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Future Opportunities for Engineering Research in International Development - a DFID perspective

Royal Academy of Engineering

29th May 2014

DFID's Infrastructure Programme Portfolio

- Historically approx £1 billion/year, 50% through partners
- Basic Services
  - Water, sanitation, rural transport, energy
- Economic Development increasing priority
  - Transport, energy, ICT, water for productive use
- >50% population now living in urban centres
- DFID focus:
  - Design, Project Preparation, Mobilising finance, High Quality Research, Influencing – MDBs, G20, G8, FCAS funding
- Post 2015 framework will include infrastructure

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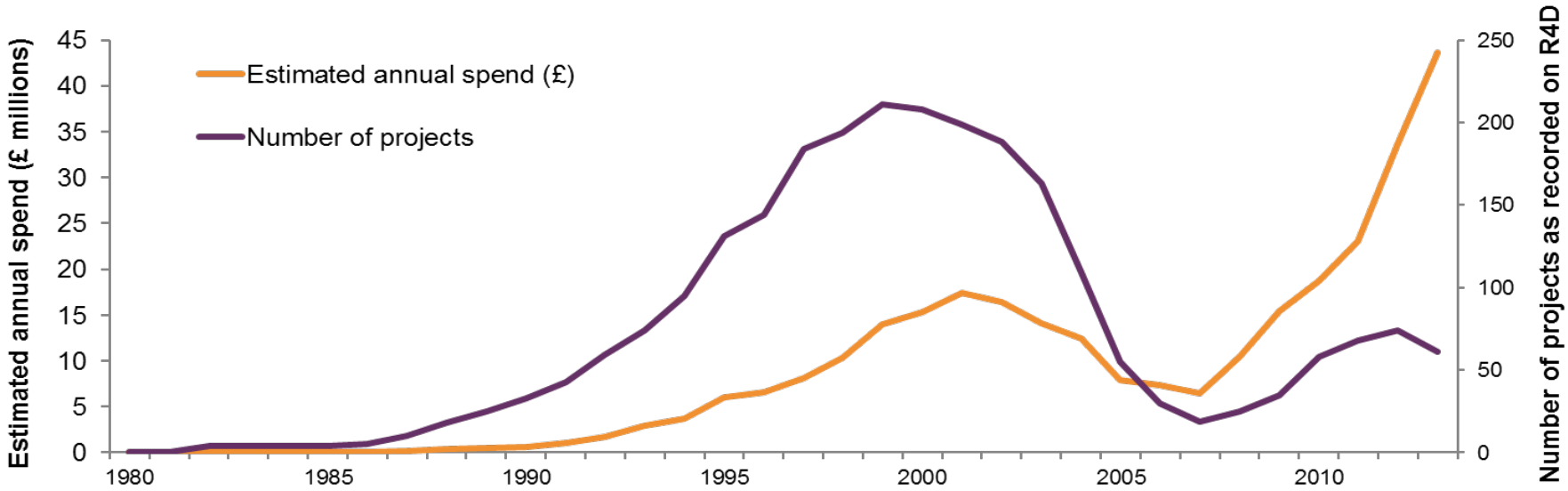
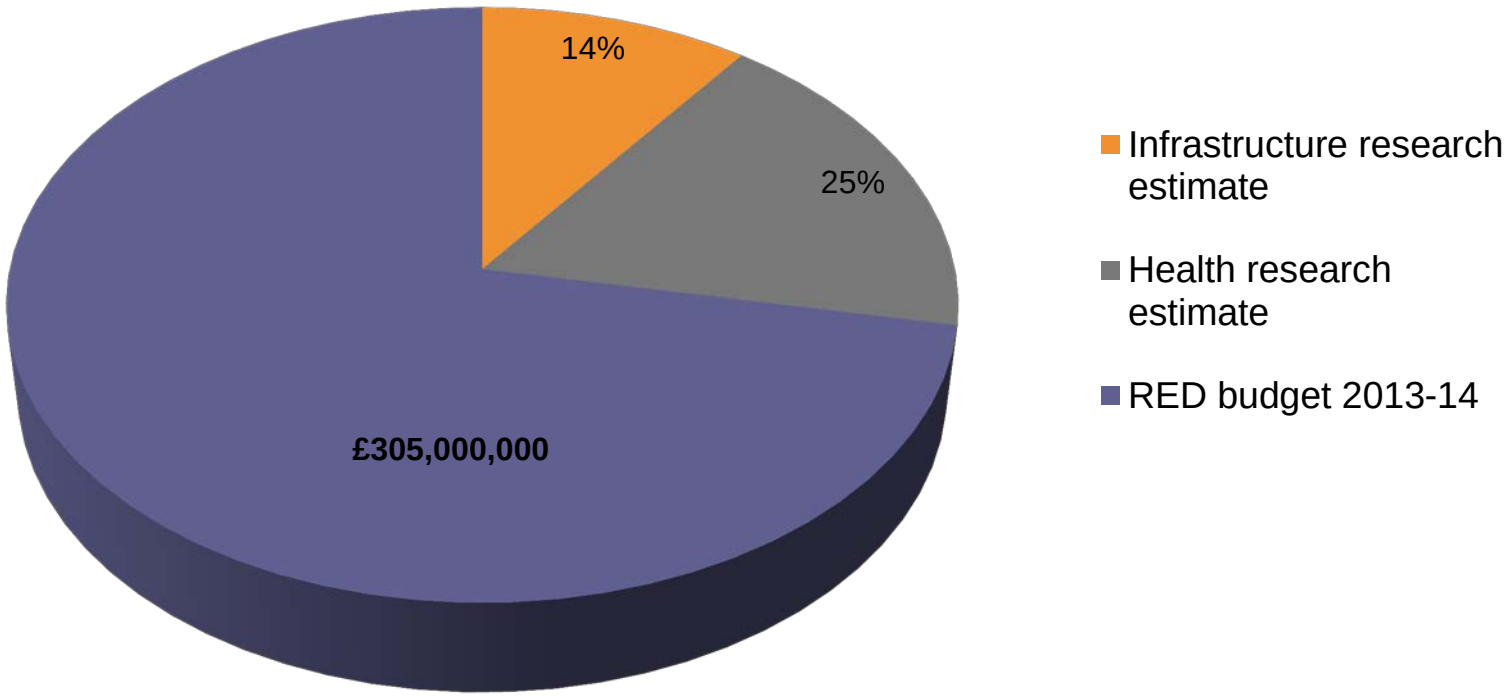
DFID Funding for Infrastructure Research

- 2013 ~£45m per annum (cf 2000 ~£15m/a)
- 14% total research spend

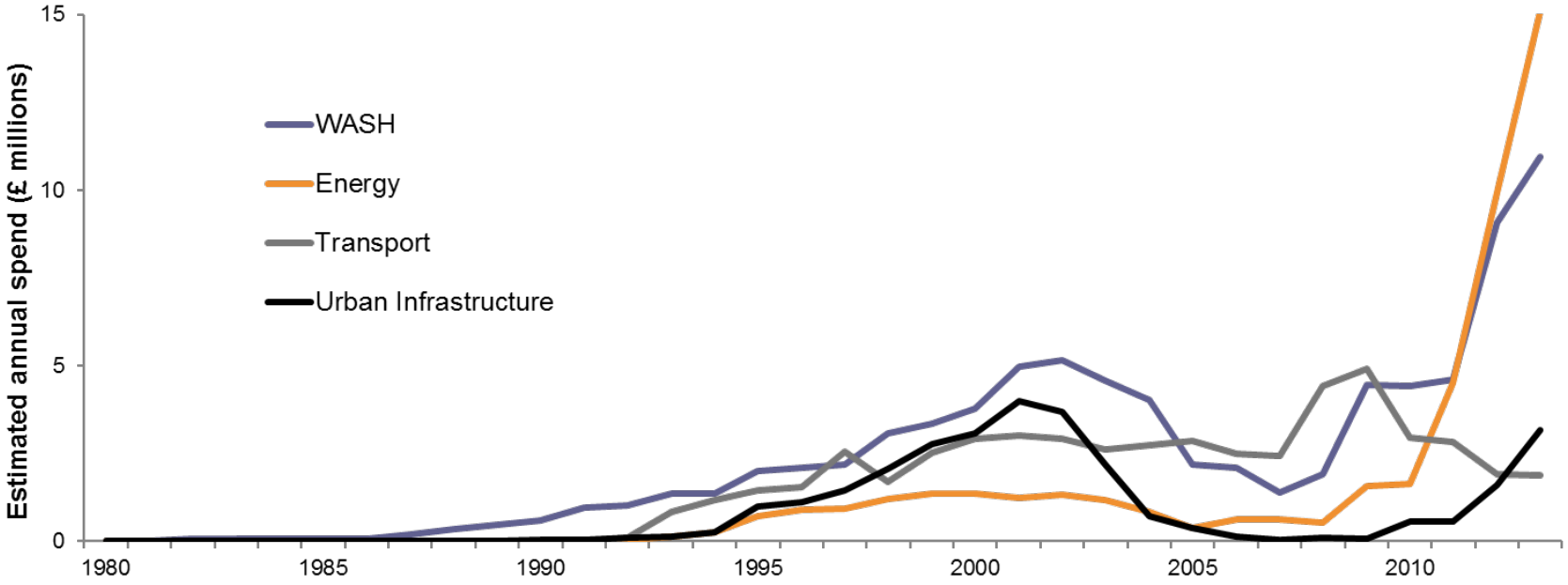


Infrastructure research in the context of the DFID research budget



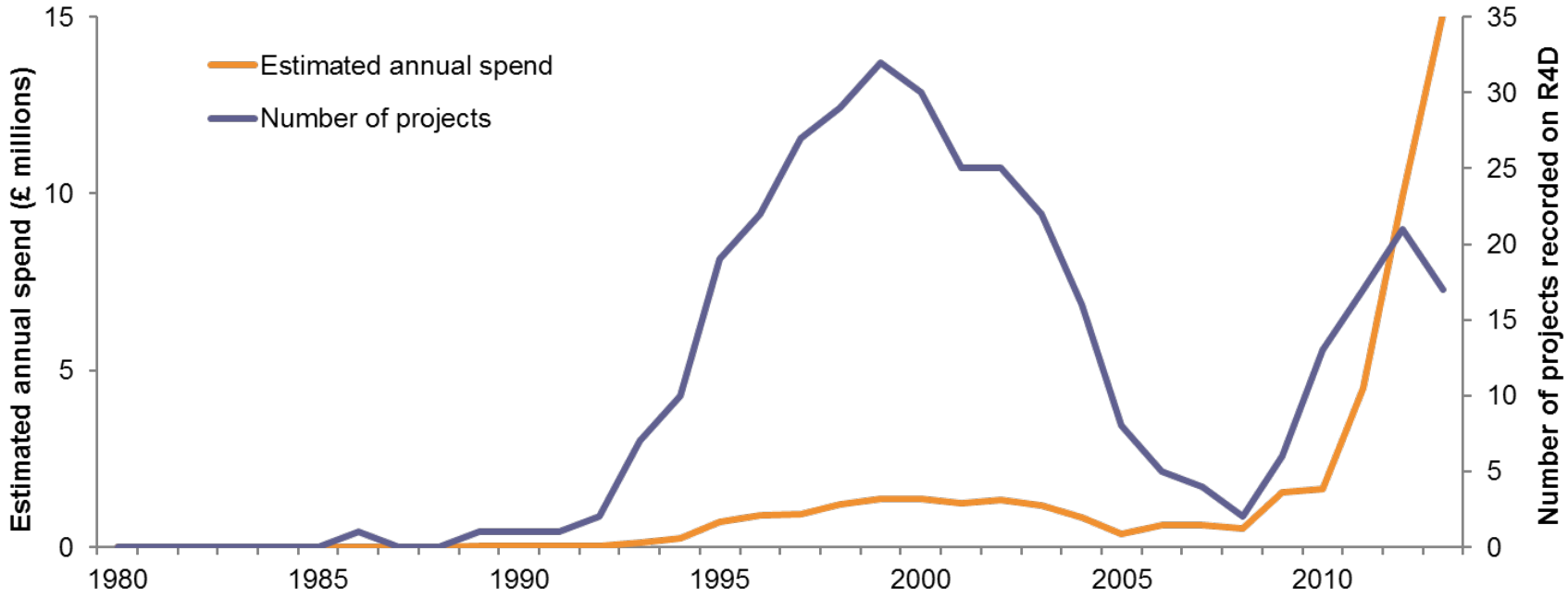
Research Spend in Four Key Infrastructure Sectors

- Energy and Water, Sanitation and Hygiene (WASH) research has increased significantly; Transport and Urban Infrastructure much less so



Estimated DFID RED spend on energy

Spend on energy research has increased to over £15 million p.a.



Energy Research Priorities – 5 themes

- Addressing barriers to sustainable energy access for all
- Climate resilient responses to changing demands for energy
- Identifying policy and market options to promote sustainable energy choices
- Scaling up use of renewable energy
- Supporting innovation through technology development and business models

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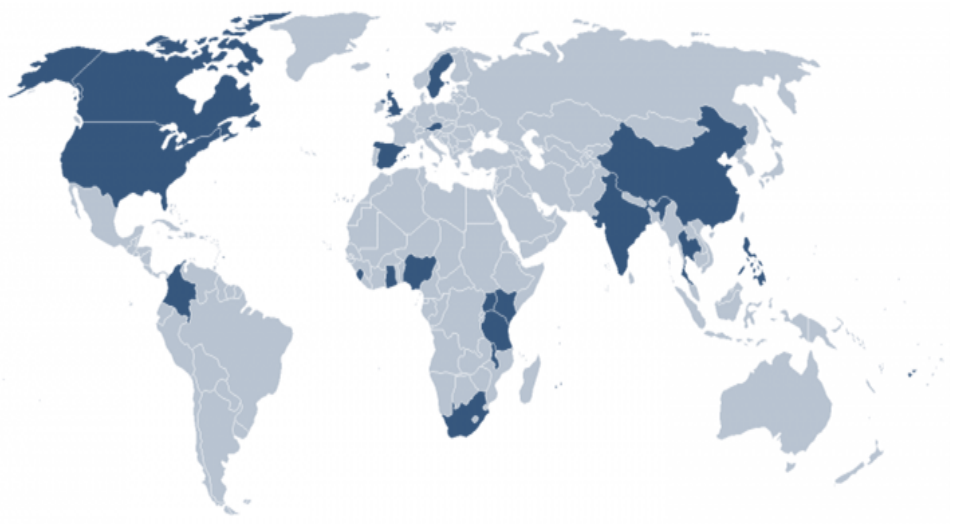
Funding call analysis: DFID-EPSRC Understanding Sustainable Energy Solutions (USES) Programme

Country	Number of EOIs
UK	116
Kenya	28
Nigeria	26
South Africa	22
India	21
Uganda	11
China	10
Philippines	10
Ethiopia	7
Pakistan	7
Tanzania	7
Bangladesh	6
Ghana	6
Zimbabwe	6
Thailand	5



Ghana as a success story – 3 of 6 Ghanaian EOIs accepted and scored in the highest quality decile.

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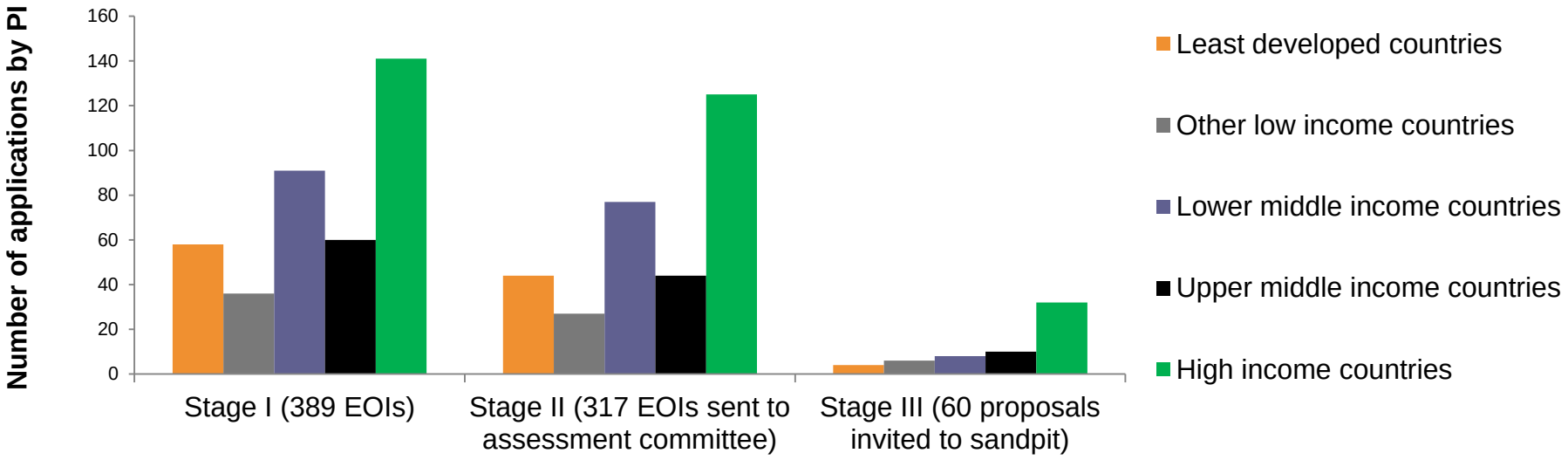
Funding call analysis: DFID-EPSRC Understanding Sustainable Energy Solutions (USES) Programme



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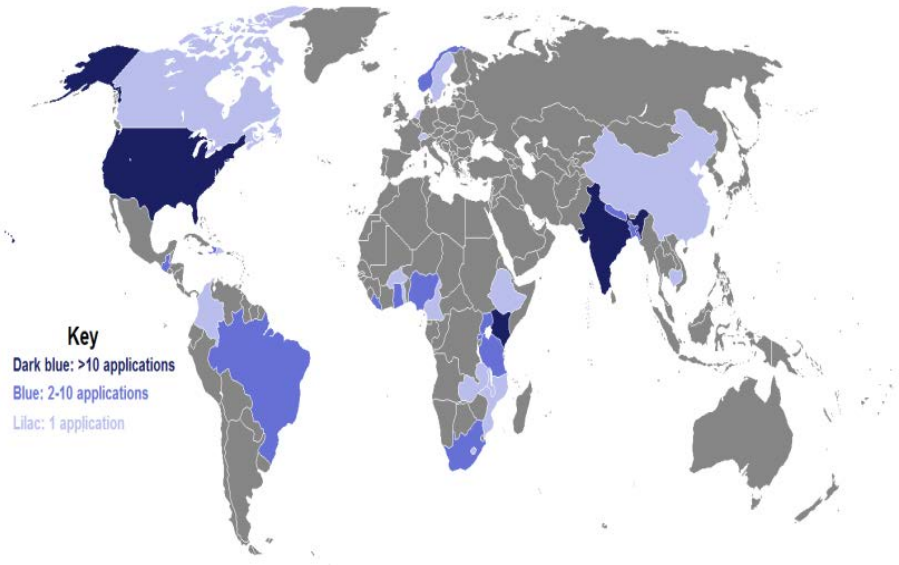
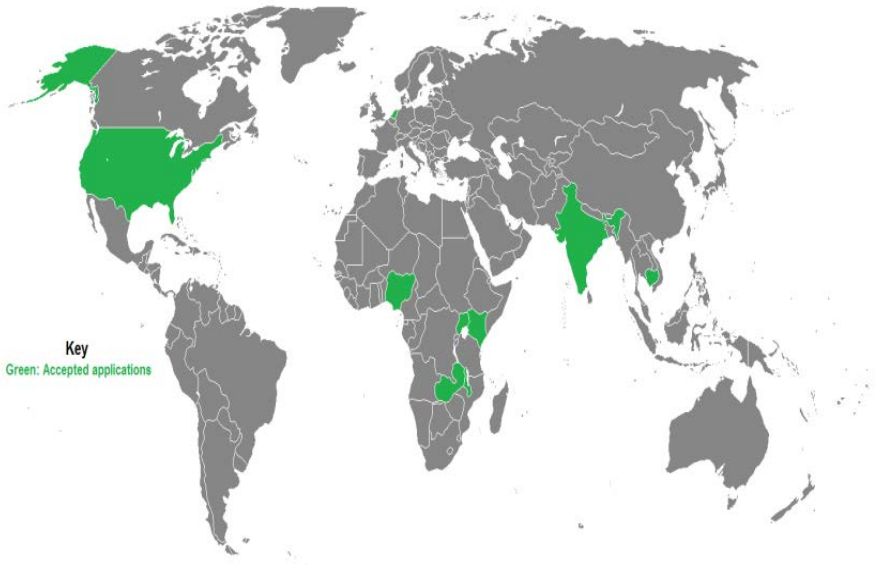
Funding call analysis: the US-based Global Alliance for Clean Cookstoves' Pilot Innovation and Spark Funds (Round II)

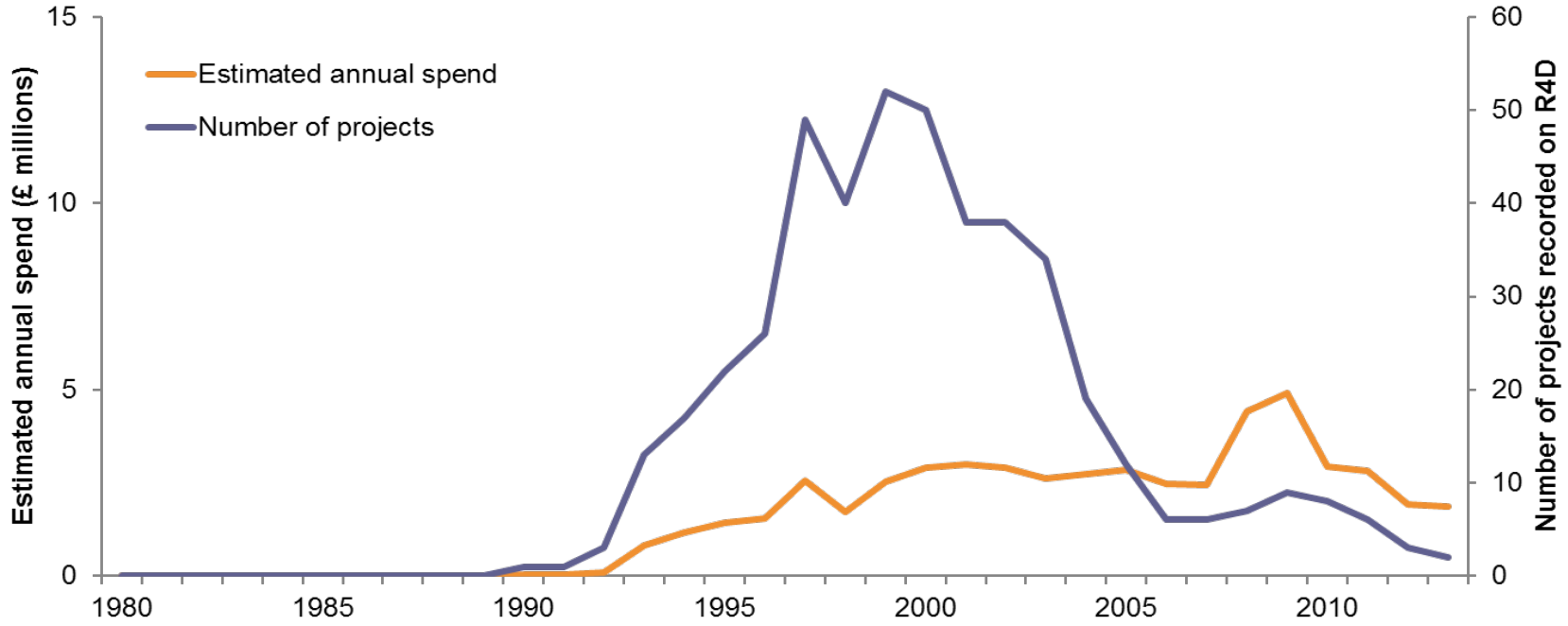




79% of the 118 applications (left) came from Southern institutes/enterprises and eight of the eventual 10 grantees (right) are based in the global South

Estimated DFID RED spend on transport

Spend on transport research has flatlined at around £2 million p.a., but is set to rise with new programmes to about £4 million p.a. and proposed programmes to £9 million p.a.

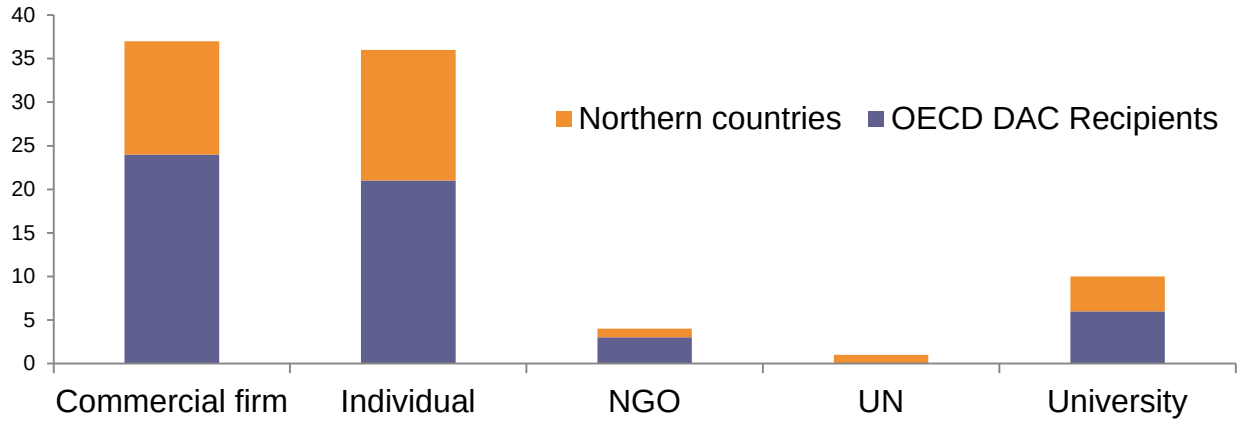


Transport Research over the next 3 years

- Approved: AFCAP2 / ASCAP Low volume rural roads, road maintenance (£24m / 6yrs)
- Approved: World Bank Strategic Research Partnership (£15m / 5yrs) (transport one of seven themes)
- Pipeline: High Volume Transport Research
- Pre-pipeline: Road Safety Research

DFID's £14.4m African Community Access Programme (AFCAP)

73 of the 88 organisations contracted for sub-projects were individuals/consultancies



The six Southern (African) academic institutions involved were CSIR (South Africa); the University of Pretoria (South Africa); the Kwame Nkrumah University of Science and Technology (Ghana); Pan-Atlantic University (Nigeria); University of Eduardo Mondlane (Mozambique); and the International Institute for Water and Environmental Engineering (Burkina Faso)

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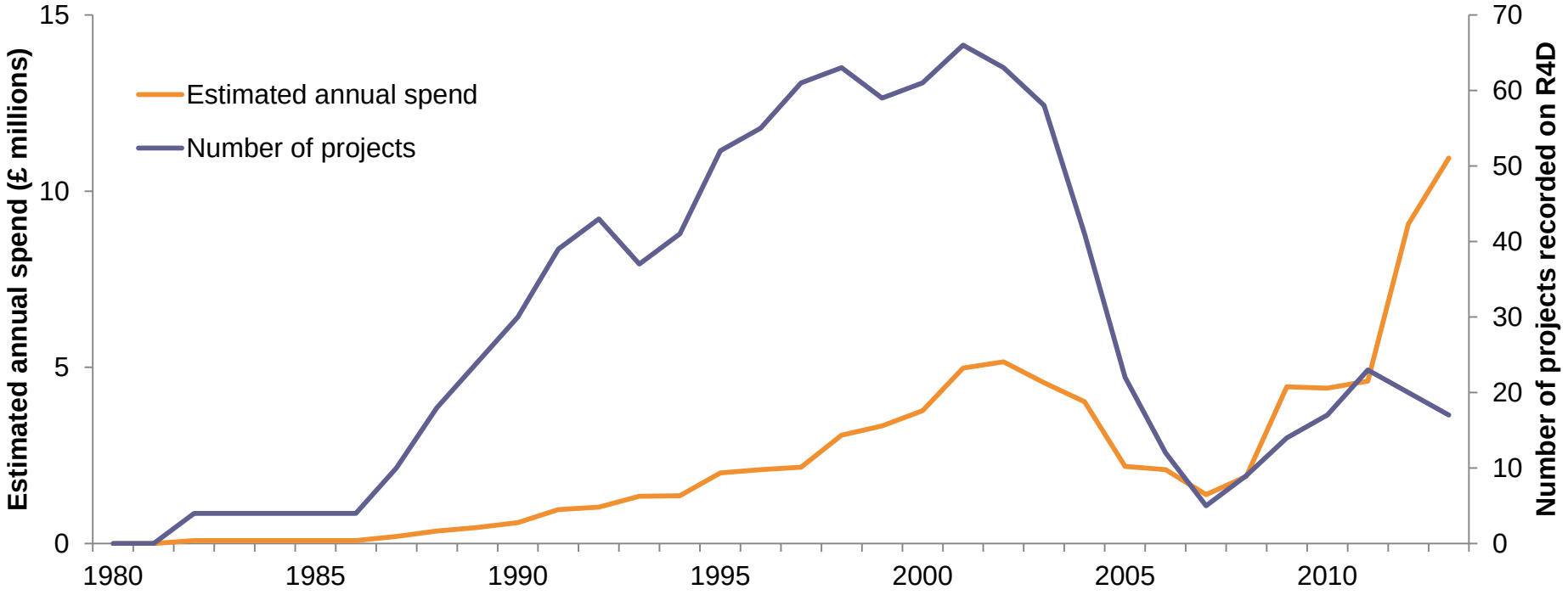
Estimated DFID RED spend on WASH

Spend on WASH infrastructure research has increased to almost £11 million p.a.



Water

£19m of new WASH research approved since May 2013

- Continuation of sanitation and hygiene funding
- Waste water/poor drainage and linkages to water supply
- Water use (particularly industrial water use) and growth

Imminent Pipeline

- Off-track Sanitation & Hygiene - Pro-poor sanitation, nutrition, improving efficiency of national investment programmes and linkages to violence against women and girls and education.
- Transformative market based models and behaviour change for low income household needs

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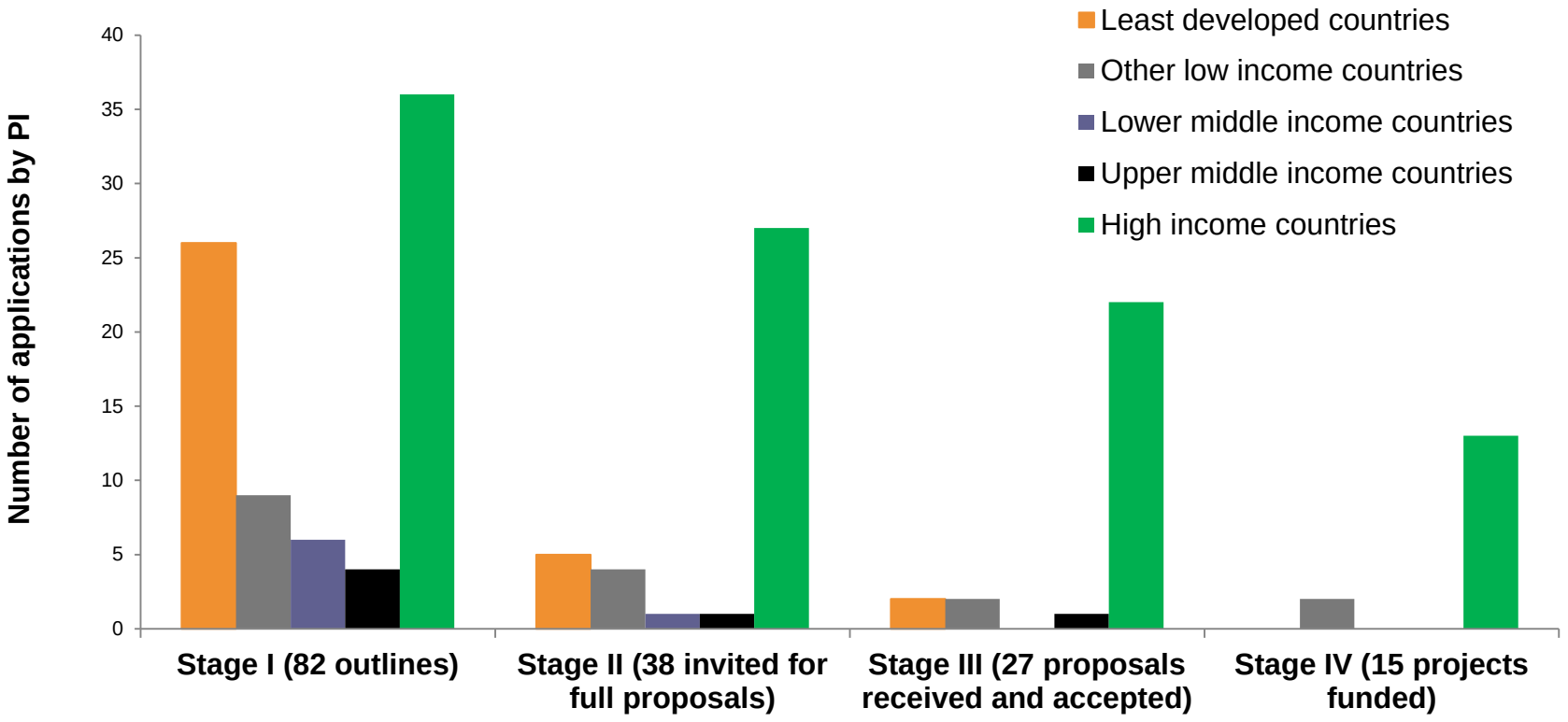
Funding call analysis: DFID-NERC-ESRC “Unlocking the Potential of Groundwater for the Poor” (UPGro) Programme



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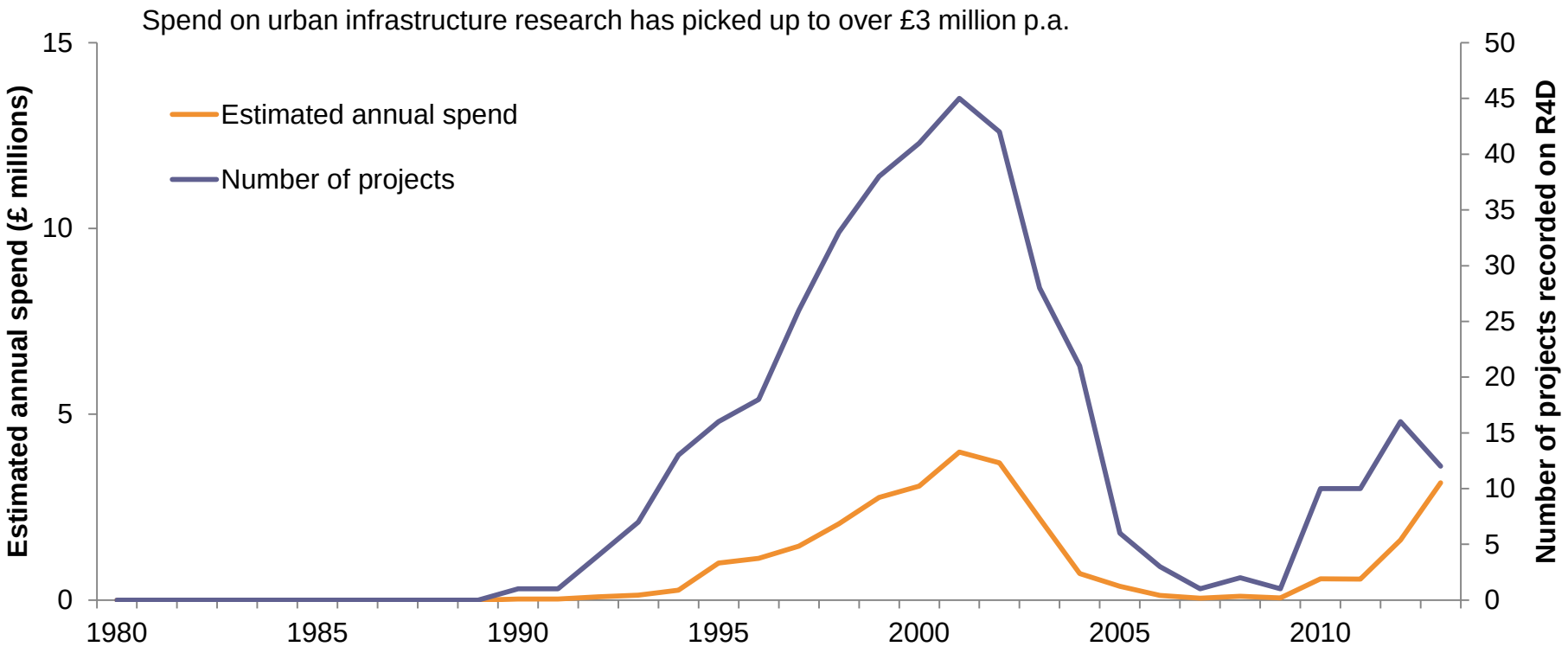
Estimated DFID RED spend on urban infrastructure



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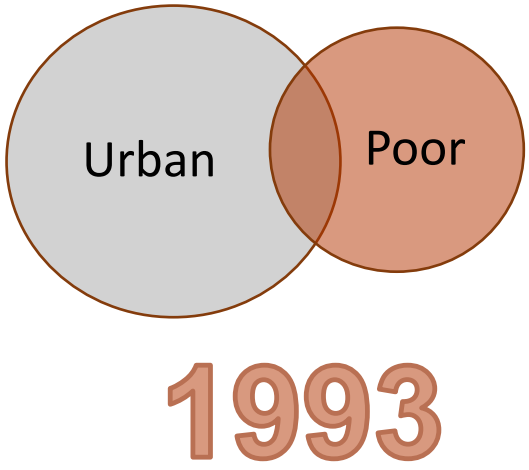
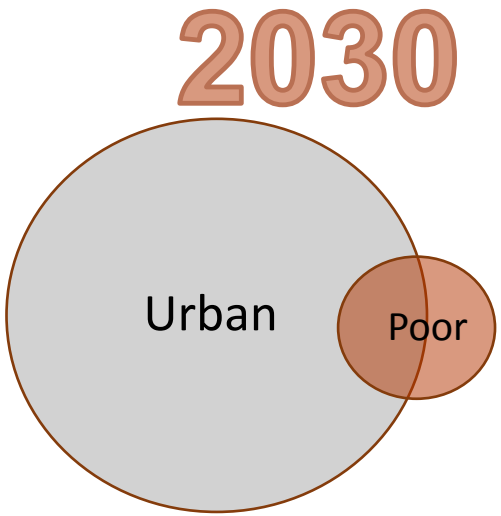
Urban

- Traditionally embedded in programmes in other sectors, such as health, education, etc. (e.g. Water & Sanitation for the Urban Poor);
- A few small research projects (e.g. Future Proofing Cities);
- But in the past, 'urban' hasn't received sustained funding at scale as a discreet theme, although now have developed two projects: Spatial Knowledge Partnership; and Future Proofing African Cities for Sustainable Growth.





Year	Urban	$1 poor	Urban AND $1 poor
1993	38.0%	28.0%	5.0%
2030	60.0%	8.0%	3.1%

**population share of current LICs & MICs*

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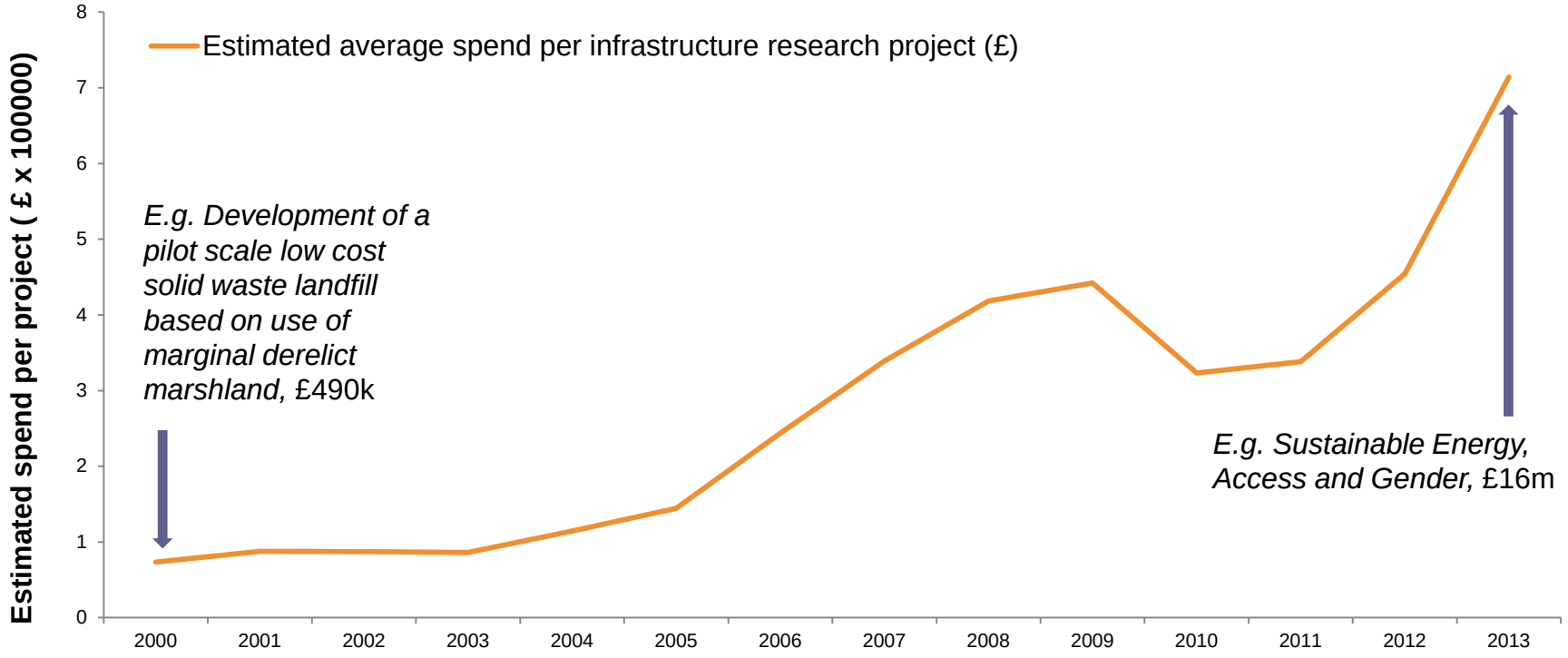
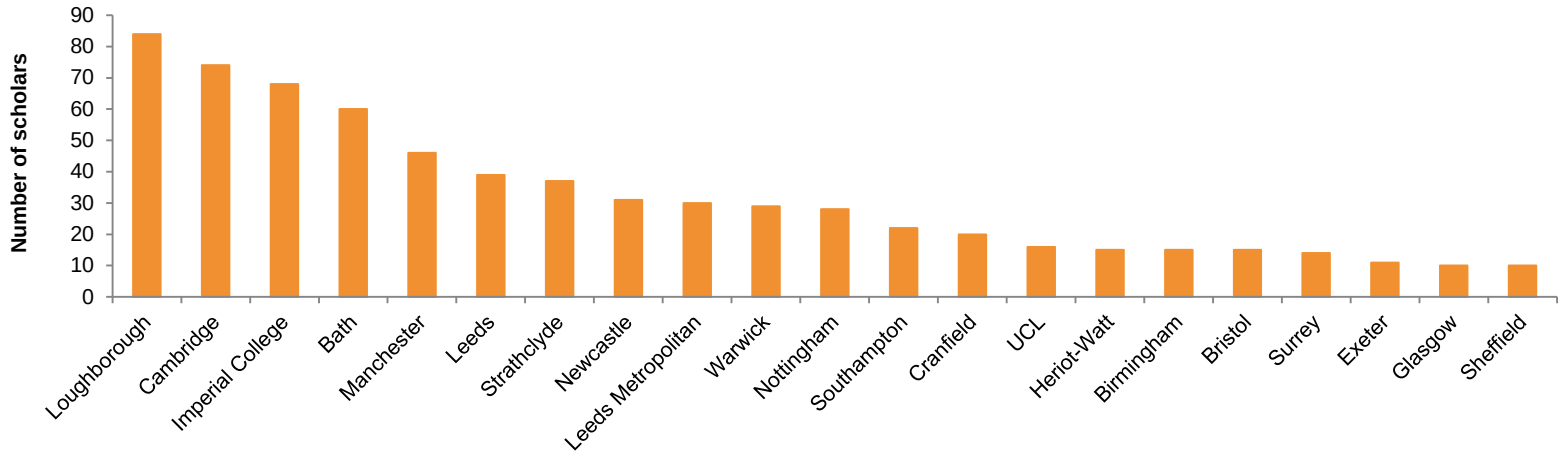
Changes to the estimated average spend per infrastructure research project since 2000

Infrastructure research projects are becoming larger and more multidisciplinary, integrating engineering with physical, natural and social sciences



Commonwealth Scholars choose similar universities to those highlighted in qualitative scoping

Number of Commonwealth Scholars in engineering by institution since 2000 (only institutions which have hosted >10 scholars are shown)



Notable omissions include the Universities of Oxford, Durham and Sussex, which were highlighted as leading institutes in discursive feedback from interviewees.

Sectoral Differences

- Consultants/consultancies play a greater role in transport research than other sectors
- UK WaSH research capacity has declined over time with a small number of key researchers focusing on development in wider departments
- Energy seems to be the sector with the most UK capacity and momentum at the moment
- Research engagement strong from India, China and some countries in Africa primarily Ghana, Kenya and South Africa

Royal Charter - 2003 (replacing Founding Charter of 1993)

The objects for which the Council is established and incorporated are:

- **to promote and support**, by any means, **high-quality basic, strategic and applied research** and related **post-graduate training** in engineering and the physical sciences;

- **to advance knowledge and technology (including the promotion and support of the exploitation of research outcomes**), and provide trained scientists and engineers, which meet the needs of users and beneficiaries **thereby contributing to the economic competitiveness of Our United Kingdom and the quality of life**;

- in relation to the activities as engaged in by the Council under (i) and (ii) above and in such manner as the Council may see fit:
  - **to generate public awareness**;
  - **to communicate research outcomes**;
  - **to encourage public engagement and dialogue**;
  - **to disseminate knowledge**; and
  - **to provide advice**.

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Some Immediate Thoughts

- Many of the challenges we face are global and the solutions require international collaborative effort
- The UK punches above its weight as a research nation
  - Field-Weighted Citation Impact ranking of UK Engineering has increased from 3rd to 2nd
- EPSRC has a “best with best” strategy on international collaborations with targets being BRIC countries, USA, Japan and European union
  - Support is through investigator-led research and managed interventions

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Some EPSRC Investments Relevant to Development

- Understanding sustainable energy solutions
- Water and waste management (clean water for all)
- Understanding seismic waves
- E-waste management and recovery

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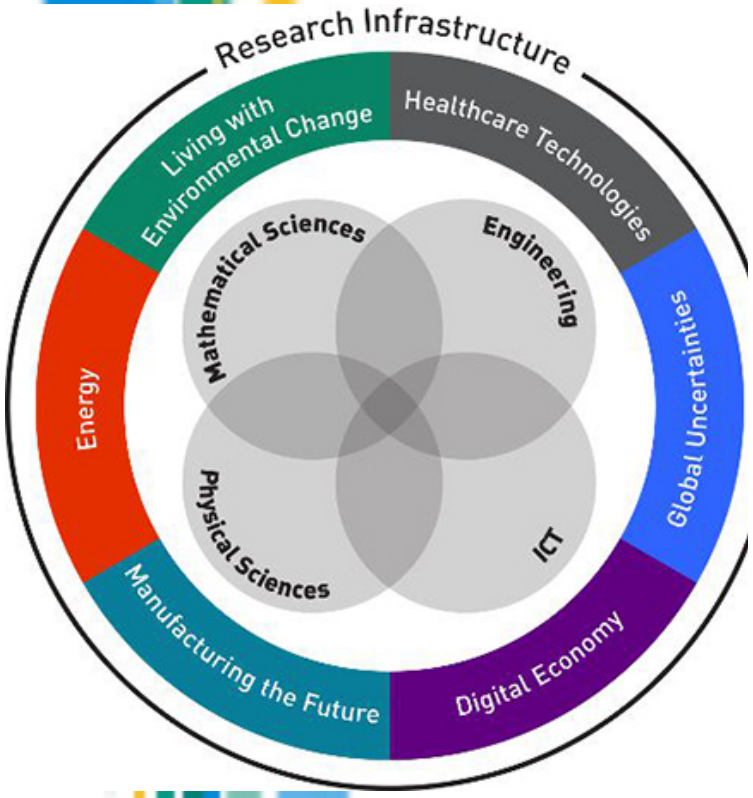
Engineering at EPSRC



£3.3 billion portfolio of research and training 5,500 researchers and over 9,000 PhD students

- To contribute to future UK prosperity:
  - supporting long-term and ambitious research
  - mobilising engineering leadership
  - shaping the portfolio in relation to national need
- Engineering research supported by EPSRC:
  - **can be** discovery-led; industry-inspired; societal-based
  - **must be** long-term with the potential to transform thinking and add to knowledge

What is needed for EPSRC to fund a project

Criteria	Assessment	Weighting
Research Quality	Degree of excellence – novelty, timeliness, ambition, adventure, transformative aspects, appropriateness of methodology etc.	Primary
National Importance	How the research: • Contributes to the health of other research disciplines • Addresses key societal challenges • Enables UK economic success or emerging industry • Establishes / maintains a world leading research activity • Complements other UK research activity • Relates to our research area(s) and strategic actions	Secondary (Major)
Impact	In relation to the pathways to impact: • How realistic are the impacts identified for this work • Effectiveness of planned activities • Relevance / appropriateness of beneficiaries or collaborators	Secondary
Resources and management	Effectiveness of planning and management, appropriate resources, viability of equipment access	Secondary
Applicant(s) ability	Ability to deliver the proposed project: track record, balance of skills.	Secondary

National Importance relates to the extent over the long term to which the research project:

- contributes to (or underpins other research that contributes to) addressing important UK societal challenges, economic success or the development of emerging industry;
- establishes or maintains world leading research activity; and
- complements other funded research in the UK (including the published strategies set out for the EPSRC portfolio).

→ Reviewers focus on **why** it is important for the research to be supported by the UK taxpayer.

Impact is the demonstrable contribution that excellent research makes to academia, society and the economy.

Pathways to Impact are the specific activities that will happen during a research project to accelerate realising impact from the research. Remember: funds can be requested for this.

→ Reviewers focus on **how** accelerate routes to realising impact will be accelerated: who are the potential beneficiaries and how might the activities enable them to benefit?

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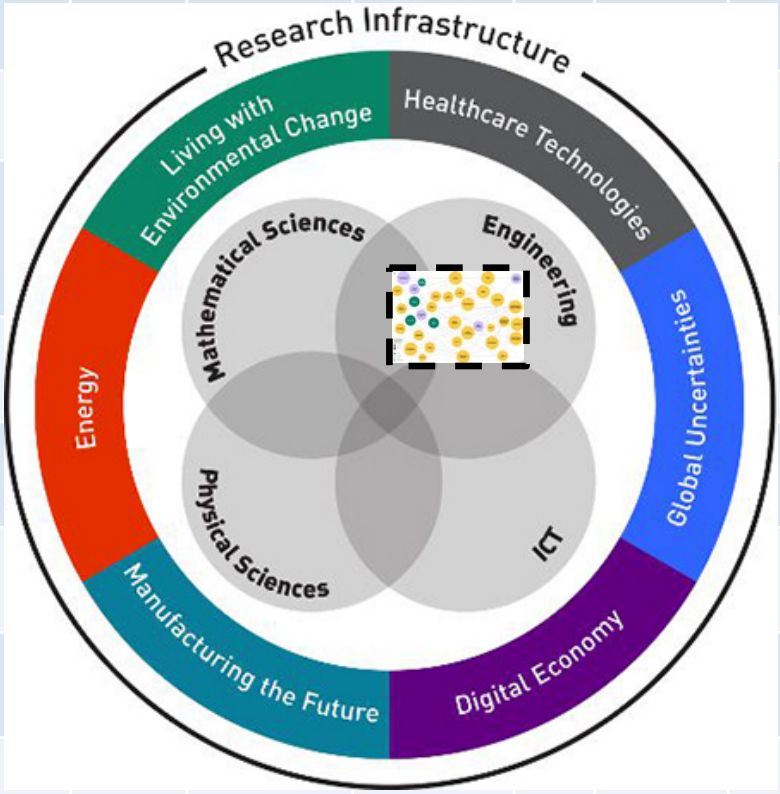
The Wider UK Context

	Aerospace	Automotive	Construction	Education	Information Economy	Life Sciences	Nuclear	Offshore Wind	Oil & Gas	Professional & Business Services	Renewables
Big Data											
Space											
Robotics & Autonomous Systems											
Regenerative Medicine											
Synthetic Biology											
Energy Storage											
Advanced Materials											
Agri-science											



Scoping: Engineering Grand Challenges

- Complex systems - building certainty in a hyper-connected word
- Supra-structures - designing the deployment of optimised connected infrastructures for information, utilities, food, materials and people
- Big data for engineering futures;
- Responsible design across scales – products and systems
- Personalised engineering – bespoke engineering revolutionising design and manufacturing processes;
- A systems engineering approach to controlling cells – engineering cellular feedback for robustness, reliability and performance
- Engineering in policy-making and society as a cross-cutting theme

Taking the Challenges Forward

- Builds on the RAEng Global Grand Challenges Summit
- Working with Strategic Advisory Team to finalise content
- Will inform an investment activity in 2014/15 and EPSRC thinking ahead of the anticipated Spending Review
- Aim to stimulate creative thinking and solutions to the challenges
  - *Interconnected systems* - challenges may need generic solutions informed by specific situations or constraints
  - Stimuli can come from anywhere – but must result in new knowledge and benefit must accrue to the UK

Final Thoughts

- UK Engineering is experiencing a renaissance – we are very well placed to respond to the UK Government's industrial strategy and growth agenda
- Yet there are challenges – perceptions amongst the young and diversity issues at all stages
- EPSRC has an "excellence with impact" agenda, framed by its Royal Charter and strategic plan
  - Interested in an open discussion on International Development Research balancing various drivers and tensions