Technology Innovation Needs Assessment (TINA)

UK best practice on low carbon innovation

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Agenda

› The Carbon Trust
› The UK innovation ecosystem
› TINA methodology
› Impacts of the TINAs in the UK
The Carbon Trust

› We are an independent, not-for-profit organization created by the UK government in 2001 to accelerate the move to a sustainable, low carbon economy

› Key part of the UK’s low carbon innovation and energy efficiency strategy

› Impartial partner of leading organisations around the world, helping them contribute to and benefit from a more sustainable world

› Working internationally since 2010 – operating worldwide with 170 employees from offices in London, Washington, Beijing, Mexico City and Johannesburg.

Our mission is to accelerate the move to a sustainable, low carbon economy
We help our clients benefit from the opportunities of sustainable, green growth

**ADVICE**

**Business Advice**
Helping businesses capture the opportunities in a sustainable low carbon world

**Government Advice**
Providing cutting-edge policy advice and insights on the transformation of markets

**Public Sector Advice**
Enabling the public sector to cut costs and emissions

**FOOTPRINTING**

**Measuring**
Understanding the environmental impact of an organisation, product or service

**Certifying**
Providing independent verification of organisational or product footprints to endorse sustainable leadership

**TECHNOLOGY**

**Implementation and Finance**
Providing expertise and support to businesses to put energy efficiency plans into action

**Innovation**
Partnering with companies and governments to overcome barriers to innovation and create value from clean technology
Agenda

› The Carbon Trust

› The UK innovation ecosystem

› TINA methodology

› Impacts of the TINAs in the UK
The UK has many public innovation support bodies, mostly coordinated by the LCICG

**Key**
- **LCICG Core members**
- **LCICG Associate members**
- **Not LCICG members**

**The Low Carbon Innovation Coordination Group (LCICG)** includes almost all the public sector funders of innovation in low carbon technologies and is responsible for ensuring their coordination.

**Basic research**
- RCUK/EPSRC
  - Supergen
- HEFCE
  - UK Research Investment Fund

**R&D**
- Innovate UK (formerly TSB)
  - Catapults
  - SBRI
- Energy Technologies Institute
  - Energy Storage & Distribution
  - Carbon Capture & Storage

**Demonstration**
- Innovation Knowledge Centres
- Carbon Capture & Storage

**Deployment**
- The Crown Estate
  - Support offshore wind deployment
- Scottish Enterprise
  - Low Carbon Implementation Plan

**Commercialisation**
- Department of Enterprise, Trade and Investment, Northern Ireland
  - Invest Northern Ireland
- Scottish Government
  - Low Carbon Economic Strategy
  - Energy Tech. Partnership
- Welsh Government
- UK Trade and Investment

**Energy Savings Trust**
- Heat pumps trial
- Smart metering trial
- Micro-CHP trial
- Boiler trial

**Central Government direct support**
- BIS – UK Innovation Investment Fund
- DECC – CCS demonstration

**Carbon Trust**
- Polymer Fuel Cell Challenge
- Offshore Wind Accelerator
- Entrepreneurs Fast Track
- TINAs

**DEFRA**
- WRAP

**DCLG**
- Regulations for buildings

**Department for Transport**
- Promotes innovation in transport

**Note:** Programs listed here are just some examples and activity may spread further across the maturity range than as depicted here.
Significant effort is spent coordinating UK innovation activity on a national basis

- The UK had a large coordination challenge, so it created the Low Carbon Innovation Coordination Group (LCICG)
- Having created a coordination body it is very important to give it the right tasks and responsibilities
- The LCICG initially focused on analysing and building consensus on priorities *internally* through the TINAs
- More recently the LCICG has focussed on communicating its consensus views *externally*
Technology Innovation Needs Assessments (TINAs)

- The Carbon Trust developed and delivered the TINAs with the UK’s major public sector backed funding and delivery bodies in the area of ‘low carbon innovation’

- The TINAs aim to identify and value the key innovation needs of specific low carbon technology families to inform the prioritisation of public sector investment in low carbon innovation

- The TINAs apply a consistent methodology across a diverse range of technologies, and a comparison of relative values across the different TINAs is as important as the examination of absolute values within each TINA
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› The UK innovation ecosystem
› **TINA methodology**
› Impacts of the TINAs in the UK
TINA purpose and framework

**TINA:** Technology Innovation Needs Assessment

**Purpose:** To inform government decisions by providing a robust and consistent evidence base on the innovation needs of technologies likely to be important in delivering the UK’s energy and climate change targets and/or economic benefits across low carbon technologies

**Application:** Can be applied to any technology area, though most successful and impactful applications have been for those at very early stages of development

**Framework:**

**Develop technology and market scenarios**
- Emissions reduction targets and energy needs
- Technology scope and stage of development
- Technology challenges and cost reduction
- Growth scenarios

**Assess potential benefit to the UK**
- Meeting abatement targets at lowest cost
- Deployment cost reduction over alternative
- Creating business value
- UK competitive advantage
- UK value added

**Assess need for public sector support**
- Extent of market failure
- Degree to which the UK can rely on innovation overseas

**Develop potential solutions**
- Requirements to achieve innovation and its benefits
- Existing UK and global support
- Public sector interventions that offer best value for money
Prioritising low carbon technologies for innovation support – how the UK did it

<table>
<thead>
<tr>
<th>UK Carbon abatement potential</th>
<th>UK carbon abatement vs. economic value creation potential</th>
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<tbody>
<tr>
<td>H</td>
<td>H</td>
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<tr>
<td>Biomass CCS</td>
<td>Nuclear fission</td>
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<td></td>
<td>• Appliances</td>
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<td></td>
<td>• Lighting</td>
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<tr>
<td></td>
<td>• Biomass to power</td>
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<td></td>
<td>• CO₂ transport/storage</td>
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<tr>
<td>Biogas (BioSNG and AD)</td>
<td>Hydroelectric (small/large)</td>
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<tr>
<td>Biomass to heat</td>
<td>• Conventional heat/cooling</td>
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<tr>
<td>High efficiency CCGT</td>
<td>• Solar hot water</td>
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<tr>
<td>Rail (Diesel/Electric)</td>
<td>• Small power fuel cells</td>
</tr>
<tr>
<td>Marine transport</td>
<td>• Hydrogen prod./storage</td>
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<tr>
<td>Thermal storage</td>
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<tr>
<td>Geothermal</td>
<td>Coal CCS</td>
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<td>Solar thermal electric</td>
<td>Hydrogen FCV</td>
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<td>Community CHP</td>
<td>Solar PV</td>
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<tr>
<td>Small wind</td>
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<tr>
<td>Nuclear fusion</td>
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<td>MicroCHP</td>
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</tbody>
</table>

| NOTE: This analysis is now out of date, presented for illustration only |

Source: CT Analysis
TINA process in practice

Scoping

Technology investigation

Value of innovation

Value in business creation

Case for public sector activity

Conclusion w/o cost

Key requirements

Potential activities
## Identified innovation programmes in offshore wind

<table>
<thead>
<tr>
<th>Sub-area</th>
<th>Key areas for public sector innovation activity/investment</th>
<th>Desired outcomes</th>
<th>Estimate total costs, 2010-15</th>
<th>Est. public sector contrib.</th>
<th>Rough benefit / cost</th>
<th>Other benefits&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Turbine</strong></td>
<td>▪ Scale up funding for test facilities, new concepts, data pooling</td>
<td>▪ “Disruptive” technology enters market</td>
<td>c. £430mn</td>
<td>Up to £100mn</td>
<td>Medium</td>
<td>▪ All areas will support the deployment of lower cost offshore wind, thereby generating fuel poverty and energy security benefits</td>
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<td></td>
<td>▪ Provide funding for monitoring</td>
<td>▪ Validated models for designing optimised arrays</td>
<td>£20mn</td>
<td>£5mn</td>
<td>High</td>
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<tr>
<td></td>
<td>▪ Develop supply chain capability</td>
<td>▪ Encourage investment in UK turbine supply chain capability</td>
<td>£100mn</td>
<td>£20-30m</td>
<td>tbd</td>
<td></td>
</tr>
<tr>
<td><strong>Foundation</strong></td>
<td>▪ Funding for manufacturing development of deep water foundations</td>
<td>▪ Scale manufactured foundations</td>
<td>£100mn</td>
<td>£35mn</td>
<td>High</td>
<td>▪ Foundations, installation and O&amp;M may lead to more specific community benefits</td>
</tr>
<tr>
<td><strong>Collection &amp; transmission</strong></td>
<td>▪ Scale up funding to incentivize supply chain to respond</td>
<td>▪ Effective solution identified and exploited</td>
<td>£15mn</td>
<td>£3mn</td>
<td>High</td>
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<tr>
<td><strong>Installation</strong></td>
<td>▪ Funding to build and test new vessels / barge</td>
<td>▪ Optimised process from foundation manufacture to sea bed installation</td>
<td>£170mn</td>
<td>£45mn</td>
<td>High</td>
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<tr>
<td><strong>O&amp;M</strong></td>
<td>▪ Funding to build and trial novel vessels and access systems</td>
<td>▪ Validated low cost O&amp;M approached</td>
<td>£25mn</td>
<td>£6mn</td>
<td>High</td>
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</table>
The UK TINAs recommended 135 programmes costing ~£2.8bn. Limited budgets necessitate further programme prioritisation.

Source: TINAs, CT Analysis
Using the TINA criteria programmes can be prioritised to match the available funding

<table>
<thead>
<tr>
<th>TINA</th>
<th>Subarea (each subarea has specific innovation programmes attached to it)</th>
<th>Value of Innovation Savings to the UK (Ranked)</th>
<th>Value of UK Business Creation (Ranked)</th>
<th>UK Competitive Advantage</th>
<th>Extent of Market Failures</th>
<th>Rely on others</th>
<th>Benefit of UK Investment</th>
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<tbody>
<tr>
<td>Offshore Wind</td>
<td>Turbines (yield/reliability)</td>
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<tr>
<td>Ind. EE</td>
<td>Low Carbon Cement</td>
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<td>Nuclear</td>
<td>Waste Management, Reprocessing, Storage</td>
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<tr>
<td>Heat</td>
<td>Heat Pumps (design ...)</td>
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<tr>
<td>Offshore Wind</td>
<td>Foundation (30-60m)</td>
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<tr>
<td>Bio</td>
<td>Woody/grassy crops</td>
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› **Impacts of the TINAs in the UK**
The TINAs have had both direct and indirect impacts on UK policy making and have the potential for increased impact

<table>
<thead>
<tr>
<th>Intended use</th>
<th>Broader use</th>
<th>Increased impact</th>
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<tbody>
<tr>
<td>› Create a robust, shared knowledge base to guide government R&amp;D investment decisions</td>
<td>› Informing academic and university research&lt;br&gt;› Feeding into the UK policy debate&lt;br&gt;› Providing a key part of the evidence base to guide government’s decarbonisation and technology strategy, linked to medium term carbon budgets</td>
<td>› The Carbon Trust is now working with the British government to explore additional ways in which the TINAs could have impact&lt;br&gt;› This could include the tailoring and application of the methodology to other countries</td>
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<td>› Create a common understanding of innovation needs and the case for support to facilitate coordinated planning between LCICG members</td>
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<td>› Allow cross-comparison and prioritisation of R&amp;D needs between and within technology areas</td>
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<td>› Provide government with the evidence needed to send clear messages to developers about UK priorities and approach</td>
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The TINAs have been very successful in achieving all their objectives under the *Intended Use* category.

**Guiding UK investment decisions and allowing between- and within-technology prioritisation**

- 85% of programmes supporting low carbon technologies from 2012 onwards target technology needs identified in the TINAs.
- Prioritisation of government funding between technologies corresponds with the recommended prioritisation found in the TINAs.

**Creating a common understanding among UK stakeholders**

- Each TINA undergoes a long and complex consultation process involving stakeholders; this has been an effective way of building consensus and resolving conflicts among technology experts, creating a common view.

**Providing private sector stakeholders with an understanding of government thinking on low carbon innovation**

- Industry are involved throughout the TINA process, during interviews and workshops for both data gathering and consensus building.
- TINA workshops will often gather all of the major actors in an industry into one room for consensus building exercises: the TINAs act as a conduit that channels government’s approach to policy making.
The TINAs have also achieved impact beyond their stated objectives – **Broader Use**

**Informing academic and university research**

› The TINAs have multiple academic citations: the Carbon Trust has identified at least 49 instances where the TINAs have been cited in academic publications, of which over 50% pertain to UK-focussed research

**Feeding into the UK policy debate**

› The Committee on Climate Change’s recent reports on cost reduction in offshore wind and potential cost reduction mechanisms for CCS cite the TINAs as key literature feeding into their research.

**Additional analysis on top of the TINAs has informed the following Government projects**

› LCICG Strategic Framework
› Objective Driven Integrated Programmes (ODIPs)
› Support for DECC Strategy in the 2015 Comprehensive Spending Review
› Additional ad hoc policy support
The TINAs could be extended and scaled up to have increased impact

- Extending the TINA scope to consider innovation needs and cost reduction outside of R&D;
- Including an analysis of the relationship between deployment, innovation and cost reduction;
- Creating a central set of deployment scenarios to be used for each technology;
- Shifting to a systems perspective when considering technologies;
- Including greater detail on potential innovation programmes;
- Including support for decarbonisation and technology strategy into the TINA scope.

These improvements could be adopted in the tailoring of the TINA methodology to Mexican needs

Source: LCICG spending 2010-2015; Carbon Trust Analysis of Government RD&D programmes, Carbon Trust analysis of academic publications
Thank you

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