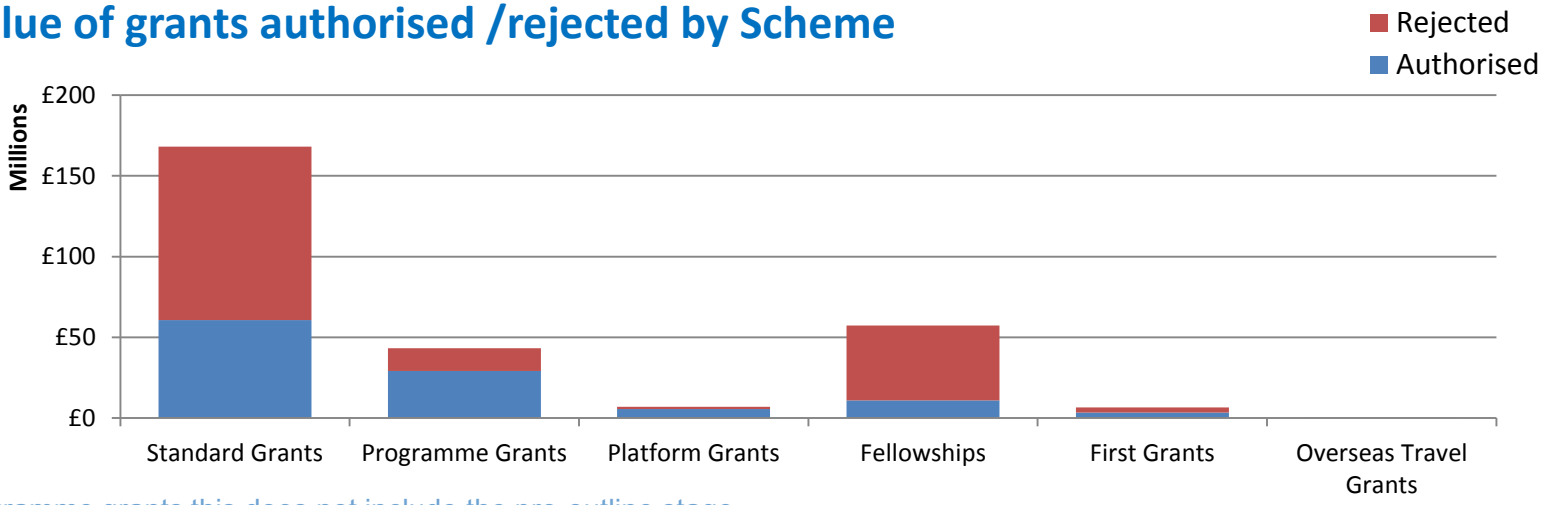
Physical Sciences Success Rates (FY 2014/15)cont'd

Success rates by Scheme



Value of grants authorised /rejected by Scheme



- Programme grants this does not include the pre-outline stage.
- Fellowships here includes the Royal Society ones that were successful (these are the only ones that come in through RCUK grant system as Royal Society handles them before this)

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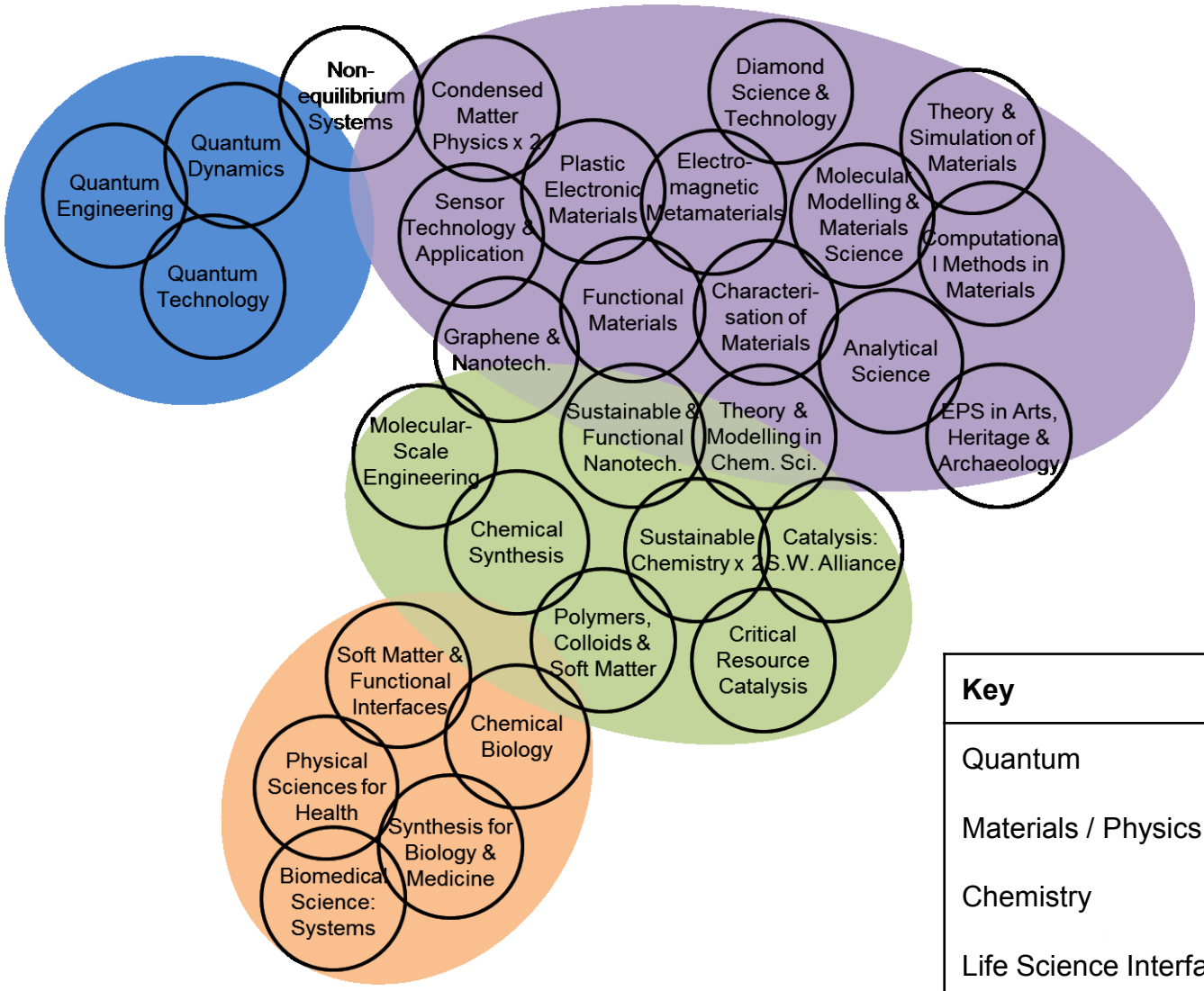
Physical science-led CDTs



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Advanced Materials

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ADVANCED MATERIALS
Overview

- Councils set up by BIS to back the 8 Great Technologies
- AMLC will provide strategic advice and leadership to accelerate development of advanced materials for UK
- Chair: Minister of State for Universities and Science
- Vice Chairs:
  - (Industry) Jack Boyer, ilika plc
  - (Gov) Sir Mark Walport (Gov CSA)

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ADVANCED MATERIALS
Objectives

- To provide strategic direction on a future UK strategy for advanced materials.
- To inform and influence Government strategy and policy, particularly the industrial sector strategies.
- To coordinate the voice of industry and academia on behalf of all materials.
- To ensure innovation and research discovery are fully integrated by encouraging continued joint working of supporting organisations.
- To identify unique opportunities and actions for strengths of the UK to ensure that the UK continues to be world leading in those areas.
- To understand the UK landscape and identify the opportunities to help UKTI exploit advanced materials, particularly where advanced materials underpin other technologies eg robotics, healthcare.
- To communicate activities to the wider community

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ADVANCED MATERIALS
Current activities

- Scoping challenges in:
  - Energy
  - Healthcare
  - ICT
  - Demanding environments
  - Resource efficiency

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Analytical Sciences

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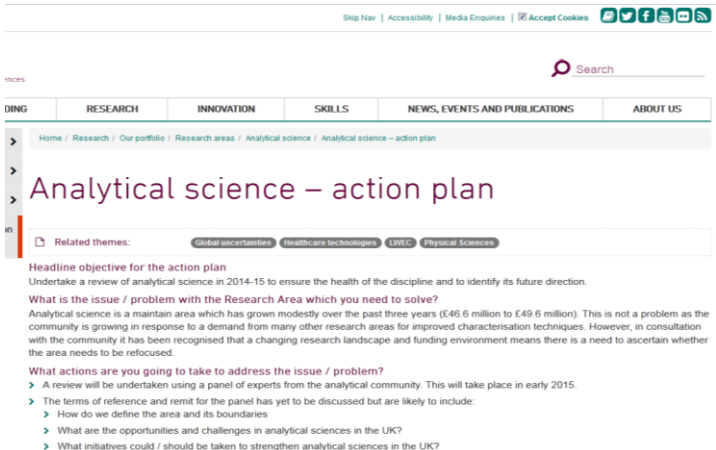
Analytical Sciences
Need for Review

- EPSRC invests a large proportion of funds in Analytical Science, however most of this investment is involved in research with a primary focus outside ‘pure’ Analytical Science.
- This has led to a diverse research community with many foci, yet a lack of recognition and direction for the area of Analytical Sciences in itself in the UK.
- This also means that EPSRC (and wider stakeholders) do not have robust evidence on which to base any future strategy in the area.

https://www.epsrc.ac.uk/research/ourportfolio/researchareas/analytical/analyticalactionplan/



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Analytical Sciences Review Process

- Using data from online survey and EPSRC portfolio combined with knowledge from an expert panel, the review considered four key questions:

1. To determine the health of Analytical Science research in the UK, considering national and international perspectives;
2. To determine how all Analytical science research enables other areas of research and what these areas are;
3. To determine how Analytical science is meeting the needs of the user community in the UK;
4. To determine the strengths of and challenges to Analytical science now and in the near future.

- And identified three options for action:

- **Do Nothing**
- **Actively Cease** – Take action to ensure that Analytical Science is embedded in other disciplines of research.
- **Actively Strengthen** – Take action to promote Analytical Science as a core enabling discipline.

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Analytical Sciences Review Recommendations

- In order to actively strengthen Analytical Science, the following recommendations should be considered:
  - The need to **improve perceptions** of the importance and value of Analytical Science.
  - The need to maintain **world class research and training**.
  - The need to maximise the potential of Analytical Sciences to enable advances **across sectors and disciplines**.
  - The need for an **effective community structure**.

Next Steps?

Explore options for action in consultation with community, continue discussions with RSC analytical division, publish report, gather wider international perspectives, link with infrastructure roadmaps….. Work in progress, and contributions of ideas encouraged!

Further info/questions: martin.sweet@epsrc.ac.uk

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Formulation Science

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Future Formulation of Complex Products

- Good basic science capability in the UK with industrial relevance
- Wide industrial interest in formulation across a range of sectors
- Several activities exist or are proposed
- Develop a call to link excellent science to the wider developing landscape and industry
- The total budget of the call is £14m, of which £10m will be supplied by the **Manufacturing the Future** theme and £4m will be supplied by the **Physical Sciences** theme.

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PHYSICAL SCIENCES GRAND CHALLENGES

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Grand Challenges - overview

- Purpose:
  - To challenge the community to new scientific breakthroughs
  - To bring the community together to work towards a solution

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Chemical Sciences & Engineering

Networks to build communities established in:

- Dial-a-molecule: 100% efficient synthesis
- Directed Assembly of Extended Structures with targetted properties
- Utilising CO_2 in synthesis and transforming the Chemicals Industry

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Physics

Topics identified:

- Emergence and Physics far from Equilibrium
- Quantum Physics for new Quantum Technologies
- Nanoscale Design of Functional Materials
- Understanding the Physics of life

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Materials Science

- *Materially Better* consultation identified GCs as a route to uniting the disparate UK community
- Challenges not yet identified
- Outputs from Advanced Materials Leadership Council could be important

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Grand Challenges

- Bottom-up, community driven
- Not to be confused with ‘societal challenges’ (eg Energy, Healthcare, Climate Change, etc.)

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Technology Touching Life

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Physical Sciences: Health and Life Sciences

- Maxwell Review: Independent review published in 2014 concludes that engineering and physical sciences research has a major role to play in advancing the health and life sciences
- To date these successes include: biomaterials, microscopy, DNA Sequencing and MRI.
- EPSRC are considering how to respond to this and build on research strengths – potential future priority could be "Technology Touching Life"

The importance of engineering and physical sciences research to health and life sciences

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Engineering and Physical Sciences Research Council

Technology Touching Life

Harnessing UK research excellence in engineering, physical, health and life sciences to deliver future breakthrough technologies.

- Proposal for future investment to deliver new technologies for the health and life sciences enabled by cutting-edge engineering and physical science research.
- These technologies will drive world class ‘breakthrough’ science and open up longer-term opportunities for commercial exploitation.
- Proposed bid will be across relevant research councils and is likely to councils to involve:
  - Increased development of interdisciplinary research environments
  - And/or critical mass groupings where engineers, physical, health and life-science researchers work together
  - greater engagement with industry both in the engineering and life sciences to identify opportunities and maximise impact.

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Responsible Innovation

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Responsible Innovation

Research can result in unintended impacts, questions, ethical dilemmas and unexpected transformations in social life.

- Responsible Innovation is a process that seeks to promote creativity and opportunities for science and innovation that are socially desirable and undertaken in the public interest.
- Responsibility must be taken by funders, researchers, stakeholders and the public.
- It includes, but goes beyond, considerations of risk and regulation.
- EPSRC will ensure our activities and funded research are aligned with RI, creating value for society in an ethical and responsible way.

EPSRC is committed to develop and promote Responsible Innovation

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Responsible Innovation: Framework steps

Anticipate: Describing and analysing those intended and potentially unintended impacts (economic, social, environmental or otherwise) that might arise e.g. through methods of technology assessment, foresight and risk analysis

Reflect: Ethically reflecting on the purposes of, motivations for and potential impacts of the research, and the associated uncertainties, areas of ignorance, assumptions, questions, dilemmas and social transformations these will bring.

Engage: Opening up such visions, impacts and questioning to broader deliberation dialogue, engagement and debate.

Act: Using these processes to influence the direction and pace of the research process itself.

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Public Engagement

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Physical Sciences – Public Engagement

- What is Public Engagement?
  - Public engagement involves activities that bring researchers and the public together. It is more than just meeting an audience and telling them about your research - effective public engagement is about two-way communication, with the researchers listening to and learning from participants.
- Why engage with the public?
  - Involving the public in research can have a wide range of benefits: for the researchers, the organisation employing them, the public involved and society more widely.
  - In the case of young people, public engagement is an effective way of stimulating interest in a subject and encouraging young people to consider research careers. This benefits the individual students, and society as a whole, as young people are encouraged to become more skilled and engaged citizens.

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Equality and Diversity in Physical Sciences

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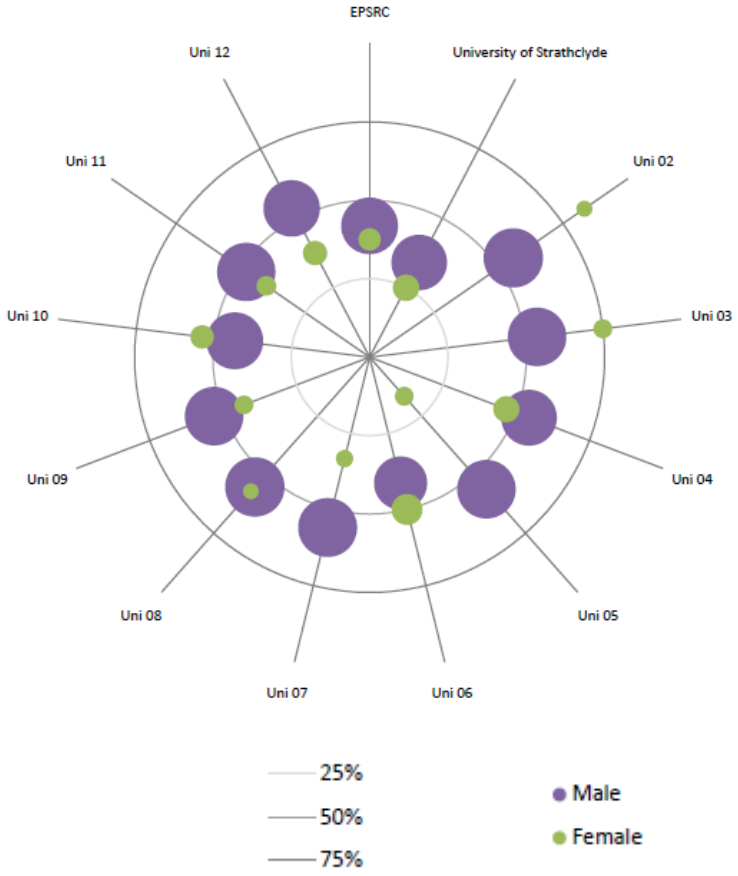
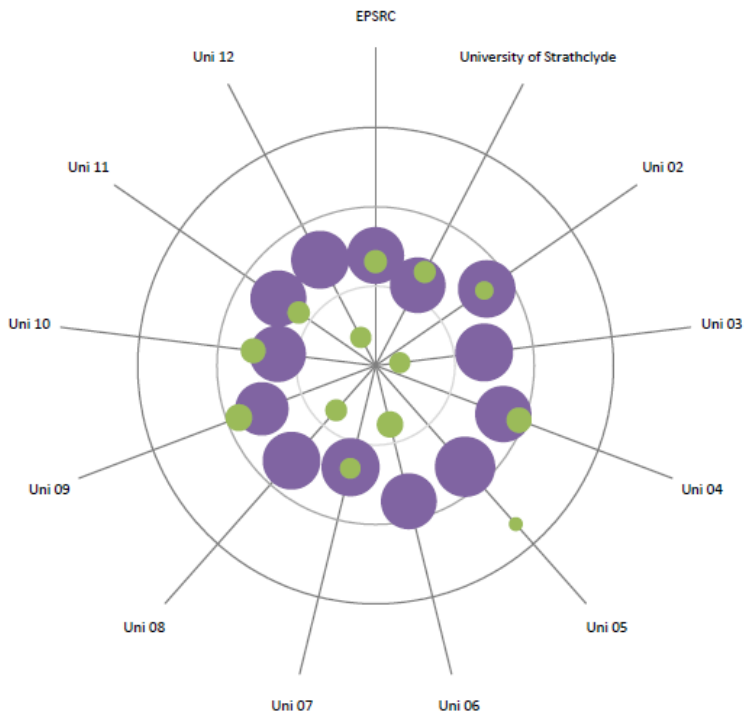
Comparison of Research Grant applications and success rates with Other Framework Universities

Research grant applications and success rates by PI gender at Framework Universities, 2011/2012



Research grant applications and success rates by PI gender at Framework Universities, 2012/2013



Bubble size = proportion of applications
Distance from centre = success rate

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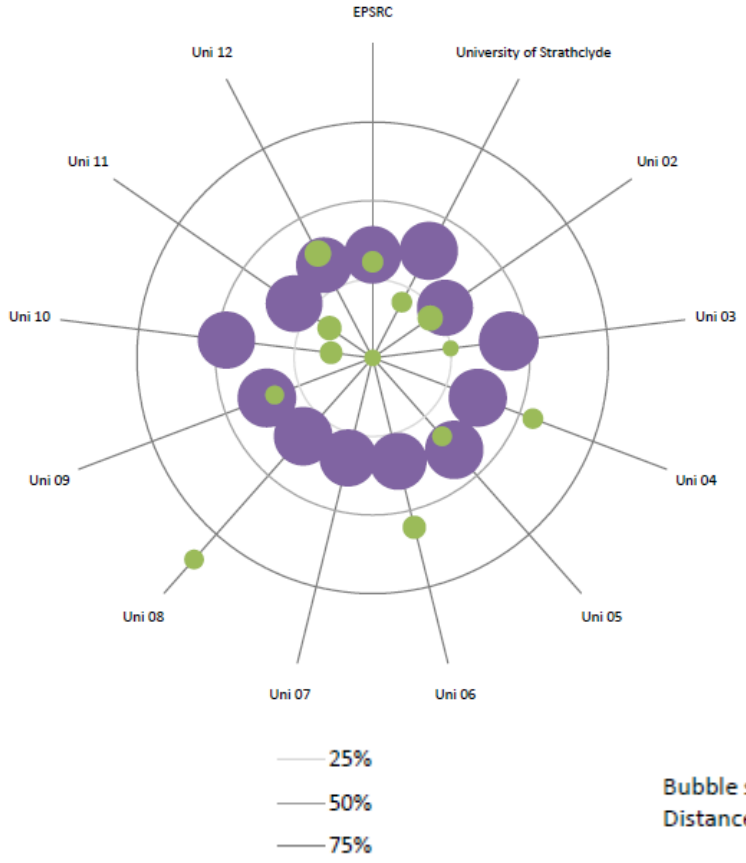
Comparison of Research Grant applications and success rates with Other Framework Universities

Research grant applications and success rates by PI gender at Framework Universities, 2013/2014



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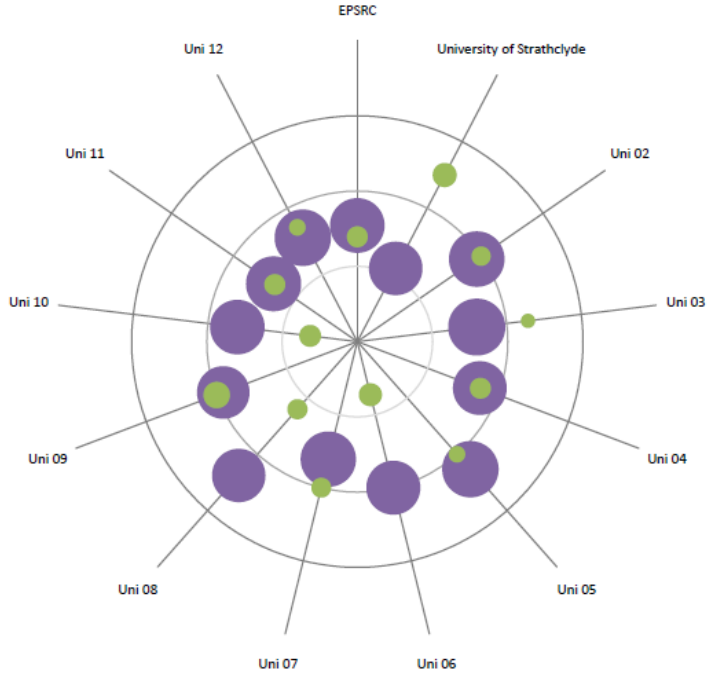

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Equality & Diversity – where we are now

- EPSRC, supported by our Council, is committed to ensuring that the best potential researchers from a diverse population are attracted into research careers

- EPSRC, with RCUK, published a statement of expectations for equality and diversity in January 2013 - http://www.rcuk.ac.uk/RCUK-prod/assets/documents/skills/EqualityStatement.pdf

- Current specific EPSRC support for E&D

  Flexible working & support on all of our grants

  - Daphne Jackson Trust Fellowships – for researchers who have had a career break of 2 or more years
  - Royal Society Dorothy Hodgkin Fellowships – for researchers who require a flexible working pattern

- EPSRC, alongside all Research Councils, have published diversity data on grant and fellowship applications, awards and success rates by gender, age and ethnicity with an analysis of HESA data to estimate the diversity profile of the academic population

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Equality & Diversity – next steps

- Work towards the E&D target set by EPSRC Council - 30% target by gender for our Council/ Strategic Advisory Network/ Strategic Advisory Teams by the end of the next Delivery Plan
- Explore opportunities for working in Partnership – extending the diversity of the pool requires working with others
- Look in detail at our own data by Theme and Scheme to help us identify any specific areas for action
- Share Institutional level data with Universities and use as the starting point for a discussion on what initiatives have been successful to feed into our future plans
- Review our own peer review processes – including considering opportunities for unconscious bias training and exploring the use of anonymous peer review
- Using the outputs from the above to develop areas for action in the next Delivery Plan

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Equality & Diversity – For Discussion

- How does your institution encourage cultural change in relation to E&D:
  - At institutional level?
  - At department level?
- How does your institution engage staff and research students at all levels in relation to E&D?
- How does your research organisation ensure the research workforce is trained and supported to address E&D?
- Are there particular issues related to E&D that EPSRC could help to address?

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Equality & Diversity – For Discussion

- What do you perceive to be the main E&D issues in your discipline?
  - Reflections on personal experience
  - Cultural issues
- Are you aware of any initiatives or activities designed to address these issues?
  - At institutional level?
  - At national level?
- Is there a role for EPSRC in addressing any of these issues? What actions could we take?

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Mid-Range Facilities

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Mid-Range Facilities

- EPSRC defines a mid-range facility (MRF) as a research facility which provides resources that are of limited availability to UK researchers for one of several reasons including:
  - The relative cost of the kit
  - Dedicated kit in every University is not needed
  - Particular expertise is needed to operate the kit or interpret the results
  - Progress is enhanced by sharing information or software.

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New MRF Assessment Process

- New facility applications go through an ‘Intent to Submit’ step
  - EPSRC checks remit and coverage by existing MRFs
- Those invited further plus MRF up for renewal submit a ‘Statement of Need’
  - This should be community driven, explaining the benefits a facility would provide. They should not be bids by an individual group/institution to host one.
  - They should address why an MRF is the most appropriate model
- Statements of Need are assessed by postal peer review and ranked at a prioritisation panel
- Themes decide what they can take forward
- Successful Statement of Need usually result in a tender
  - The exact specification is defined.
- Funding for facilities comes from the same budget as research grants

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Large Grants

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Longer Larger Grants (Flexibility & Stability)

	Platform Grants	Programme Grants
Length	5 years	5-6 years
Key Feature	Underpinning support for existing EPSRC/RC research portfolio	Single coherent programme of highly inter-dependent projects
Aim	Stability and strategic development of the team	Delivery of the research programme
Entry Criteria	Established team; excellent track record of EPSRC funding	Best with best; fit of the research programme to EPSRC strategy
Staff retention or recruitment		
Staff development		
Fostering collaboration		
Networking		
Speculative research		
Research Projects		

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Platform grants – additional assessment criteria

Criteria	Assessment
Added Value	Degree of added value – what opportunities does Platform Grant funding provide that would not be available through standard project based funding?
Strategic Development	How does Platform Grant funding allow the group to take a longer term more strategic view of its research? Will the funding be used to develop and strengthen the group?
International Standing	Are the group internationally leading, and internationally recognised in the relevant research area?
Management	Effectiveness of planning and management, appropriate resources, viability of equipment access
Team Development	Effectiveness of plans for active development, management and promotion of the careers of team members?
Funding	Is there evidence of the group's ability to obtain significant funding from a variety of sources ? Will they continue to do so?

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Programme grants – additional assessment criteria

Criteria	Assessment
Added Value	The need for Programme Grant funding rather than individual project grants, discuss the value of the longer term funding and how the flexibility of both staff and other resources will be exploited.
Vision and ambition	The overall research vision should be ambitious, transformative and have potential to result in a significant step change in knowledge and understanding which will have a major impact on the research area.
Leadership quality	Effective leadership to drive the projects forward to ensure all members of the team are focussed on the overall vision.
Management Strategy	A clear management plan ensuring that resources are deployed in the most effective way to deliver high quality research outputs.
Advocacy	How the group will be advocate for the engineering and physical sciences. Applicants should specifically address how they will influence policy makers on the importance of engineering and physical sciences.

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Programme Grants

- A team of world leading researchers and ‘best with best’, not necessarily an existing collaboration
- A coherent programme of highly inter-dependent projects.
- A single, unifying, highly ambitious vision.
  - It should be imperative or highly advantageous to the vision that the research strands (also known as work packages) are tackled together
    - There should be a high degree of linking and feedback between the strands e.g. research findings in one project have implications for others in different research strands and/or individuals’ expertise is required in more than one work package and project.
  - The exact approach over the grant lifetime is unknown or highly changeable; requiring a flexibility in resource allocation including Postdocs
  - Finances do not dictate what is or isn’t a Programme grant, the above characteristics do. That said:
    - Programme grants are 5-6 years in length
    - In Physical Sciences they are usually of the order of £4m+
  - 12 month application process and more management overheads.
  - EPSRC can choose not to invite a grant on strategic grounds.

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Critical Mass

- A Critical Mass grant is effectively a standard grant (sometimes known as ‘responsive mode’) but costs are higher than average.
  - Critical Mass was previously sign posted in Physical Science’s panels. While this has been removed, we still want to encourage these grants to be submitted.
  - The approach and activities are sufficiently defined that resource allocation, including staff, can be made from the outset.
  - Finances do not dictate what is a Critical Mass grant, the above characteristics do. That said:
    - A grant would typically be £2m+
  - 6 month application process,
  - They are assessed as standard proposals – same process and assessment criteria, and **no separate list**.
  - We request that you let your ESPRC Portfolio Manager know if you are planning to submit a critical mass grant so we can plan commitment. We may request a specific submission window to aid this.

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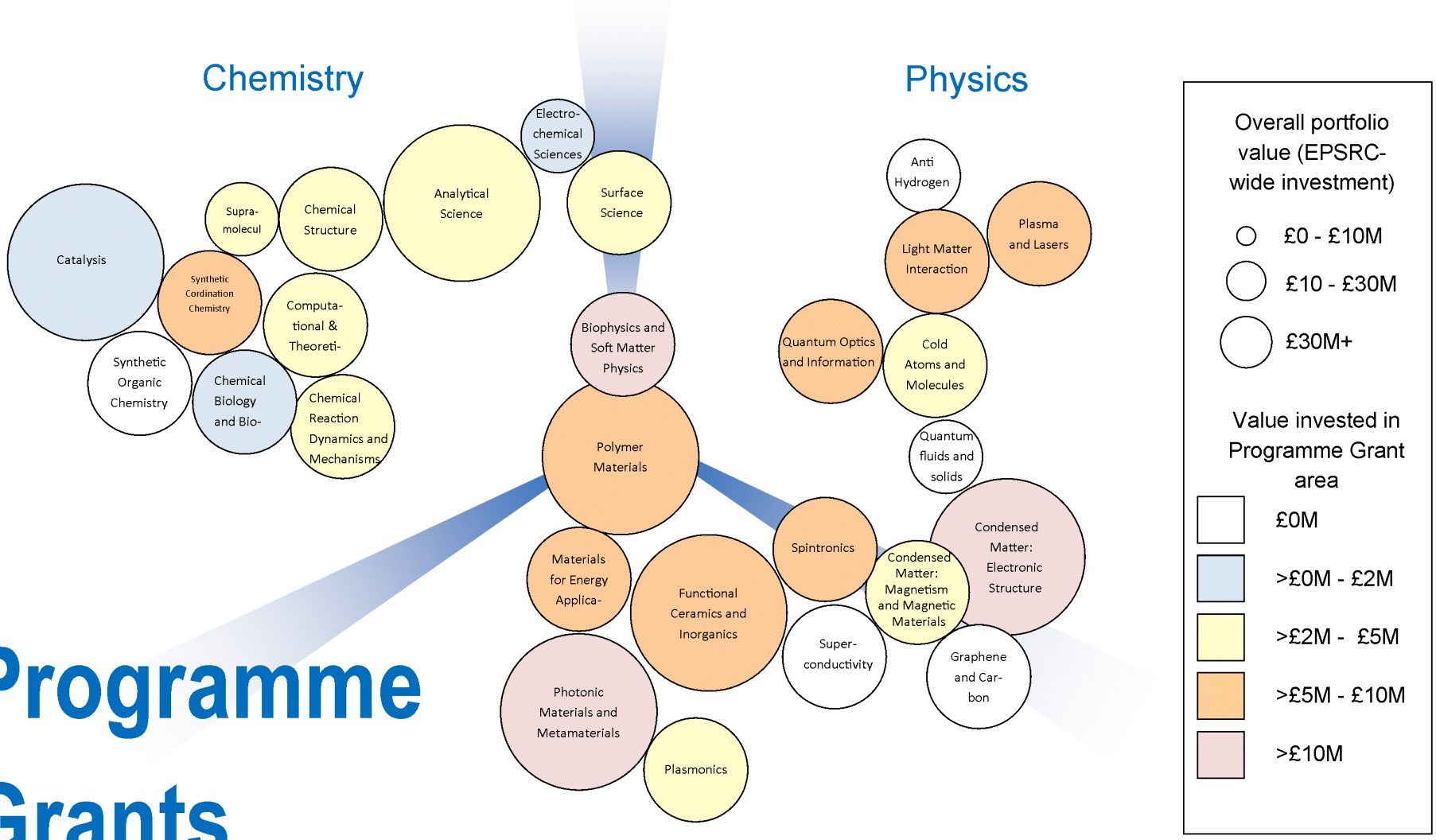
EPSRC Physical Sciences Research Area Map April 2015



Programme Grants

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