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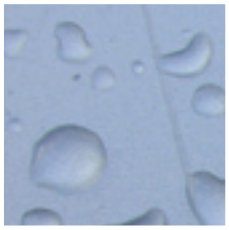
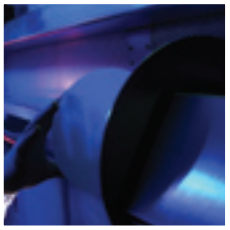
UK Energy Innovation





Introduction

The Energy Research Partnership (ERP) has undertaken a review of the innovation chain for 12 key energy technology areas. It is technologies in these areas that are expected to transform the UK's energy landscape, making dramatic reductions in greenhouse gas emissions whilst maintaining secure access to competitive sources of energy.

The supporting agencies are identified for each area giving a clear picture of the sources of public funding that help move technologies from R&D through demonstration to final deployment. Gaps and barriers in the innovation chain are also highlighted and specific recommendations made to overcome these. The ERP is now looking in detail at the development needs in 100+ more specific technologies and assessing each against a set of criteria to help prioritise RDD&D investment.

In bringing this all together the ERP hope to highlight its recommendations to ensure that the UK will have the technologies available to meet the daunting challenge set by climate change. These are best summarised as:

- Development of a strategic vision for each technology area
- Better co-ordination, with some consolidation, of support along the innovation chain
- R&D to be strengthened and more strongly focussed on market need
- Much stronger joint public/private support for demonstration and early deployment

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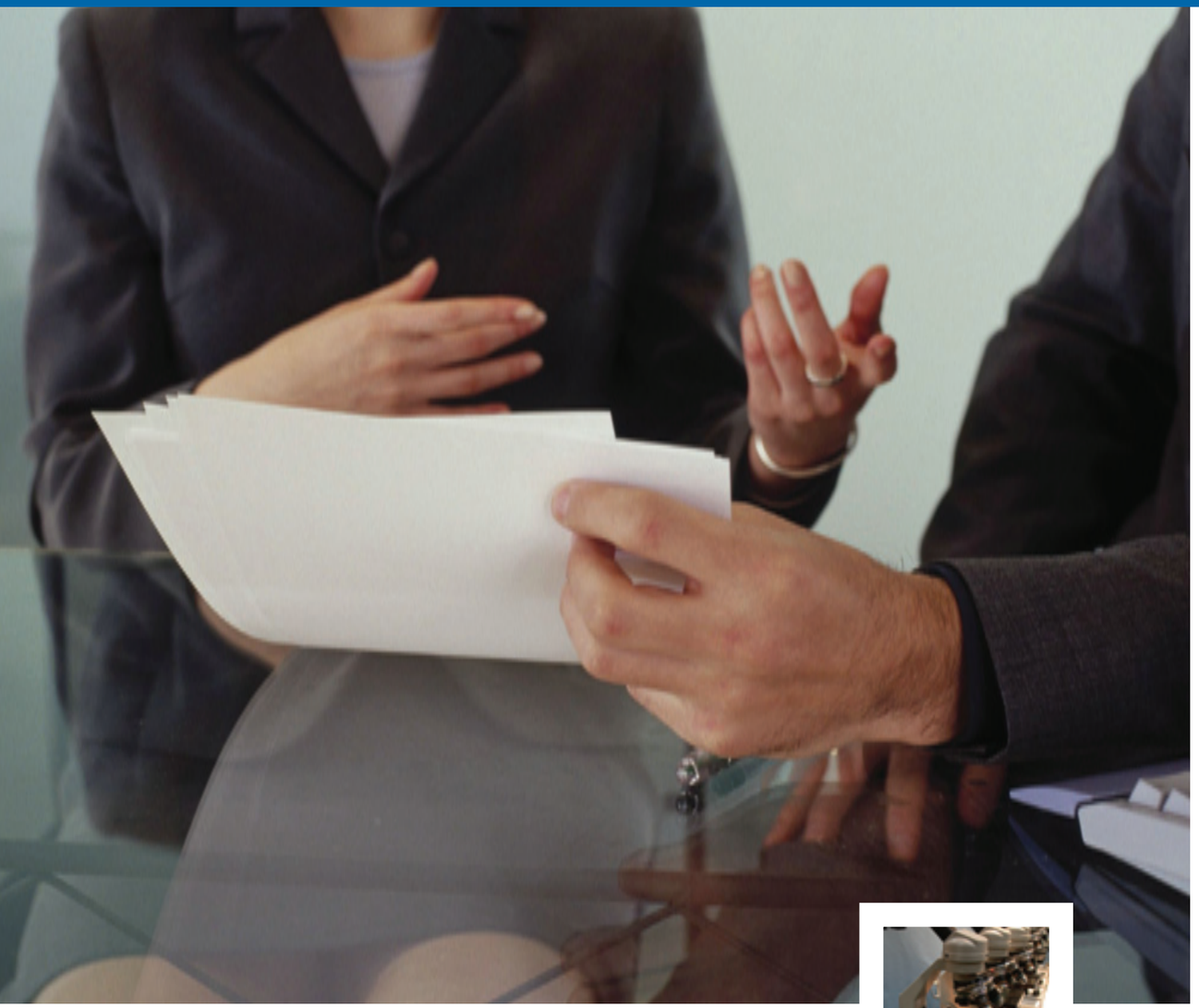
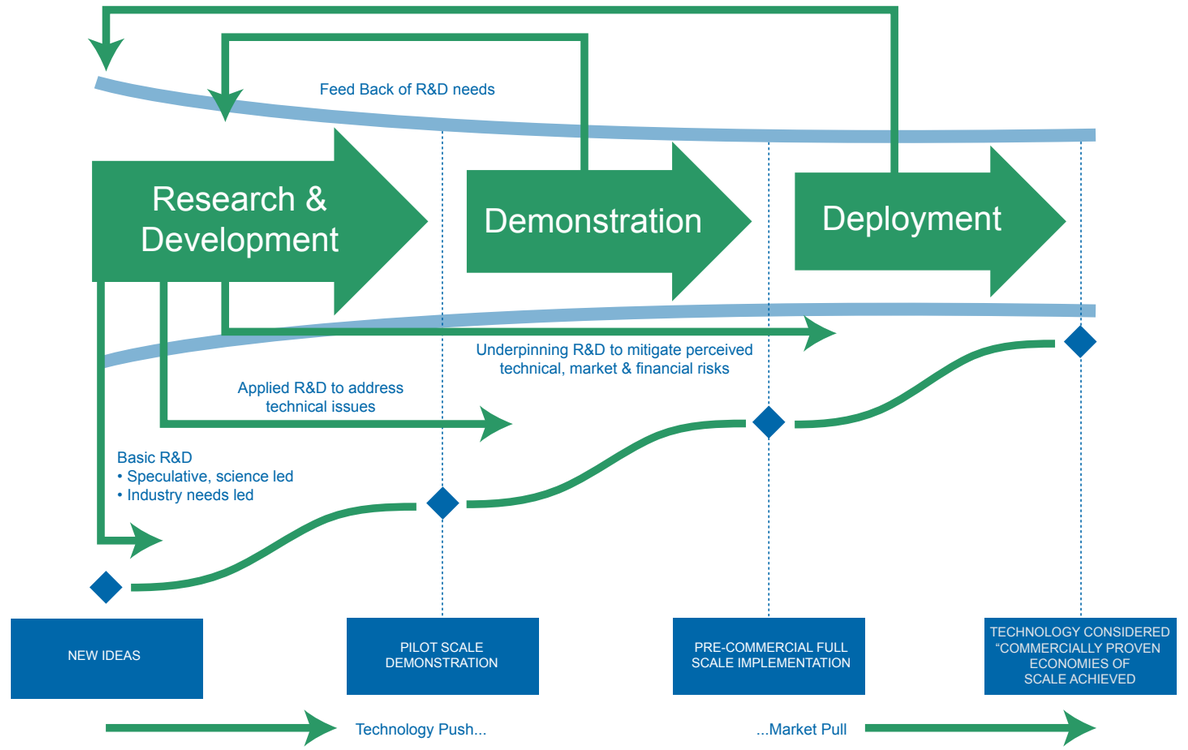


Fig 1



UK Energy Innovation Process (figure 1)

- The R&D, Demonstration and Deployment phases are defined to correspond with government and EU funding definitions.
- R&D comprises Basic 'blue-skies' Research, Applied Research, Generic Development and Product Development.
- Demonstration takes a product from pilot scale to full scale.
- Deployment is early commercialisation when economies of scale are realised and the technology becomes "commercially proven".
- R&D has important roles to play throughout the innovation chain in driving technologies up the "learning curve".
- Feedback at all stages defines further needs for R&D.
- Technology Push is where ideas emerge from scientific research and are pushed forward towards the market.
- Market Pull is where R&D is initiated in response to market need.

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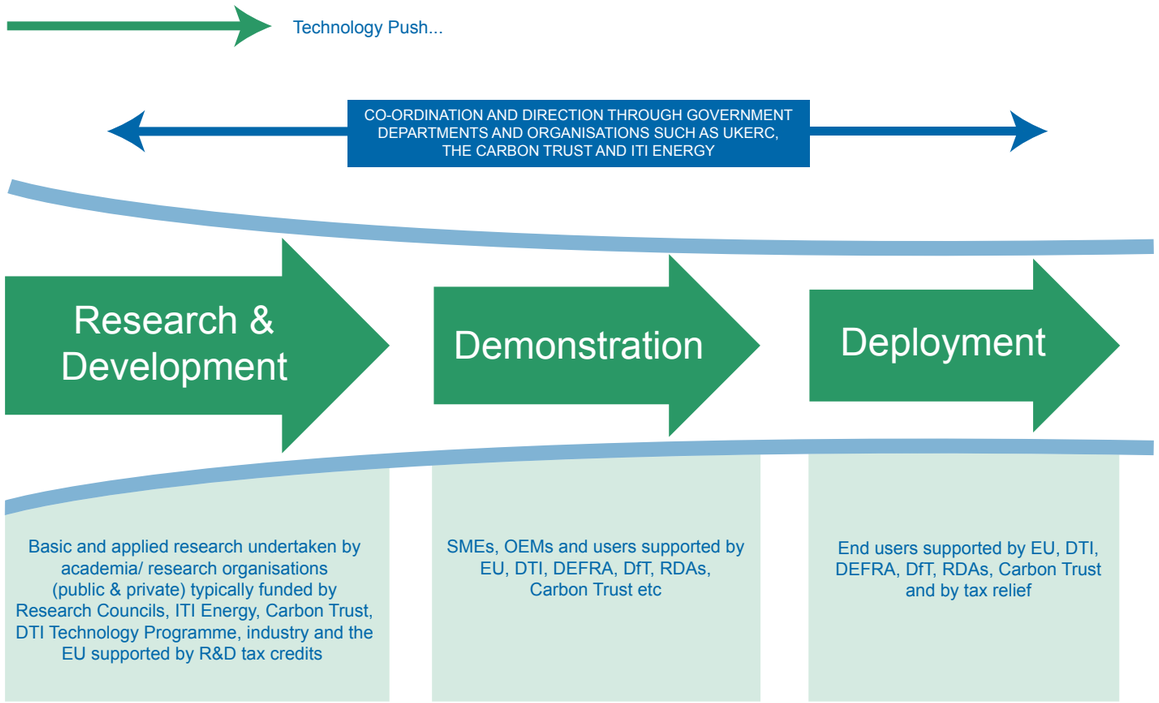
Fig 2



Key Stakeholder Issues (figure 2)

- Government support is needed because the market drivers are not strong or urgent enough to drive technologies through the innovation chain.
- This innovation chain contains diverse schemes and scheme providers.
- Support for Demonstration stage is inadequate in many sectors.
- EU State Aid rules inhibit large scale demonstration projects.
- Extended support is needed during early commercial deployment phase when market incentives are insufficient.
- Not all sectors have a coherent technology road map.
- Focus of academic research needs to be better directed towards sector priorities.
- In most sectors the extension and modernisation of existing R&D facilities would be more than valuable than the development of new facilities.

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Recommendations

1. Tailored and strategic Government intervention is essential to ensure seamless support for UK Energy RDD&D.
2. Careful co-ordination will be required to realise the full potential of recent improvements to the energy innovation chain:- The public-private Energy Technologies Institute will bring focus, momentum and scale to innovation and will be further enhanced by the announcement of the Environmental Transformation Fund and the Research Councils' long term commitment to better exploitation of research
3. Appropriate Government support for early stage demonstration is essential. In most cases, international collaboration would allow such projects to proceed with maximum benefit.
4. The UK energy innovation chain is characterised by a diversity of schemes and scheme providers. It is timely to consider whether this diversity is appropriate and whether it is adding value.
5. The design and introduction of new government support mechanisms (financial, fiscal and regulatory) should be part of a strategy for accelerating energy innovation. These mechanisms should be coherent, consistent and significant - tailored as appropriate to agreed priority technologies.
6. The development of a strategic vision by the principal stakeholders has been very useful in some technology areas and should be extended to cover all priority technologies.
7. The Government should engage with industry and relevant bodies regarding the review of EU State Aid rules to ensure that large scale demonstration projects can be supported adequately.
8. It is timely for the Energy Research Partnership to take an overview of the level and type of innovation support needed over the next 10 years to improve the impact of funding for energy RDD&D in the UK.

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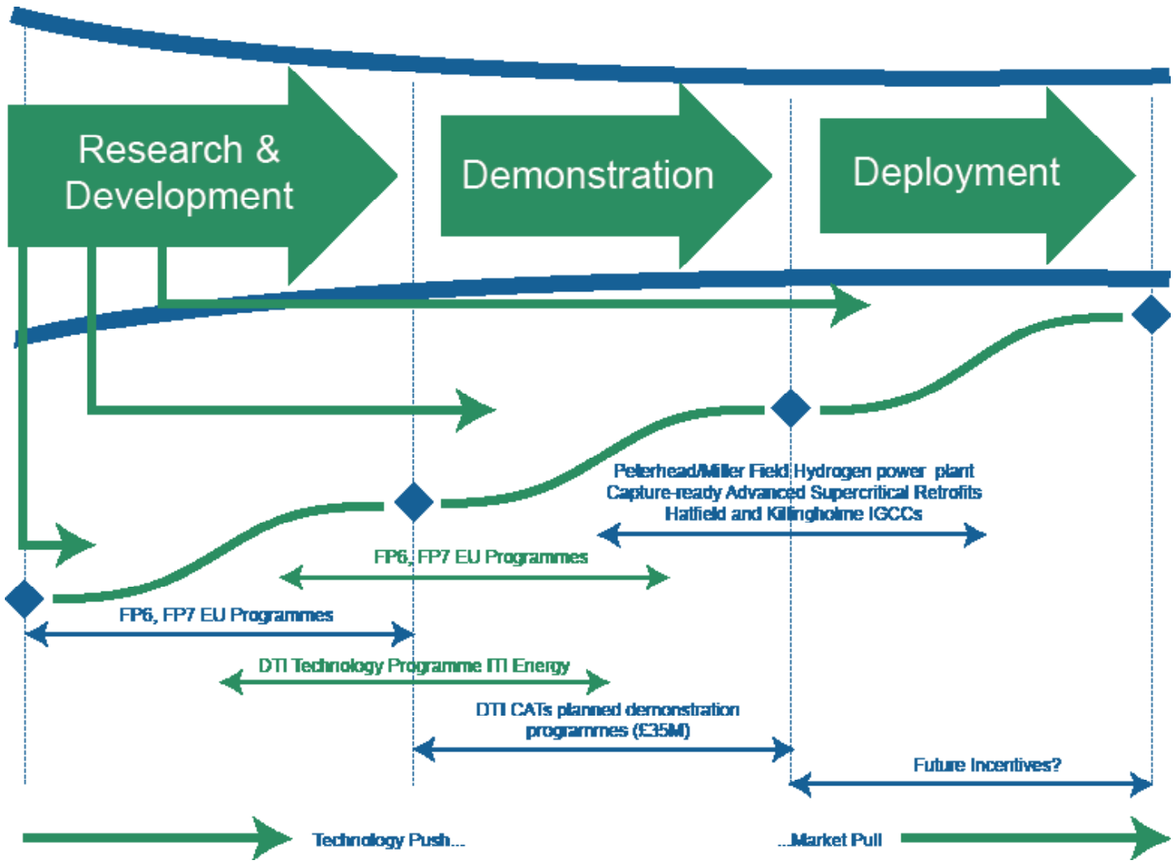
Fig 3



Carbon Abatement Technologies for Fossil Fuels (figure 3)

- Government/industry CAT Strategy (July 2005) integrates public and private activities along the full chain recognising the importance of this sector.
- Government intervention is necessary because the market incentive (carbon price) is too weak to justify risks of investment on the scale and timescale needed.
- Research & Development support is being implemented via the DTI Technology Programme and Research Councils.
- A major gap is the lack of support for demonstration projects and deployment.
- To meet government ambitions this gap has to be filled via the Environment Transformation Fund and new Treasury incentives for Carbon Capture and Storage.

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Wind (figure 4)

- More work is needed to develop a clear strategy and road map for the UK offshore wind power sector.
- Industry underestimated the challenges of offshore wind, and was overly optimistic about its timing and contribution.
- Offshore wind – particularly deepwater – is still under development and far from competitive so government support across the entire RDD&D chain is essential.
- There is a major opportunity for the UK to capitalise on excellent offshore wind regimes and to utilise its extensive offshore engineering, construction and operations expertise.
- There is a paucity of wind R&D facilities and expertise, and a lack of wind industry equipment suppliers in the UK.
- International collaboration is both necessary and desirable in order to open up opportunities for R&D into niche products and services.
- The Beatrice demonstration project is enormously important.

Fig 4

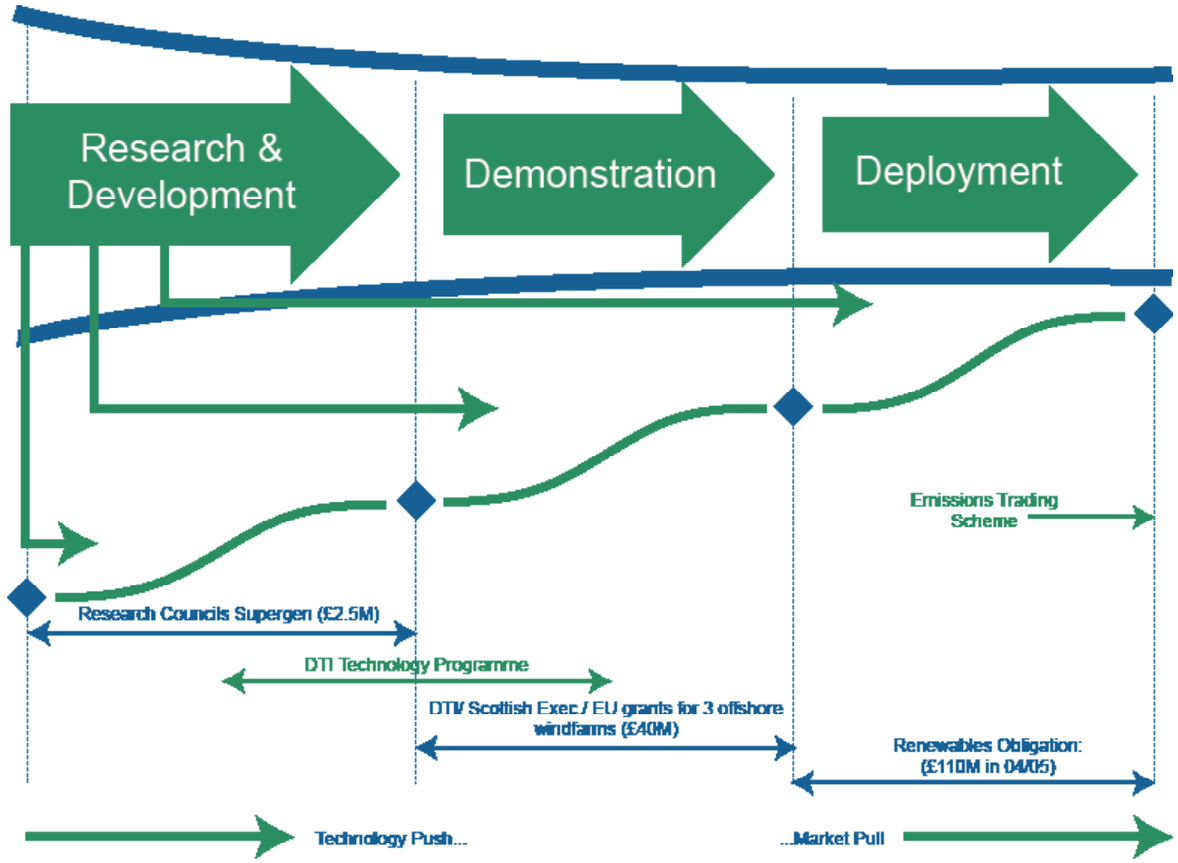

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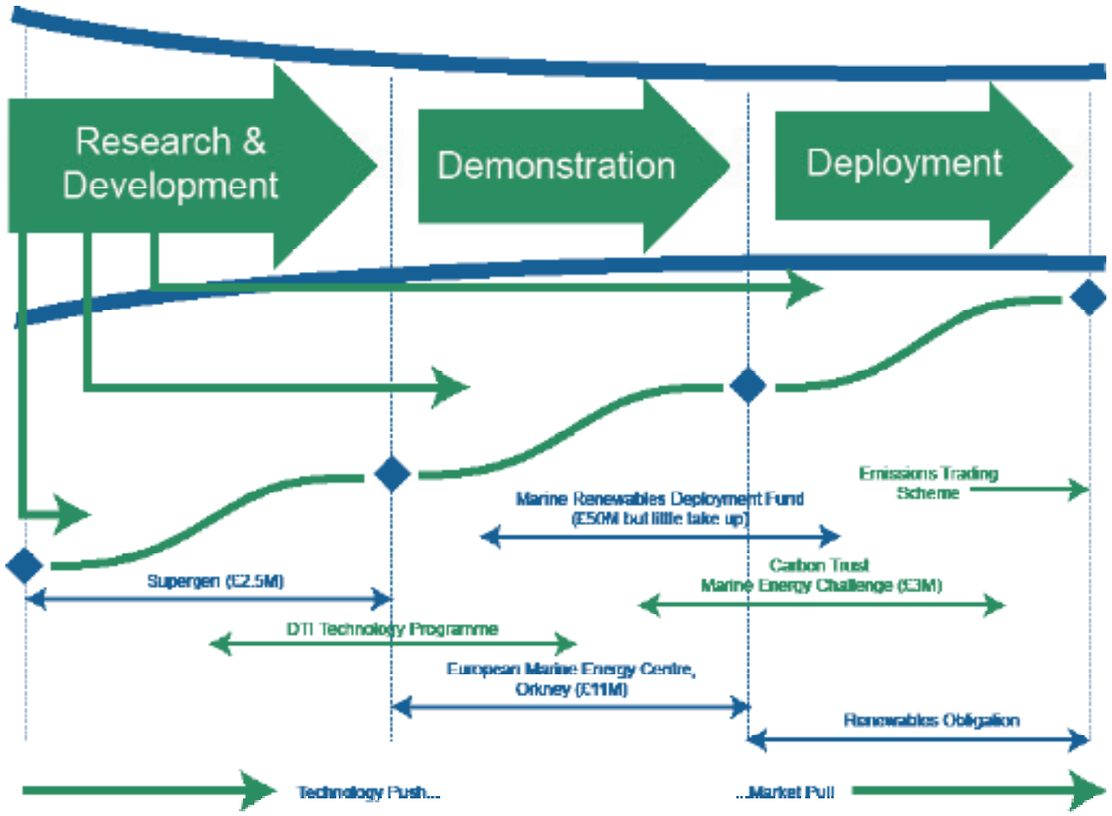
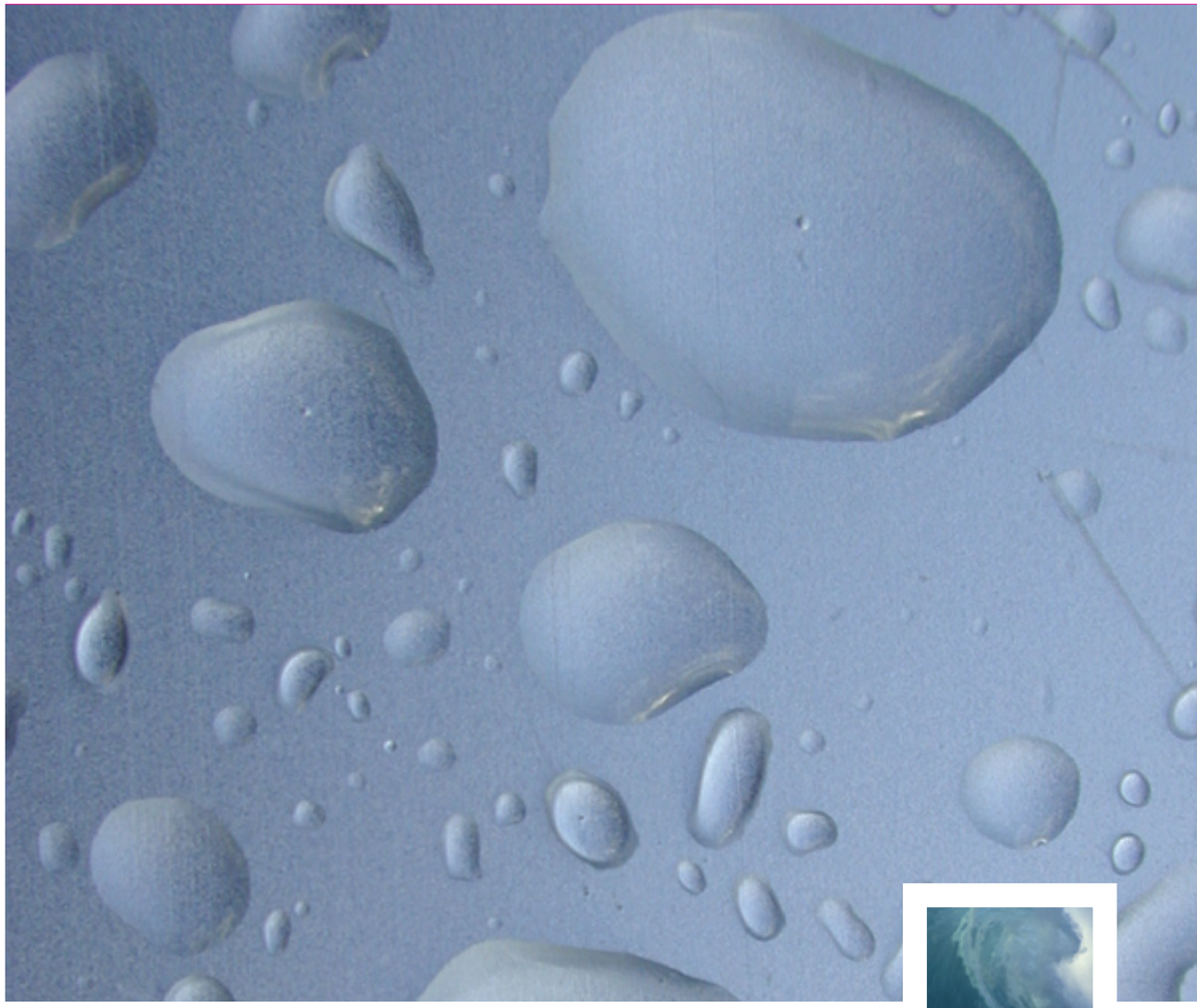
Fig 5





Marine (figure 5)

- The marine energy sector is still in its infancy. There are significant uncertainties relating to cost, the time to commercial viability, and the sector's ultimate power contribution.
- The UK has some potentially telling first mover advantages – excellent natural resources, strong research capability, active and innovative SMEs, extensive offshore engineering expertise and depth of supply chain, and world-leading test facilities.
- To maintain its embryonic leadership, the UK needs to develop, articulate and commit to a long-term strategy.
- Sustained public funding will be required in two areas:

  1. RD&D to maintain the UK's research edge, to develop and test prototypes, and to pursue design improvements and value engineering.

  2. Incremental market support or lead-in tariff; the technology will not become economically competitive without a period of serious commercial application nor without a power purchase environment that attracts private, risk capital.

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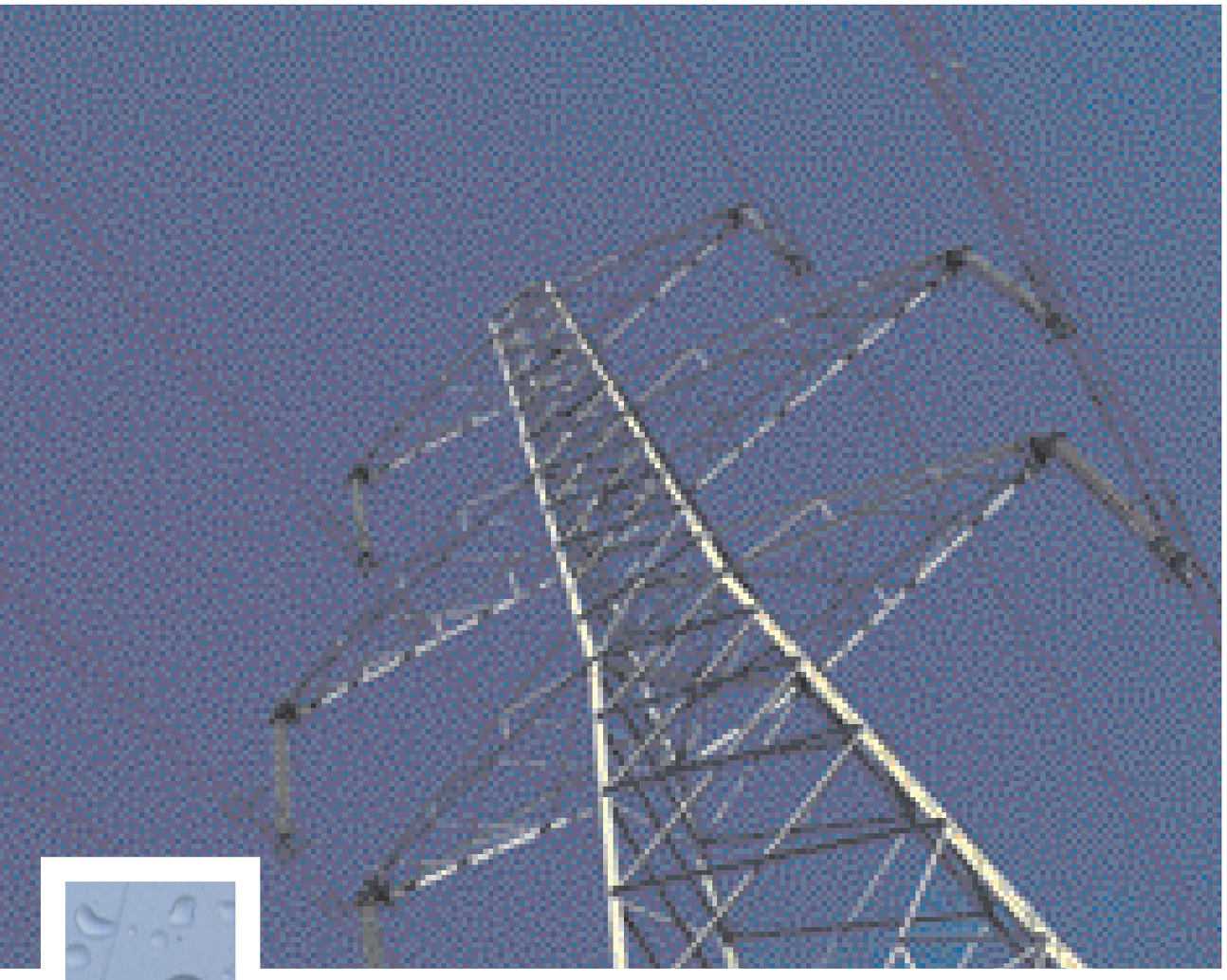
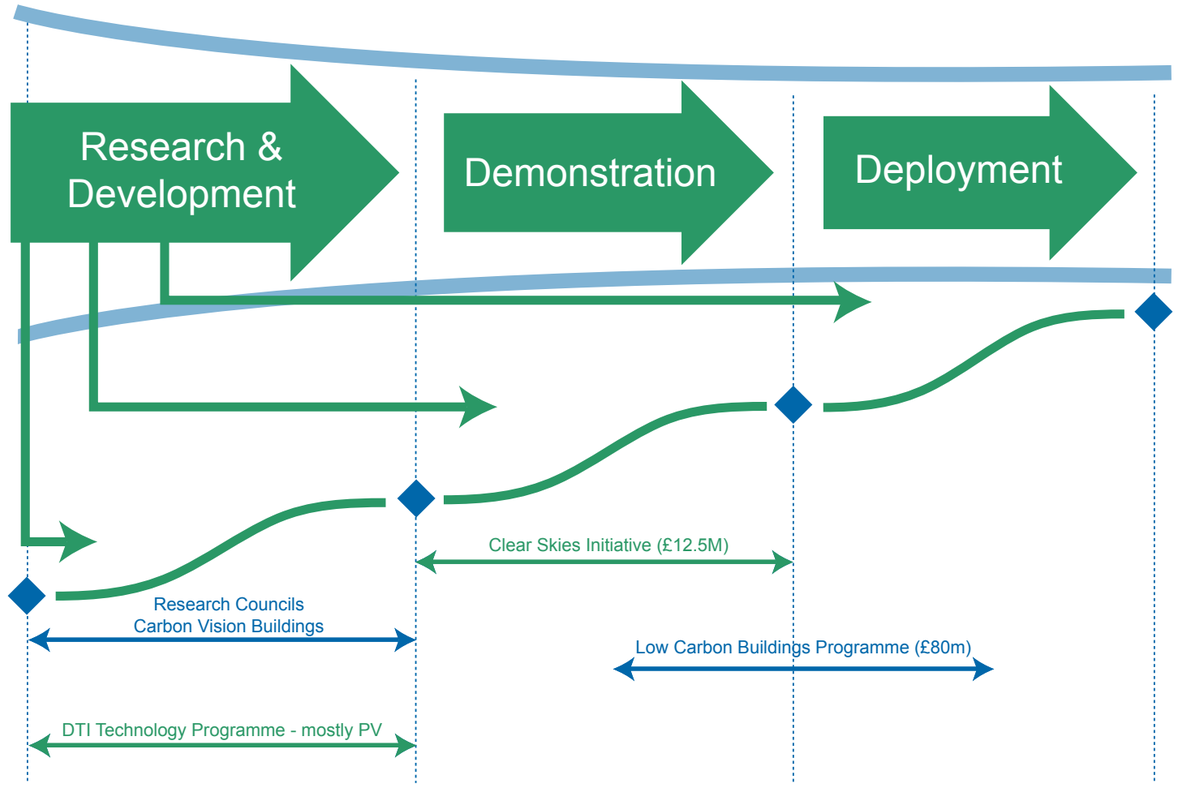


Fig 6



Microgeneration (figure 6)

- Microgeneration covers many technologies - solar, wind (building-mounted and pole mounted), biomass, hydro, heat pumps, CHP and fuel cells.
- The Government recently published (the microgeneration strategy) measures to address the current barriers to the development of a sustainable market. A key action is the development of technology specific route maps.
- Most microgeneration technologies are mature with less need for R&D than other less advanced technologies. The challenge for microgeneration lies with commercialisation. Exceptions to this are solar PV and building-mounted wind (a relatively new product).
- The microgeneration market is inhibited not only by up front costs but also significant non-monetary barriers such as a lack of accessible information for consumers and the complexities of planning policy. Both of these are being tackled through the microgeneration strategy.

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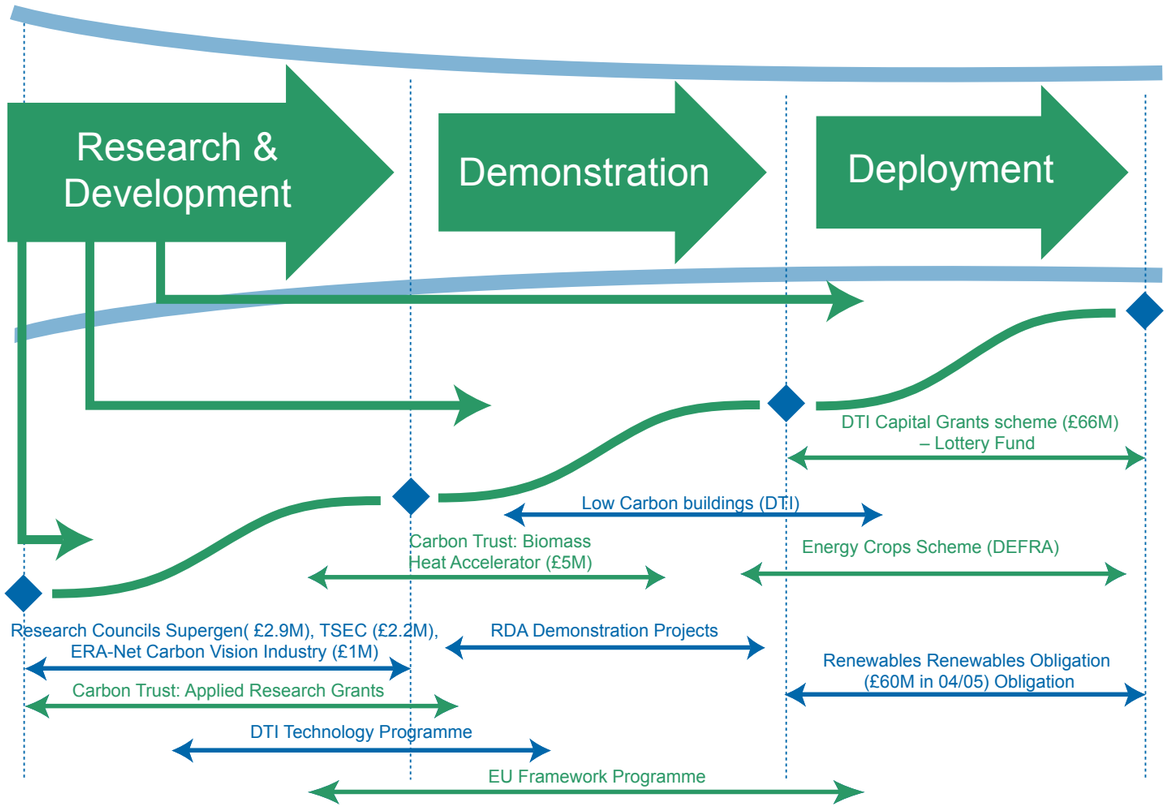
Fig 7



Bioenergy (figure 7)

- Realisation of bioenergy's full potential will require utilisation of all available feedstocks, through better application of the UK's research strengths in basic bioscience and engineering.
- Full deployment of the most effective bioenergy technologies will require improvements to the innovation chain.
- A wide range of public and private sector funders are supporting activities throughout the innovation chain.
- Sustainable bioenergy requires a stable policy framework and good cross-sector co-ordination.
- Public procurement could be significant in driving commercial deployment of biomass technologies, particularly for smaller scale applications.
- There is currently no revenue incentive mechanism to drive heat generation from biomass.

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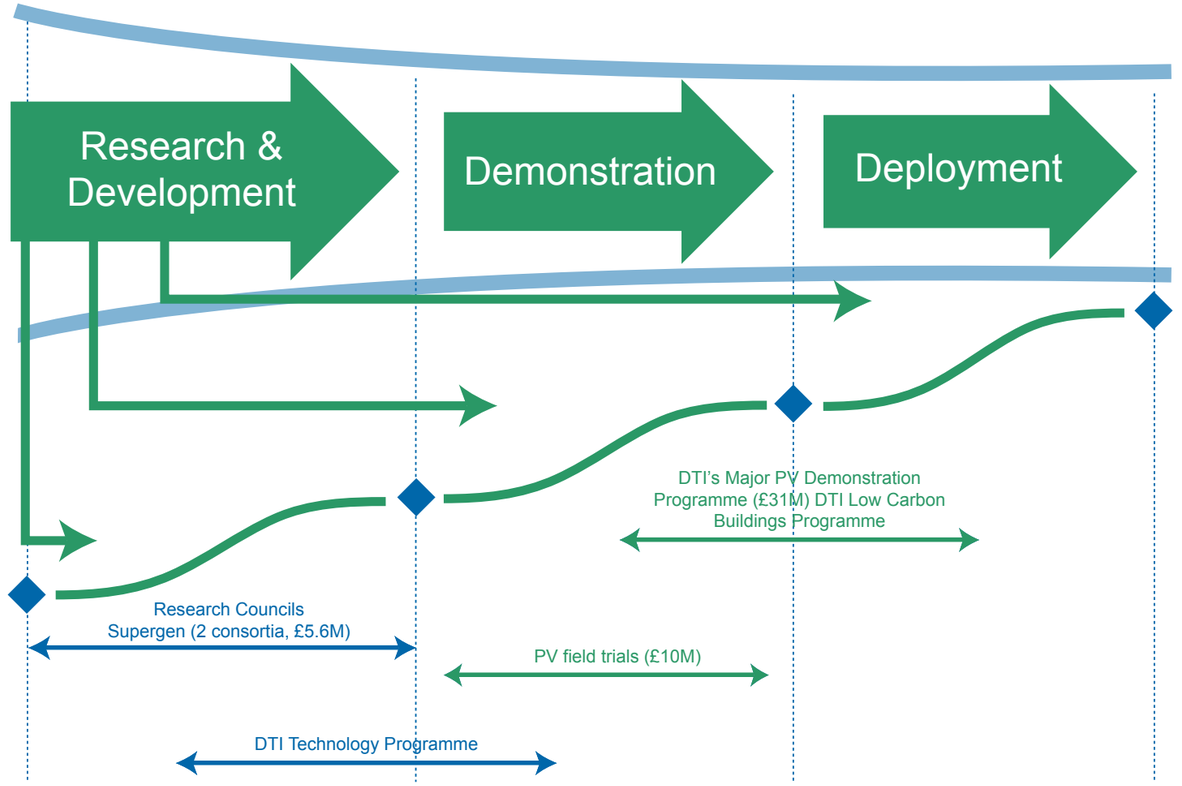
Fig 8



Solar (figure 8)

- The UK Photo Voltaic (PV) community needs reorganising, and the volume and nature of research funding needs improving.
- PV applied research is limited in the UK.
- The overall aim of PV research has to be a dramatic reduction in costs to be competitive with conventional generation.
- An improvement in conversion efficiency is required, particularly for thin films.
- Increased research emphasis on manufacturing is required. Materials research must bear in mind the manufacturability of devices.
- The UK lags behind because of a lack of aggressive market support and a failure to translate strong science research into technology.
- The UK lacks the central laboratory infrastructure for PV that other leading countries have used very effectively.

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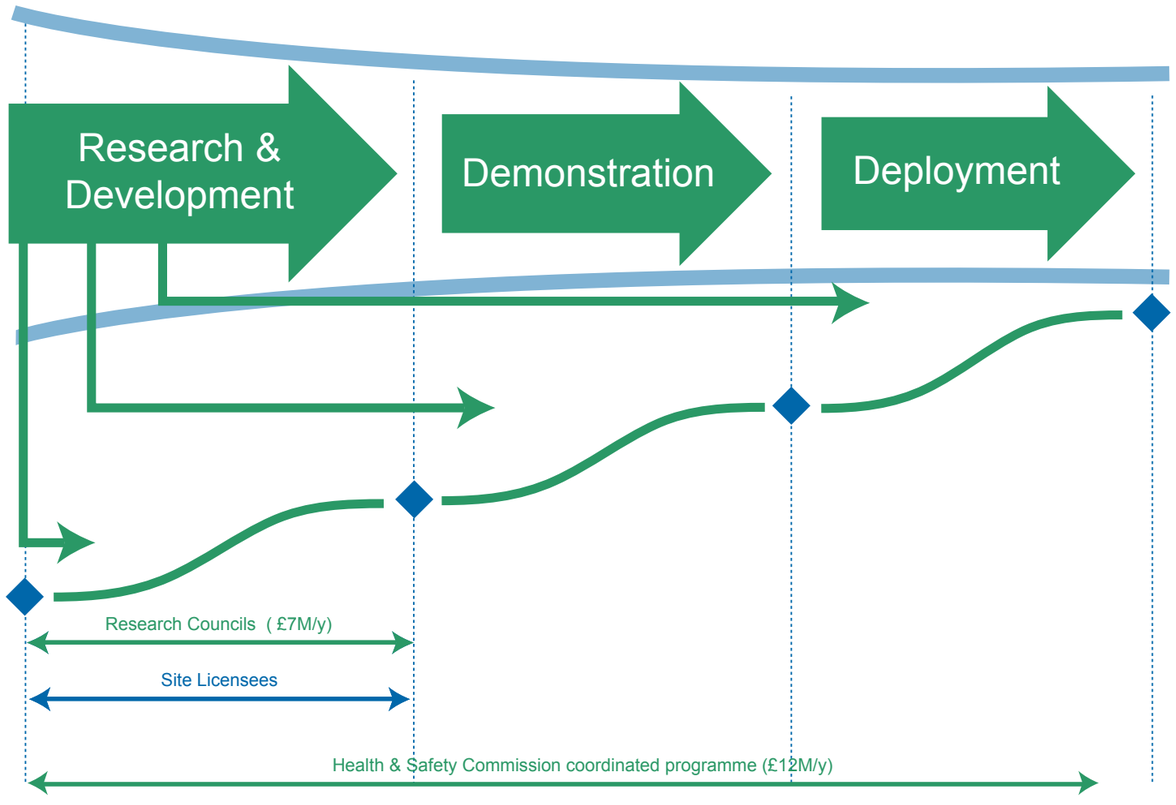
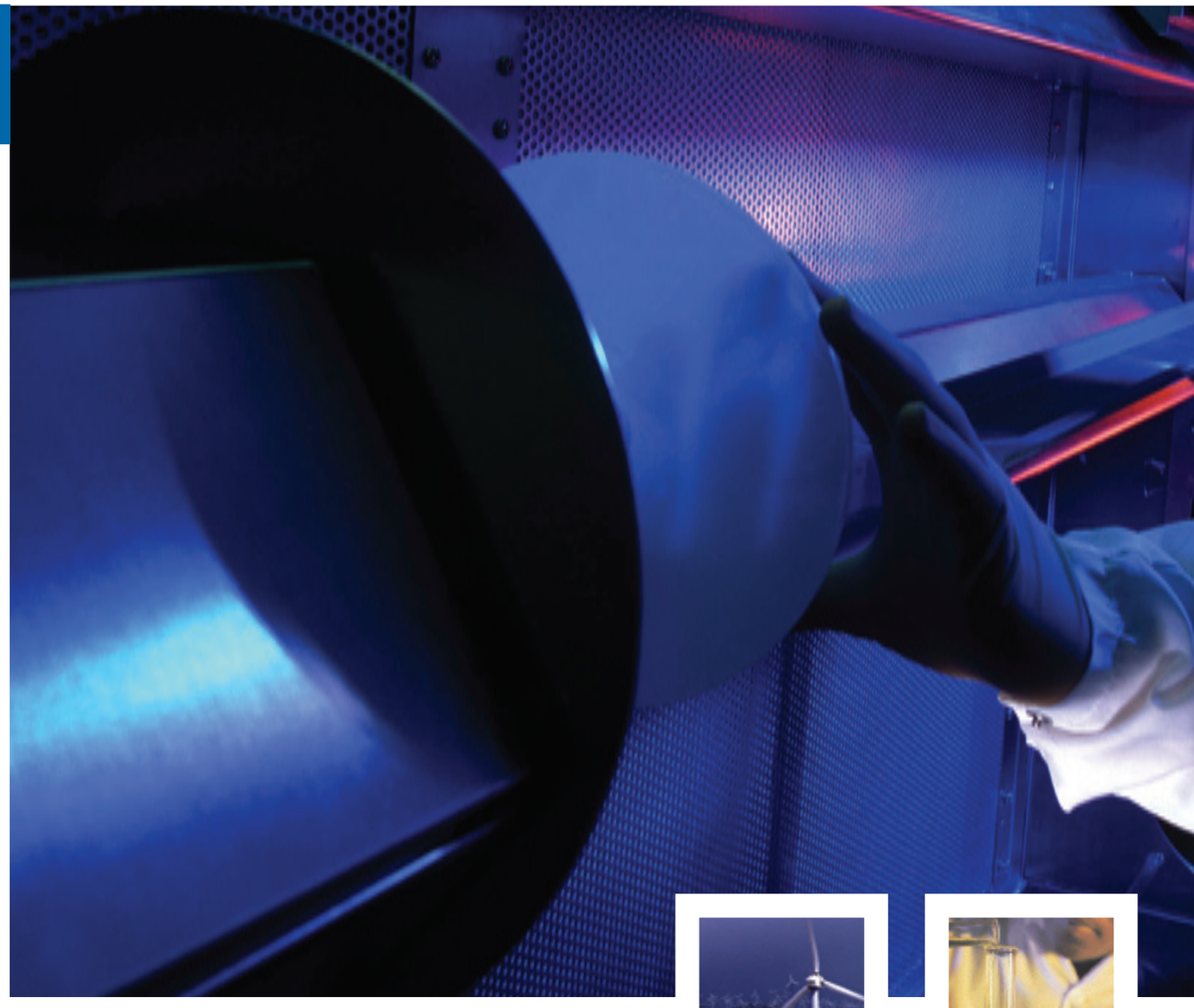
Fig 9





Nuclear Fission (figure 9)

- Continued generation plays a key role in ensuring reliable base-load generation and contributes to reduced CO^2 emissions.
- There will be significant reductions in nuclear capacity over the next 10 years as stations reach end-of-life.
- Existing plant benefits from R&D support to ensure safe operations, possible lifetime extension and ultimately low carbon, baseload electricity generation.
- Over the coming years there are major research and skills challenges related to new build, geological disposal and legacy waste clean-up.
- The UK must stay abreast of international developments in advanced reactor and fuel cycle technology.
- The proposed national nuclear laboratory is vital to tackle the fragmented and incoherent approach to nuclear R&D in the UK.

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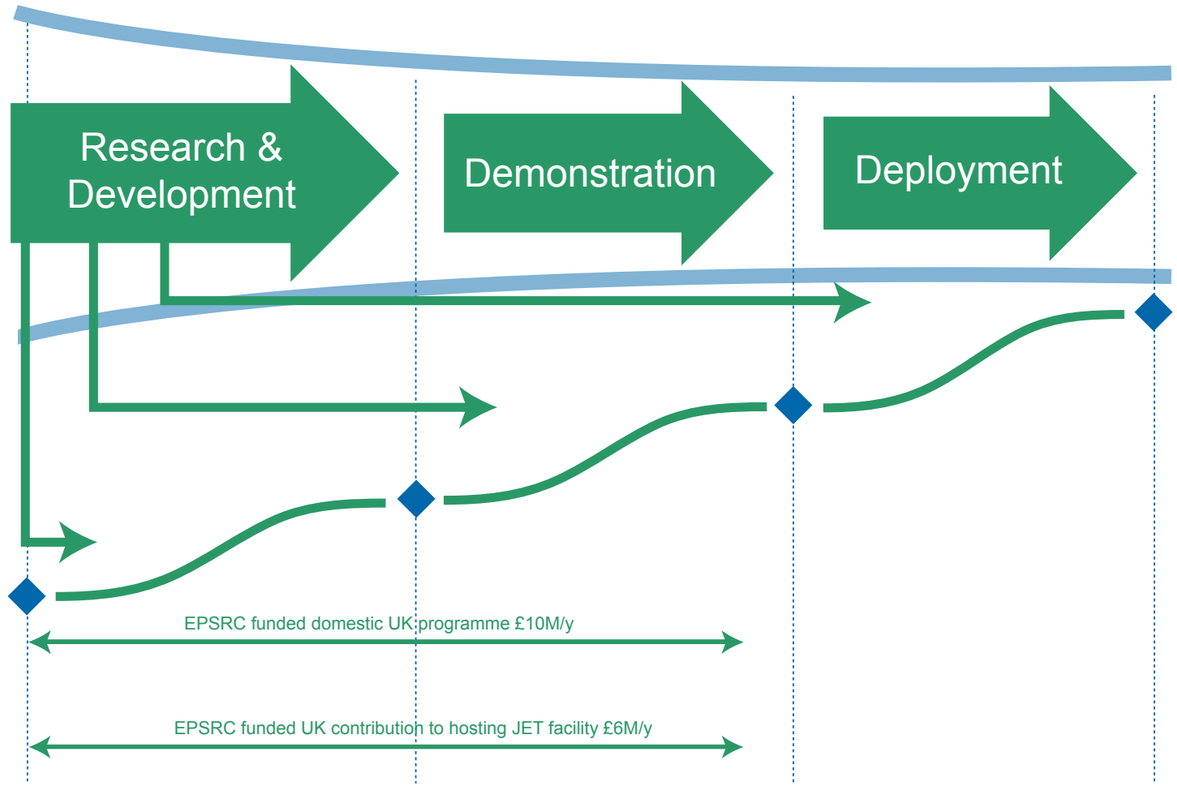
Fig 10



Nuclear Fusion (figure 10)

- UK remains at the forefront of fusion research through hosting the JET device and its own domestic research programme.
- The deployment of the international experimental fusion reactor (ITER) is key to demonstrating the success of fusion technology.
- The UK's domestic fusion programme aimed at developing the novel spherical tokomak concept has attracted significant world-wide interest. The domestic programme also helps UK play a key role in support to ITER.
- Fast tracking fusion with materials irradiation facilities and demonstration plant could result in commercial realisation before 2050.
- High profile scientific programmes such as fusion help to attract graduates into science and engineering activities.

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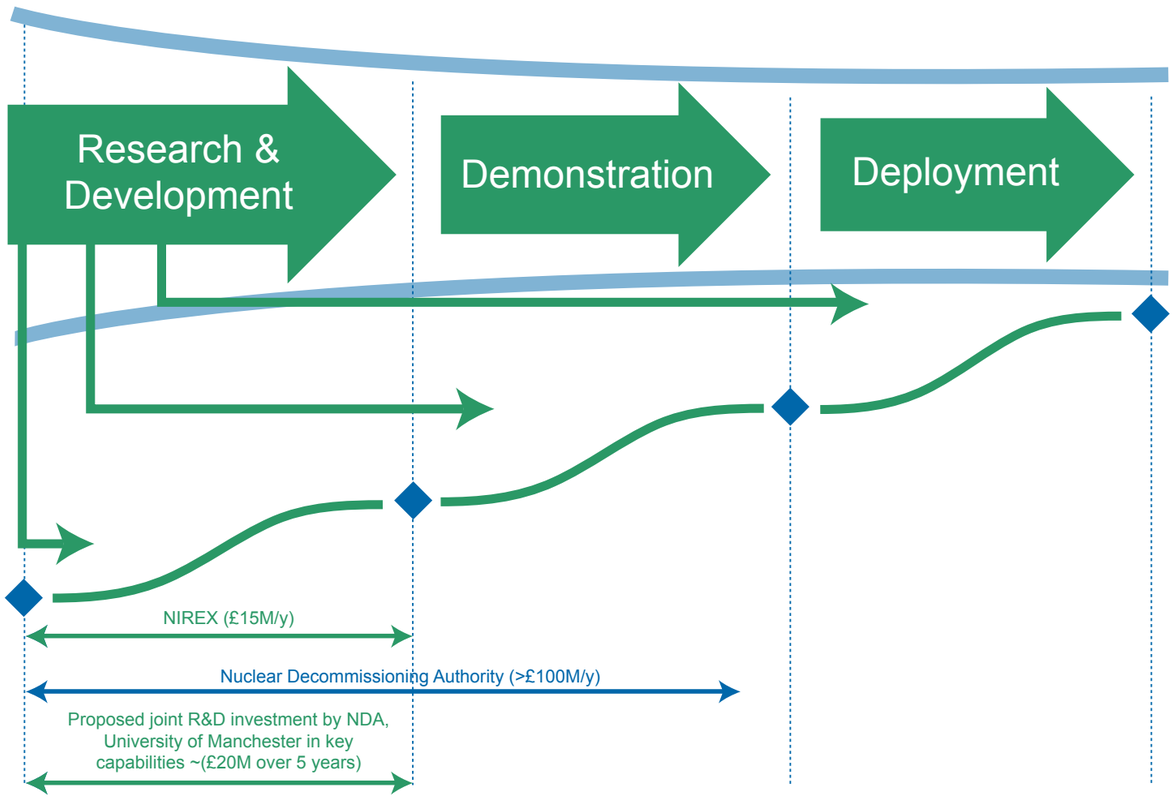
Fig 11



Nuclear Decommissioning and Waste Management (figure 11)

- The UK has an extensive decommissioning & clean-up programme with R&D playing a key role in helping to deliver it quicker, cheaper and safer.
- The UK is at the forefront of clean-up and remediation technologies which helps establish a world-leading position.
- The way forward on waste disposal has been defined as a deep geological repository which will require significant R&D to support implementation.
- Research facilities that have now transferred to the Nuclear Decommissioning Authority are unique and state-of-the-art which helps attract overseas collaborative ventures.
- Critical capabilities to support activities are being re-generated through strategic investment by NDA, EPSRC and Manchester University's Dalton Nuclear Institute.

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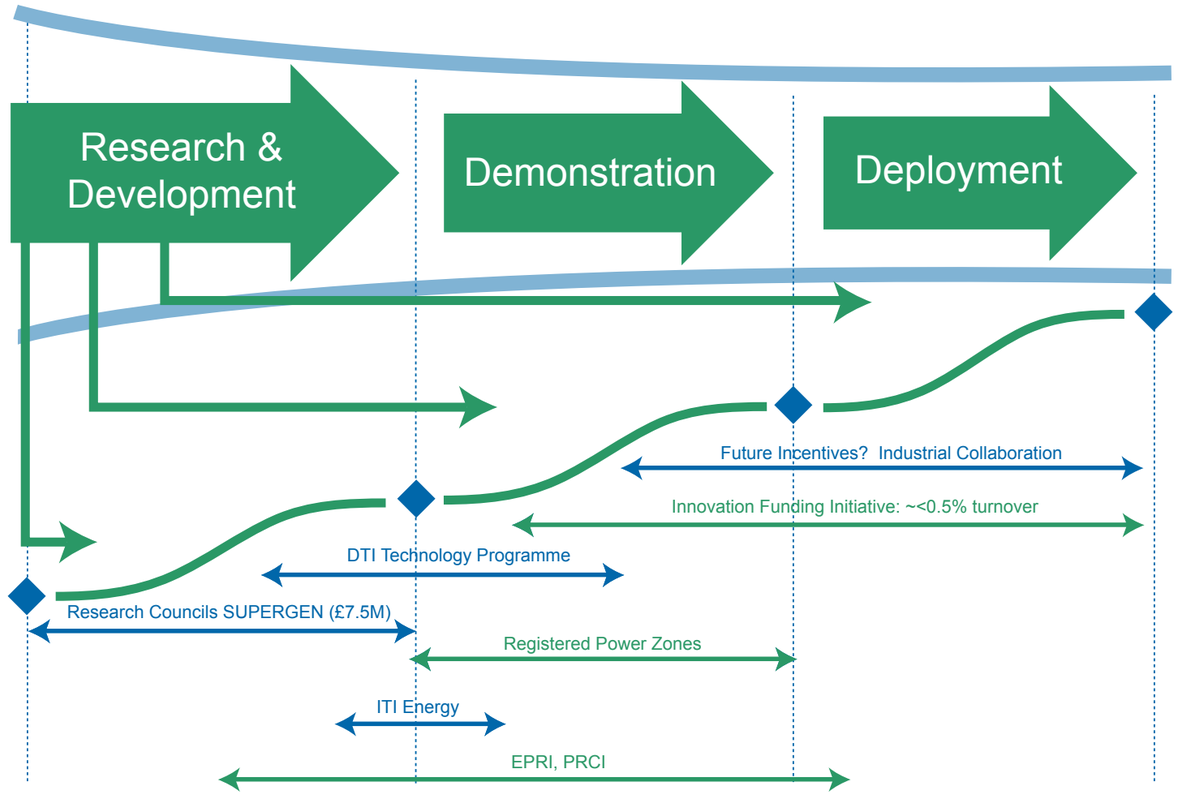
Fig 12



Networks (figure 12)

- Networks RDD&D is pivotal to the energy innovation chain and is essential to enable achievement of government energy and environmental targets.
- The significant risks incurred through large scale demonstration or deployment on the networks are potential barriers to innovation.
- Co-ordination of the increased number of cross-cutting UK initiatives is essential to drive the strategic direction of Networks' innovation.
- Regulatory incentives to promote innovation are starting to make a positive impact on industrial funding in the sector.
- Utilities need to reconnect with manufacturers and learn from the international market.

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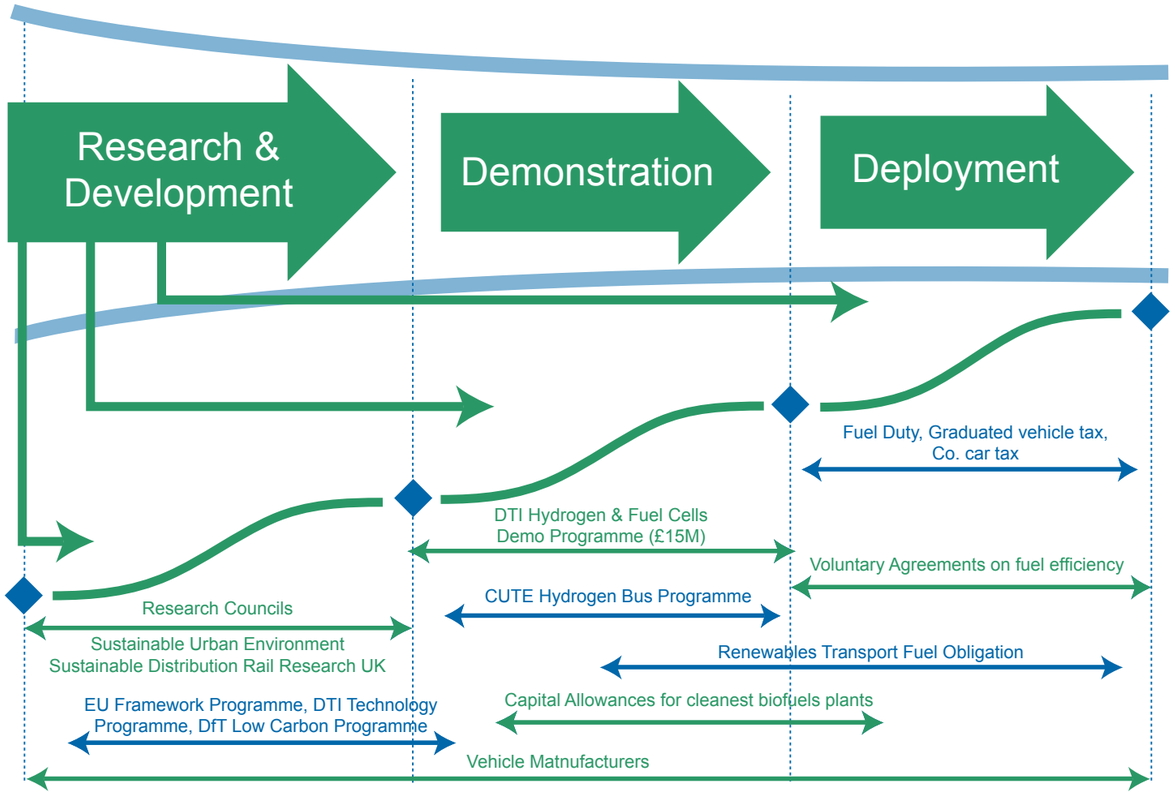
Fig 13



Transport (figure 13)

- Transport is complex with some long lead times for implementing significant change.
- A Low Carbon Transport Innovation Strategy is being developed to provide a consistent approach to incentives.
- Low carbon transport technologies must be considered in the light of carbon abatement options for other sectors, to ensure the most cost effective abatement.
- Fuel efficiency improvements and demand management need to be balanced to ensure both environmental and economic sustainability.
- Measures to pull through low carbon and fuel efficient vehicles and technologies already exist, eg, graduated Vehicle Excise Duty.
- Government funding is provided for transport innovation, but the majority of R&D funding comes from vehicle manufacturers.

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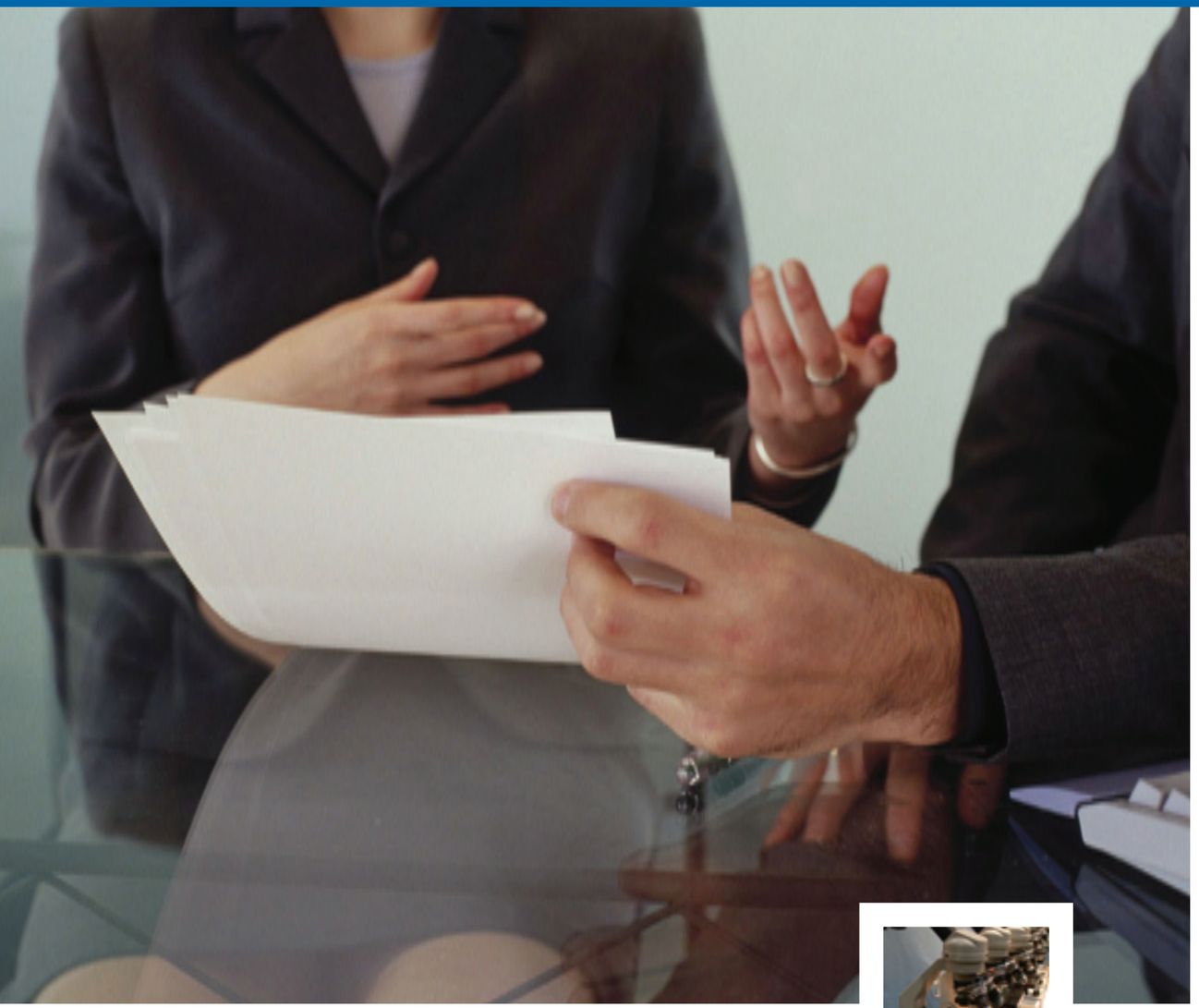
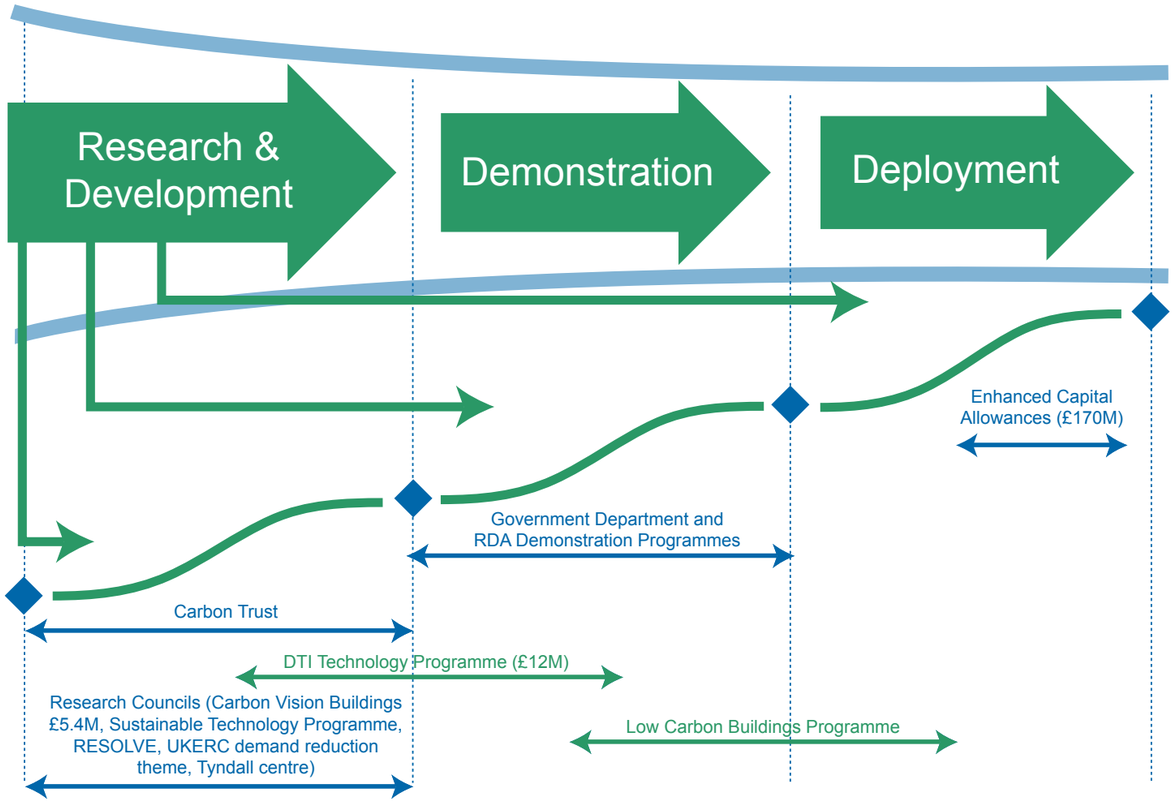


Fig 14



Demand Side (figure 14)

- Energy efficiency can deliver 20-30% savings across the UK economy a huge potential for energy, carbon and cost savings.
- Many measures are available today: the key challenge is not R&D into new energy efficiency measures but finding ways to increase the take-up of those we already have but are not priorities for investment.
- Energy intensive users apart, prices are insufficient to stimulate investment in energy efficiency. Further encouragement such as fiscal incentives, energy efficiency accreditation schemes, minimum product standards, etc is required.
- Energy efficiency is about “systems” and “management” not individual components. There are insufficient managers, specifiers and installers with training and experience of installing and managing the use of new energy efficient technologies.
- There is a need for independent information on comparative performance in use to give confidence to the consumer that the energy efficiency measures work.

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NOTES:

This report was commissioned by the Energy Research Partnership. The views are not the official point of view of any organisation or individual, are independent of Government and do not constitute government policy.

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