Engineering and Physical Sciences
Research Council

EPSRC
Investing in research for discovery and innovation

EPSRC – Research Funding Landscape

Kathryn Magnay, Head RCUK Energy Programme

Contents

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- EPSRC Delivery Plan
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- EPSRC Strategies
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  - Leaders,
  - Impact
  - International
- Energy Programme Priorities
- Nuclear Fission portfolio
- Questions
- Breakout session

Strong economies are science economies

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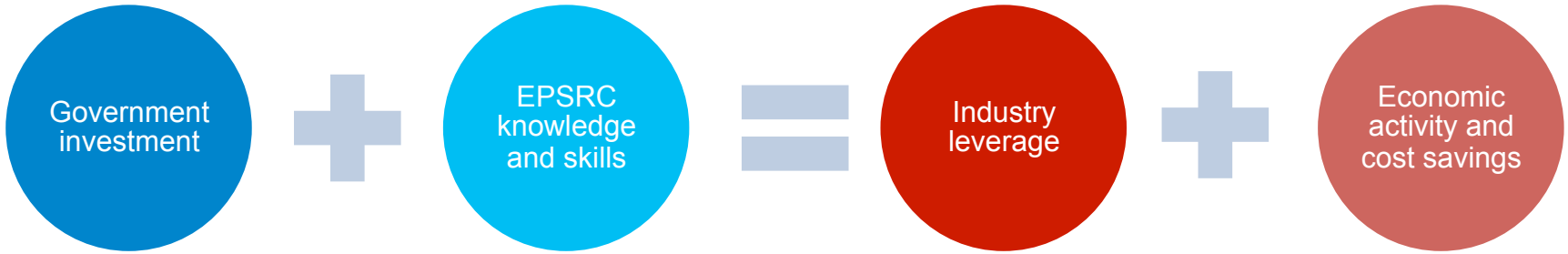
EPSRC is the most effective means of delivering a world leading, innovative research base that can help build a productive, healthy, connected and resilient nation.

- Annual budget of ~**£900 million** invested in research and training
- Annual leverage of ~**£230 million** from industry, charities and other public sector organisations
- Estimated return on investment of **~£10 billion** based on £1 generates £9.6

EPSRC is an efficient and flexible organisation, delivering added value as the partner of choice.

- Less than **2%** of budget spent on administration and programme delivery



EPSRC Allocation and Delivery Plan

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		16/17	17/18	18/19*	19/20*	20/21*	Total SR15
AHRC	Resource Total	101	101	99	98	-	398
BBSRC	Resource Total	353	356	350	347	-	1,406
	World Class Labs Capital	64	66	*53*	*58*	*58*	241
EPSRC	Resource Total	807	796	790	783	-	3,176
	World Class Labs Capital	52	52	*52*	*54*	*54*	211
ESRC	Resource Total	155	157	154	153	-	618
	World Class Labs Capital	28	26	*21*	*17*	*12*	92
MRC	Resource Total	581	594	597	594	-	2,367
	World Class Labs Capital	33	33	*34*	*47*	*50*	147
NERC	Resource Total *Of which the ALI Partition*	291 *30*	294 *30*	290 *30*	288 *30*	-	1,163 ***118***
	World Class Labs Capital *Of which the ALI Partition*	40 *7*	39 *7*	*35* *7*	*31* *7*	*31* *7*	144 ***28***
STFC	Resource Total	388	396	406	414	-	1,603
	World Class Labs Capital	124	117	*123*	*114*	*115*	479
	Resource Total	**2,676**	**2,694**	**2,686**	**2,676**	-	**10,732**
	World Class Labs Total	**341**	**333**	**318**	**321**	**320**	**1,313**

- Delivery Plans published on 4th May

* Indicative only.
Totals may not add due to rounding.
The SR15 period is from 2016/17 – 2019/20.

EPSRC central to UK prosperity

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RESEARCH COUNCILS
RCUK
AHRC
BBSRC
ESRC
MRC
NERC
STFC

GOVERNMENT DEPARTMENTS
BEIS
DECC
HO
DoH
DfT
MOD

UK PROSPERITY

ACADEMIA
University partners
Learned societies
Professional bodies

INDUSTRY
Innovate UK
Leadership Councils
Strategic Partners

The outcomes framework

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The Outcomes framework provides

- an **exciting, strategic expression** of our plans which captures our value-add to the nation
- contextual opportunities for **seeking additional funding from government**
- a **framework to help researchers** to think about their contribution to national and global challenges and to stimulate collaboration

It is **NOT** intended to tightly prescribe research activities

We continue to welcome long-term discovery-led research

See:
https://www.epsrc.ac.uk/newsevents/news/deliveryplanupdate/outcomesandambitions/

Delivery Plan Outcomes in the context of the research landscape

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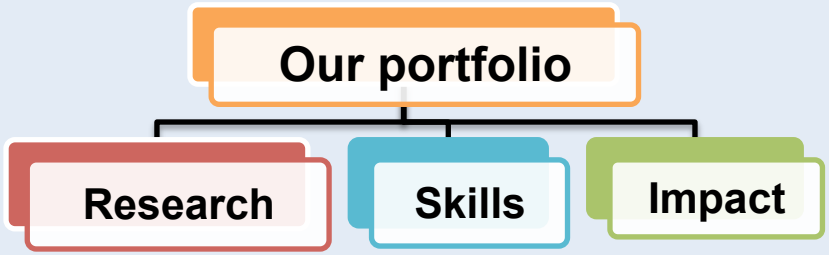
UK PROSPERITY

WORLD CLASS LABORATORIES

INSTITUTES
Alan Turing
Physical Sciences
Royce
UKCRIC

UK RESEARCH AND INNOVATION

GLOBAL CHALLENGES RESEARCH FUND



STRATEGIES
Balancing capability
Building leadership
Accelerating impact

Resilient nation – adaptive, prepared, protected, secure, safe and sustainable

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Safeguarding opportunities for future generations requires an ability to anticipate, adapt and respond to changes, natural or man-made, short or long-term, local or global. UK prosperity depends on the smooth and sustainable functioning of complex infrastructures: transport; communications networks; water, energy and waste utilities.

Engineering, mathematics, ICT and physical sciences are fundamental to the new thinking and innovation needed to build a truly resilient nation and increase UK competitiveness. .

- **R1: Achieve energy security and efficiency**
- **R2: Ensure a reliable infrastructure that underpins the UK economy**
- **R3: Develop better solutions to acute threats: cyber, defence, financial and health**
- R4: Manage resources sufficiently and sustainably
- R5: Build new tools to adapt to and mitigate climate change

Productive nation – creative, innovative, competitive economy

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The future competitiveness of the UK economy requires the successful development of world leading products, processes and technology based on the discovery and innovation in the engineering, ICT, mathematical and physical sciences.

- **P1: Introduce the next generation of innovative and disruptive technologies**
- P2: Ensure we have affordable solutions for national needs
- P3: Establish a new place for industry that is built upon a ‘make it local, make it bespoke’ approach –
- **P4: Driving business innovation through digital transformation**
- **P5: Transform to a sustainable society, with a focus on the circular economy**

Connected nation – surviving and thriving in a digital world

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The UK's success will be driven by whole new industries and services, as yet unimagined, as well as new, more cost effective ways of delivering existing services through the development of transformational technologies to connect people, things and data together, in safe, smart, secure, trustworthy, productive and efficient ways.

This will be a major driver of economic growth and efficiency across all regions and sectors of the UK. This will rely on discovery and innovation in mathematical sciences, computing, engineering and physical sciences and is essential to the continued delivery of a knowledge economy.

- **C1: Enable a competitive and data driven economy**
- **C2: Achieve transformational development and use of the Internet of Things**
- C3: Deliver intelligent technologies and systems
- **C4: Ensure a safe and trusted cyber society**
- C5: Design for an inclusive, innovative and confident digital society

Healthy nation – improved quality of life through better mental and physical health

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Our health is our state of mental and physical wellbeing and impacts on our quality of life, the resilience of communities and the productivity of the nation. Advances based on new research in the Engineering and Physical Sciences will revolutionise our ability to manage our own health, help us to maintain healthier behaviours and environments and transform the way care is delivered.

Novel technologies and materials, along with improved understanding, will continue to improve our ability to predict, diagnose and treat disease. Research will deliver better quality of life, higher standards of affordable care and will drive UK growth through new products and services.

- **H1: Transform community health and care**
- **H2: Improve prevention and public health**
- H3: Optimise diagnosis and treatment
- H4: Develop future therapeutic technologies
- H5: Advance non-medical interventions

Delivery Plan Framework

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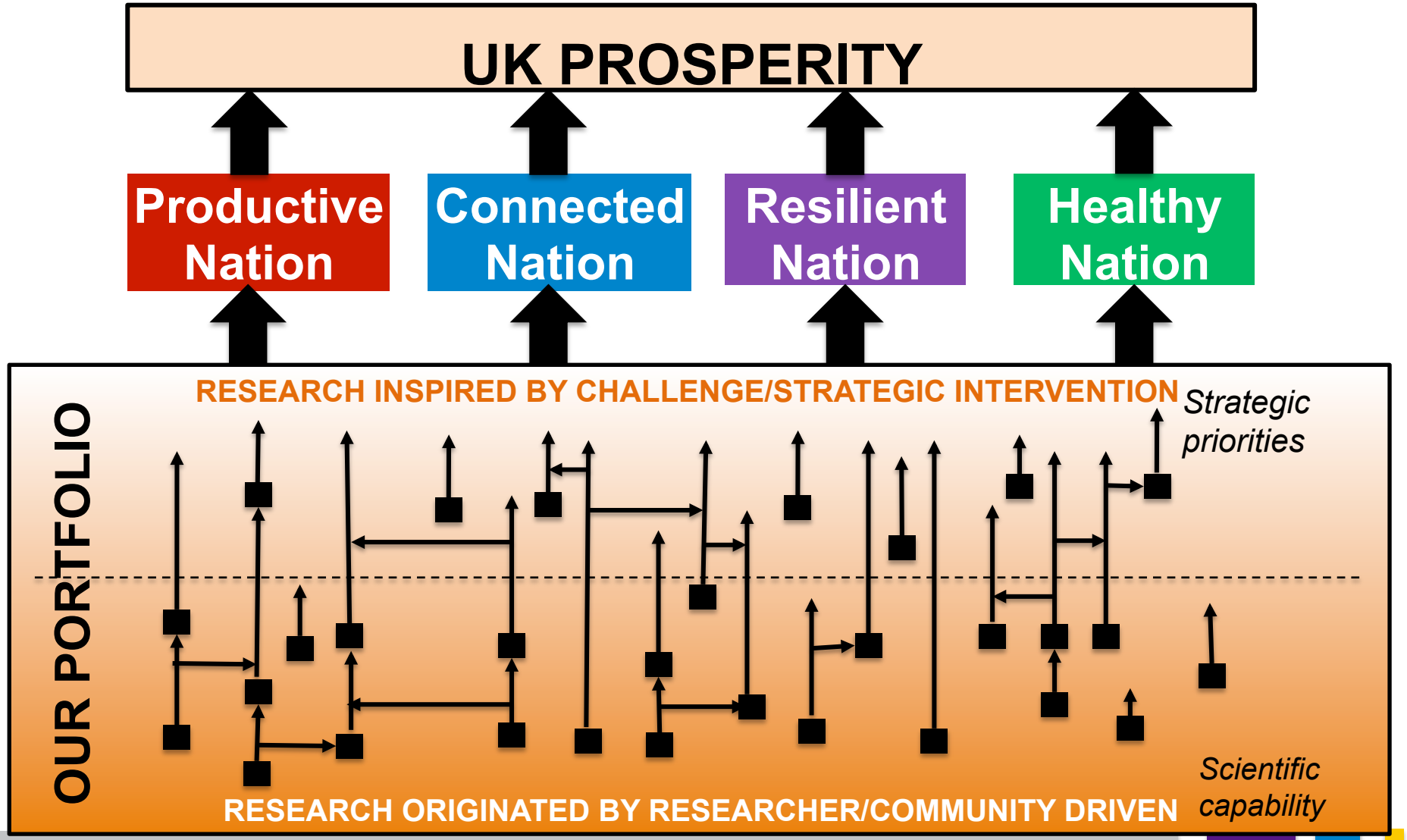

60% community driven ideas

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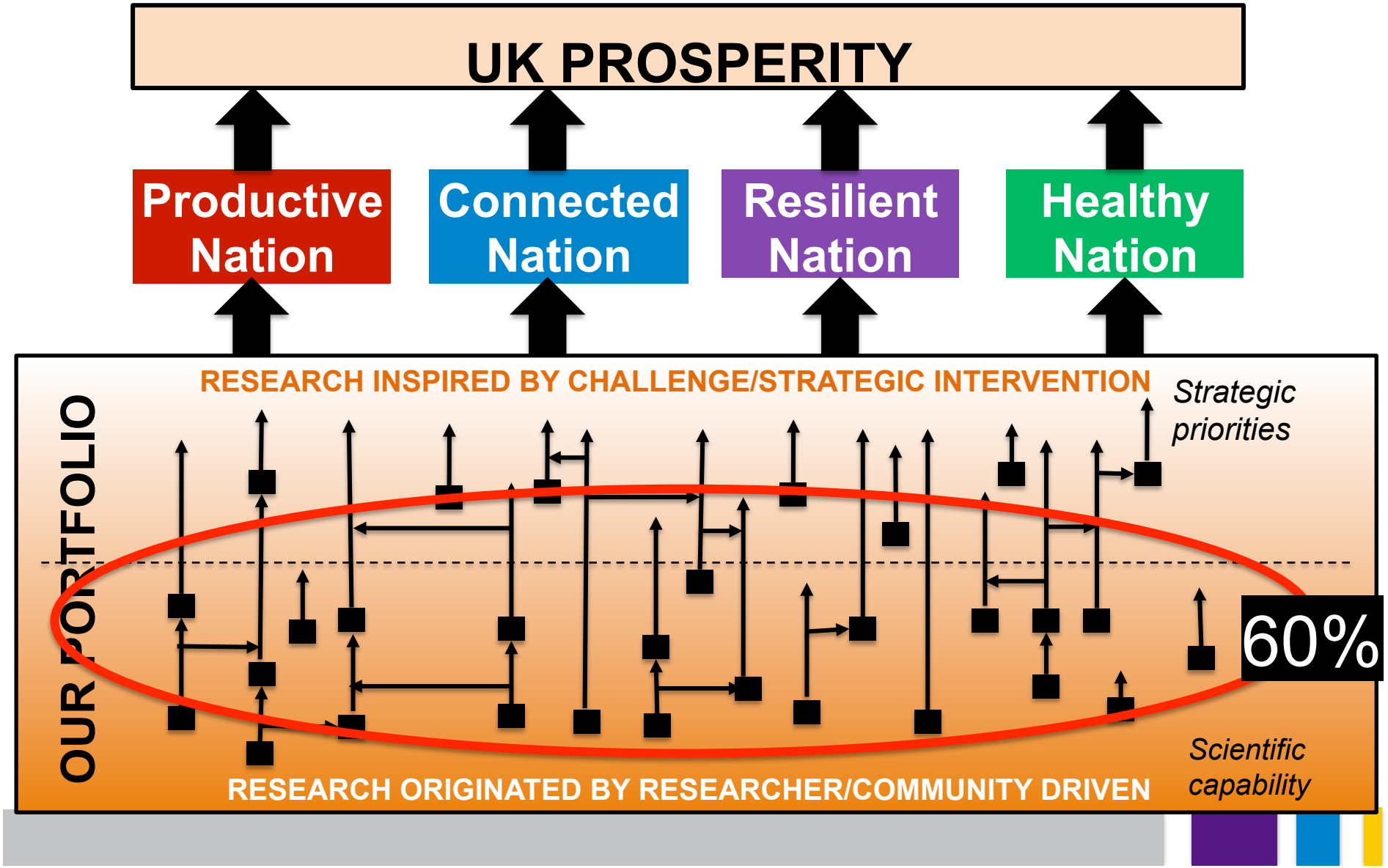

In Energy…

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- EPSRC Energy theme has operated solely by managed calls for a number of years
- Energy research needs to engage a multidisciplinary community including expertise that is outside EPSRCs core disciplines
- As a challenge theme the focus has been on user needs – industry and policy

- EPSRC recognise that the status quo needs to change to ensure the continued participation of our whole community
- A range of options are being considered

- Short term plans - Currently planning to launch a call for feasibility studies in energy

EPSRC Strategic Vision

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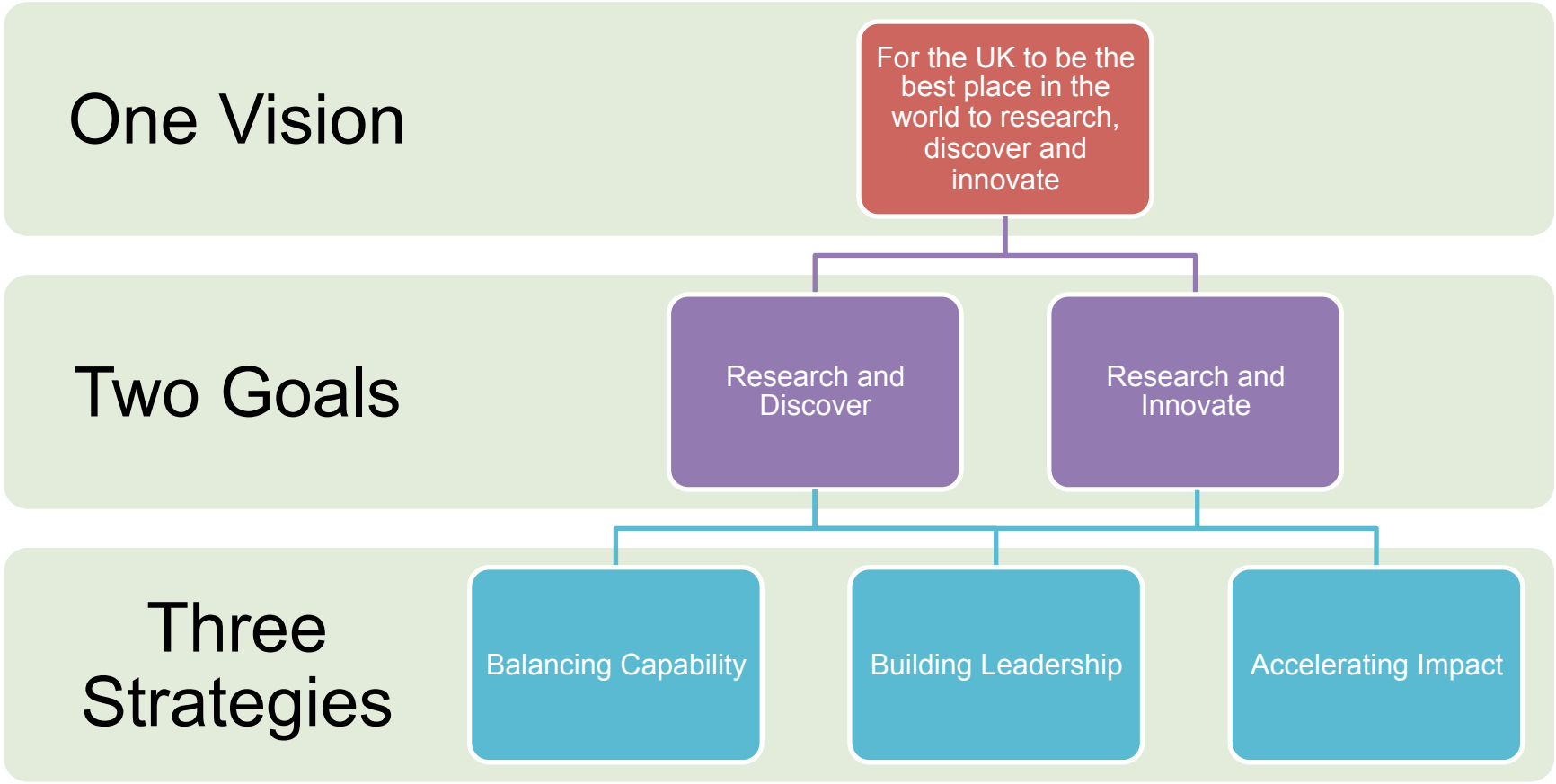

Why Balancing Capability?

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- It is not realistic for the UK to aim for world leadership in every scientific field and every sector, and this implies some element of choice on priorities*.

- While the UK punches above its weight to deliver increasingly high-quality research outputs, it may not be possible to sustain its position as a world-leading research nation without an increase in investment.

- To maintain the UK's global research standing in light of increasing international competition, and with limited funding available to us, we must focus our investments to remain internationally leading in areas that are of long-term strategic importance to the UK.

- This will ensure that the country's international standing is maintained and enhanced within a competitive international research environment.

*BIS Analysis Paper Number 3, Insights from international benchmarking of the UK science and Innovation system, Tera Allas (2014)

Balancing capability

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- Goal of Strategy:
  - Balancing capability's goal is to align our portfolio to areas of UK strength and national importance.
  - Aiming to maintain the UK's international research standing in the face of increasing competition

- Aims for the next Delivery Plan are to:
  - Continue prioritising at the research area level;
  - Articulate EPSRC's ambitions in relation to the *Prosperity Outcomes* so that the community can identify where they can contribute;
  - Incorporate the training landscape into our research area strategies;
  - Give a stronger voice to businesses by engaging them in our strategy development as part of 'national importance';
  - Identify synergies within our current portfolio to ensure we obtain the best outputs from our investments.

Balancing Trajectories

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Nuclear Fission Research Area

Nuclear Fission power generation including waste clean-up, decommissioning, regulation, public acceptability, existing operations, new nuclear build, advanced reactor technology, fuel cycle and geological waste disposal.

Proposal to maintain investment relative to the EPSRC portfolio

Proposed Strategic Focus

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Nuclear materials is an underpinning theme

UK research community continue to build on strong academic-industrial links with NNL, NDA and other industrial partners.

There are a number of key challenges that should be addressed over the next delivery plan including but not limited to:

- Addressing the challenges of new build (Gen IV) as they emerge including incorporated planning for decommissioning, fuel reprocessing and waste.
- Developing fundamental research into the implementation of safe, cost effective decommissioning, clean-up and waste disposal of existing nuclear sites, facilities and legacy
- Maintaining capability in internationally recognised UK strength areas such as decommissioning, waste management and fuel reprocessing.
- In conjunction with industry underpinning the fundamental research needs of the current reactor fleet during operation and decommissioning.
- Supporting the supply of a diverse and skilled research base, and maximising impact in academia and industry through close links with users.
- Engaging internationally with key countries, including Japan, USA and India, who share UK research needs, either as a knowledge customer or a supplier.
- Engaging with infrastructure investments and requirements through the National Nuclear User facilities.

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Further layers of detail...

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NIRAB recommendations - Priority research areas:

- Future fuels
- 21st century advanced nuclear manufacture
- Advanced reactor design
- Recycling and reprocessing fuel for future reactors
- A strategy toolkit

TINA recommendations:

- Construction, Installation and Commissioning (New build)
- Decommissioning
- Waste management, reprocessing, storage

EPSRC independent review on fission and fusion:

- A strategy to mitigate the risks of possible developments and outcomes
- National policy needs to be clarified

Priority research areas: Waste management and decommissioning, materials, fuels, reactor engineering and modelling

GO Science statement of research needs – broader understanding including market barriers and role of nuclear in other markets, e.g. heat

Further layers of detail...

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Community Meeting

Community identified priority areas:

- Materials
- Fuels and Cladding (as a subset of materials)
- Fuel Reprocessing
- Decommissioning, disposal and waste
- Cross cutting issues, e.g. instrumentation, remote sensing, operations support

Key research challenges in each area identified:

- Identifying materials that can survive high temp, high displacements per atom and high gases
- Low activation materials
- Minor actinide fuels
- Demonstration of aqueous fuel reprocessing
- Environmental clean up with smart materials
- Producing a system that can be monitored continually for the duration of its use
- Improved construction capability
- Thermal hydraulics – neutron radiation and hydraulics

Building leadership

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- Our aim is to nurture the most promising and skilled researchers and innovators, enabling them to maximise their contribution within universities, business and other organisations to a prosperous nation

- We will
  - Increase diversity in our portfolio and governance structures
  - Identify new ways of encouraging innovation through people
  - Support a balanced portfolio of routes to doctoral training
  - In partnership with universities
    - Develop an active approach to the management of early careers
    - Explore postdoctoral career development

In Energy…

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- CDTS
  - Mid term review starting
  - Preparations for the next round of CDTs will start after mid term review
- Fellowships
  - Encouraging fellowship applications across the energy portfolio
- Energy critical mass investments
  - Leadership opportunity
  - Build capability of a community
  - Flexible use of funding – helps retention and career planning
  - Influencing ECRs
- Diversity
  - broadly the Energy community is not gender diverse
  - We are addressing gender diversity in governance structures
  - Considering how to increase gender diversity in our portfolio

Accelerating impact

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- Our aim is to enable and accelerate the pace of impact from the research portfolio supported by EPSRC by enabling the partnerships and linkages that can support research outcomes having an impact in business, society and policy

- In 2016/17 we will
  - Continue to embed impact in our portfolio through Pathways to Impact
  - Refresh the portfolio of Impact Acceleration Accounts
  - Identify new ways of encouraging innovation through people including looking at engagement with the Catapult network
  - Look to review our public engagement support

In Energy…

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- User-led research, co-creation of research projects
- Maximising impact
- Ensure the community have the connections they need to users – industry, policy makers, regulators

EPSRC international strategy

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- Our aim is to enable every EPSRC sponsored researcher (from student to principal investigator) to collaborate with the best researchers from across the world where it adds value to the research they are undertaking.
  - UK costs of international collaboration can be included in any grant proposal to us.
  - Collaborators can be from anywhere, subject to the scientific case being made (as judged by peer review).
- Our strategic focus is on enabling collaborations with key partners in US, Europe, China, India and Japan.
- We are working to put in place lead agency agreements with overseas funding organisations where practicable to avoid the double jeopardy of parallel submissions – trials underway/in development with several funders.

EPSRC international – future plans

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- As well as planning our future GCRF and Newton Fund activities, we are currently considering ‘where next’ with our priority countries as part of planning for the new Delivery Plan

- Key questions to consider:
  - Which research areas are of such global importance/size that working with other countries to share risk/cost is a must?
  - Which research areas should we avoid in international engagement so as not to jeopardise the UK’s leading position?

In Energy…

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- Recognise that Lead Agency agreements are not in place for key countries
- Plan to continue supporting international collaboration with India, Japan, US and South Korea via calls for proposals

RCUK Energy Programme Priorities

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- Investment in high-quality**,** inter-disciplinary research to target the **energy** '**trilemma**' of reducing carbon emissions, energy security and affordability
- **Systems Approach:** whole energy systems and integration within the energy system.
- **Understanding Future Energy Options:** Social, governmental environmental and economic implications.
- **Reducing Energy Consumption and Demand:** Development of behavioural, market and technological advances informed by a whole system understanding.
- **Enabling Technologies:** that underpin research across disciplines, e.g. energy storage, materials research; and cross cutting themes, e.g. heat, transport

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Nuclear Fission Portfolio
UKNADM 2016

Louise Anderson
Kate Bowman

Nuclear Fission Portfolio

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Louise Anderson

- Manchester CDT
- LCICG nuclear sub group
- UK-India interaction
- UK-USA interaction
- Nuclear Champion group
- EPSRC InnovateUK interaction
- BWR Steering group
- PACIFIC

Kate Bowman

- Imperial CDT
- NIRAB representation
- UK-Japan interaction
- UK- South Korea interaction
- NNUF lead
- DISTINCTIVE
- RATE EPSRC representation

Neil Bateman: Nuclear Fusion

Nuclear research areas – current portfolio

from April 1st 2015 to April 1st 2016

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Theme	No. of projects	Value (£M)	Change (£M)
Training; CDT, IDC	2	9.3	-
Nuclear systems	10	8.1	- 1.8
NNUF + Nuclear Champions group	1	15.7	-
Safety	2	2.0	-
Fuel	5	7.1	+ 0.9
Decommissioning, Waste Geodisposal	7	13.8	+ 1.8
Environment	3	7.7	-
Materials	14	20.4	- 1.0
Supply Chain	8	1.5	- 0.7
Total	52	85.9	-8.7

Responsive Mode statistics

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Aug 13 to Aug 14

Applications (15)	Value (£)
Authorised: 8	4.4 M
Unsuccessful: 7	2.1 M
53 % success rate by number	67 % success rate by value

Engineering:

Applications (353)	Value (£)
Authorised: 94	32 M
Unsuccessful: 259	109 M
27 % success rate by number	23 % success rate by value

Fellowship statistics

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Aug 13 to Aug 14

Applications (4)	Value (£)
Authorised: 1	0.78 M
Unsuccessful: 3	1.4 M
25 % success rate by number	36 % success rate by value

***Other Research areas*:**

Applications (19)	Value (£)
Authorised: 2	0.8 M
Unsuccessful: 17	7.9 M
9 % success rate by number	9 % success rate by value

International Collaborations

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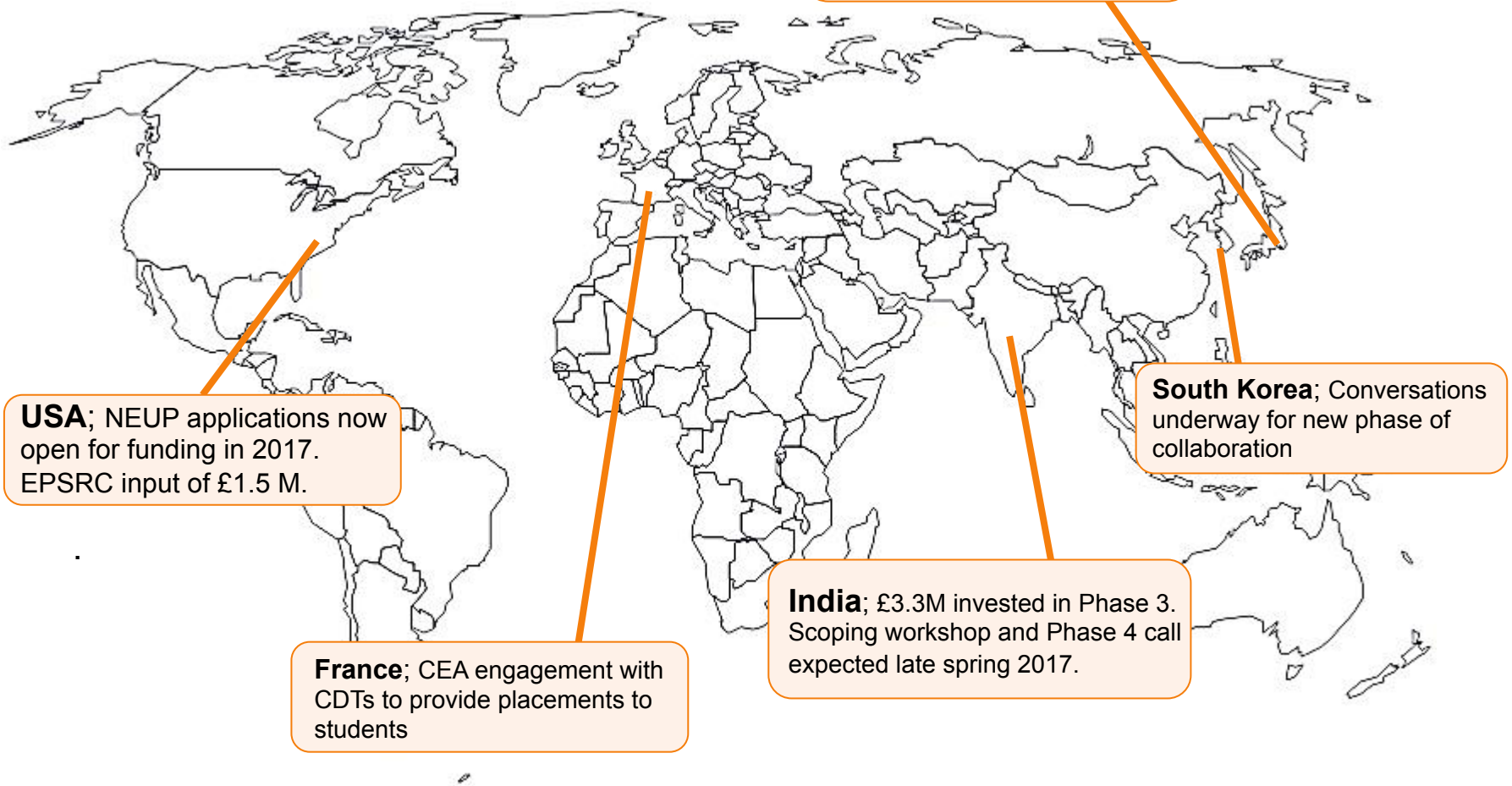

Japan; Phase 3 call completed, announcements shortly. Next stage under discussion at November UK-Japan annual bilateral meeting

USA; NEUP applications now open for funding in 2017. EPSRC input of £1.5 M.

South Korea; Conversations underway for new phase of collaboration

India; £3.3M invested in Phase 3. Scoping workshop and Phase 4 call expected late spring 2017.

France; CEA engagement with CDTs to provide placements to students

Summary of developments

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- **NNUF:** Near final iteration of business case with BEIS. State of funding when released is as yet uncertain.

- **UK-Japan Civil Nuclear Collaboration:** Phase 3 funding decision complete. Phase 4 under discussion for (17/18).
- **UK- South Korea Collaboration**– conversations are underway to discuss a new phase of the collaboration (financial year 18/19)

- **UK-India Civil Nuclear collaboration:** Review meeting of phases 1,2,3 in October 2016, scoping workshop spring 2016, phase 4 commitment proposed end of 2017.

- **UK-US Collaboration:** Current NEUP cycle now open for full applications (check EPSRC/DOE websites). Intention to maintain this collaboration on an annual basis.

- Planning to maintain investment in critical mass activities within the portfolio

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https://www.epsrc.ac.uk/research/ourportfolio/researchareas/nuclearfission/

Questions?

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Outcome framework

60/40

Energy Programme Priorities

Balancing Capability

International strategy

TINA

Government statement of research needs

Fission/Fusion review

NNL Science and technology strategy

NIRAB recommendations

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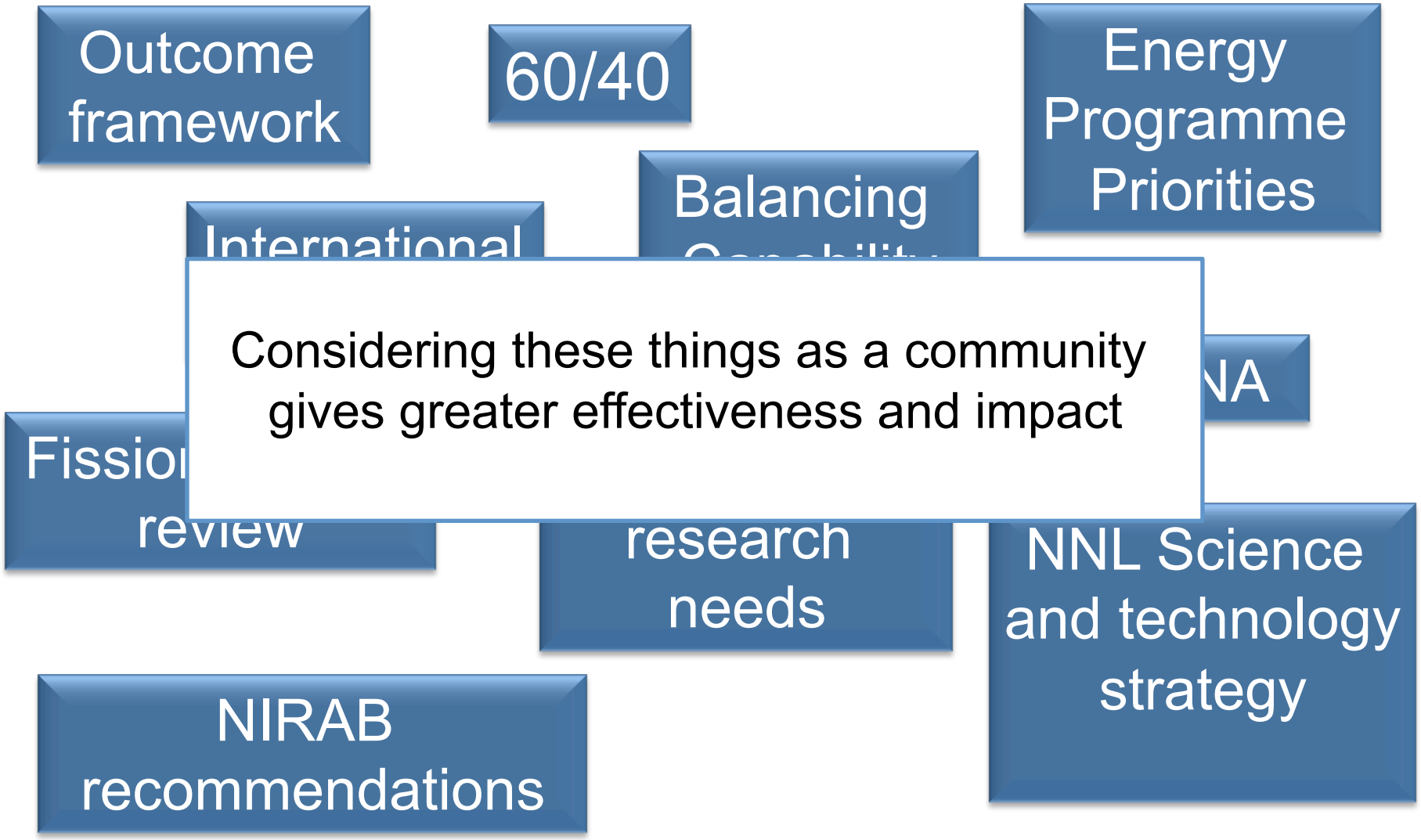

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Outside the framework of a call how does the community:

- Prioritise research topics?
- Work with users to set research challenges for the community to respond to?
- Connect communities?
- Maintain momentum?

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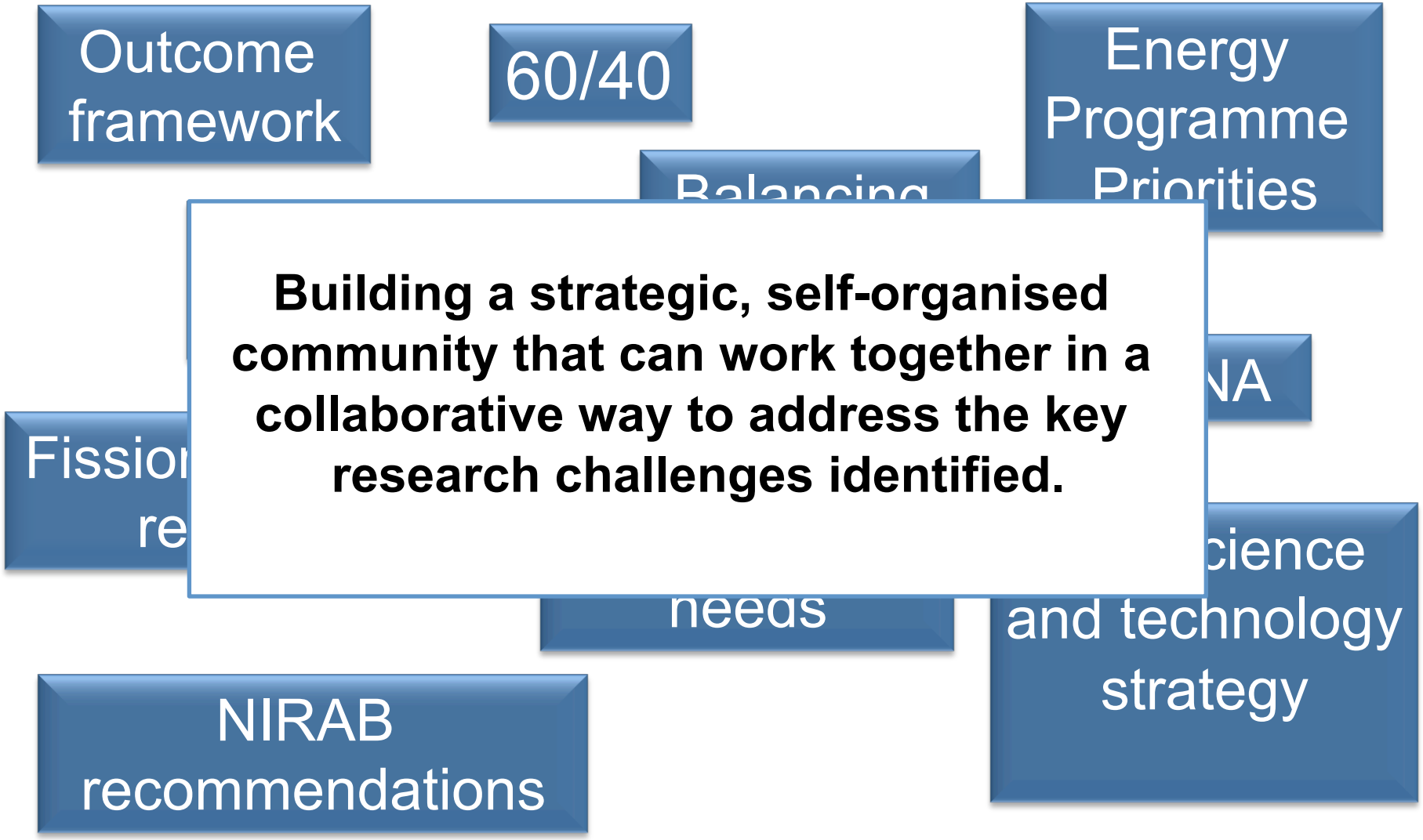

Some ideas…

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- Nuclear Champions
- Networks
- Network plus
- EPSRC organised topic workshops
- Industry/user engagement forum/workshops
- Community building events – to bring in other disciplines
- High Level Group to bring together and advise on networks and critical mass activities

Group discussion

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6 groups,

Networking in the community

What has the effect of the nuclear champions been? What impact have you seen from this investment?

What has been the role of the nuclear champions in setting a strategy for fission research?

Connecting to users of research

How does the community currently connect to industry/research users?

What would the community want to get from links to research users?

Coordination and organisation of Nuclear Fission research

Is there anything missing at the moment in the coordination and organisation of the research community?

Is there anything that the community would like to see more of? (set in the context of limited calls)

Is there a need for greater organisation as a community? What steps can EPSRC take to help the community achieve this?

What does a coordinated, self-organised community in nuclear fission look like?

Additional slides

Current GCRF Call

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- **Tackling global development challenges through engineering and digital technology research**
  - **Closing Date: 16:00** 15 November
  - Up to **£25 million** is available from EPSRC for this call. We aim to support in the region of twenty research projects through this activity.
  - The proposed research must be predominantly in EPSRC remit, although interdisciplinary and/or multidisciplinary proposals are welcomed. Proposals must also be compliant with Official Development Assistance (ODA) guidelines.
  - **Please note that applicants may only be named as Investigator (either Principal or Co-Investigator) on one proposal to this call.**
  - Overseas Co-Investigators from research organisations in low-/middle-income countries - countries on the Development Assistance Committee (DAC) list of the Organisation for Economic Cooperation and Development (OECD) - may be included on proposals through this call.

Current GCRF Call

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- **Tackling global development challenges through engineering and digital technology research**

- Exemplar areas are given under each heading below, but these should not be seen as exclusive. Proposals may also span both headings.

- **1) Tackling global development challenges through engineering research**
  - Sustainable infrastructure development
  - Engineering for disaster resilience
  - Engineering for humanitarian aid

- **2) Tackling global development challenges through digital technology research**
  - Access to digital services
  - Use of data for vital services
  - Secure and trusted digital infrastructures

Recent changes in UK Government

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Greg Clark, Secretary of State for Business, Energy and Industrial Strategy

Justine Greening, Secretary of State for Education

Jo Johnson, Minister for Universities and Science

UK Research and Innovation

Office for Students

Current arrangements

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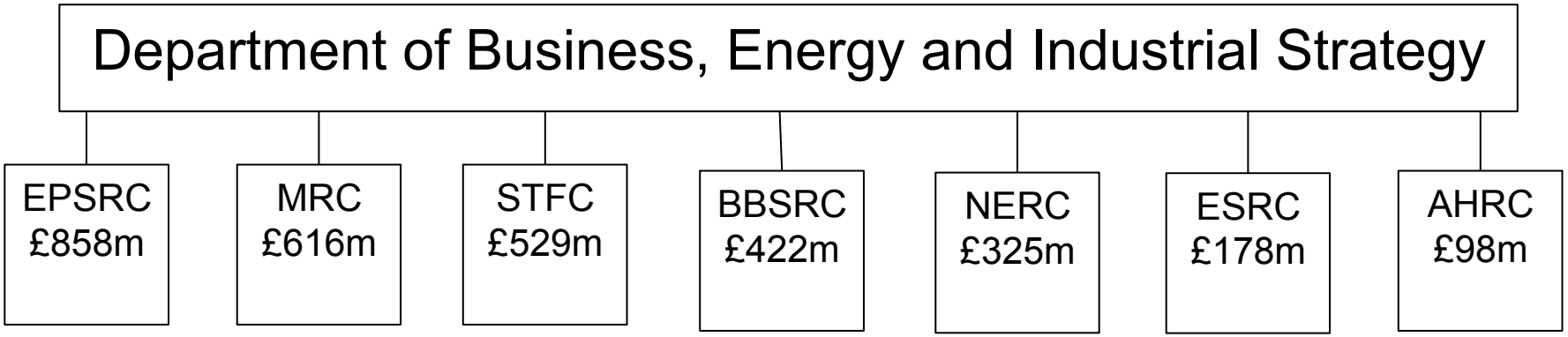

- Royal Charter defines Research Council mission (3 pages)
- Relationship with BEIS defined by Management Statement (54 pages) and Financial Memorandum (28 pages)
- Corporate responsibilities of Council Members defined in Code of Practice (26 pages)
- Total number of staff employed: ~770 Administration; ~450 Programme Support; ~8000 Research Delivery

Higher Education and Research Reform

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White Paper “Success as a Knowledge Economy” and Higher Education and Research Bill – second reading held on 19 July and will not pass to Committee stage

- Proposes the creation of UK Research and Innovation (UKRI) to include the 7 Research Councils, Innovate UK and parts of HEFCE
- UKRI will be a single arms-length body with a single Chief Executive as Accounting Officer
- The current Research Councils will no longer exist in their current form and Royal Charters will be removed
- John Kingman has been appointed as interim Chair of UKRI and will advise ministers on the appointment of its first Chief Executive
- The White Paper restates the Government’s commitment to the Haldane Principle and Dual support

UK Research and Innovation

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Investing in research for discovery and innovation

Department of Business, Energy and Industrial Strategy

UK Research and Innovation (UKRI)

IUK	EPSRC	MRC	STFC	BBSRC	NERC	ESRC	AHRC	QR
£547m	£858m	£616m	£529m	£422m	£325m	£178m	£98m	£1686m

Opportunities

EPSRC
Investing in research for discovery and innovation

- Strengthened strategic thinking and better engagement with policy makers
- Operational policies that are effective, optimised, simplified and common where possible
- Strengthened support for multidisciplinary/interdisciplinary research
- Mechanism of resource re-distribution among Councils to support emerging fields
- Strengthening research council leadership through better support, reduction of bureaucratic interference
- Better coordination with other stakeholders across research landscape

(*In agreement with those identified in the Nurse Review!*)