The role of innovation and collaboration in transforming the energy system

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Carbon Trust has accelerated sustainable, low carbon development for more than 10 years

What we do

Advice

We **advise** businesses, governments and the public sector on their opportunities in a sustainable, low carbon economy

Footprinting

We **measure and certify** the environmental footprint of organisations, products and services

Technology

We **help develop and deploy** low carbon technologies and solutions, from energy efficiency to renewable power

What we have achieved

Customer cost savings

- Helped customers save **£5bn**

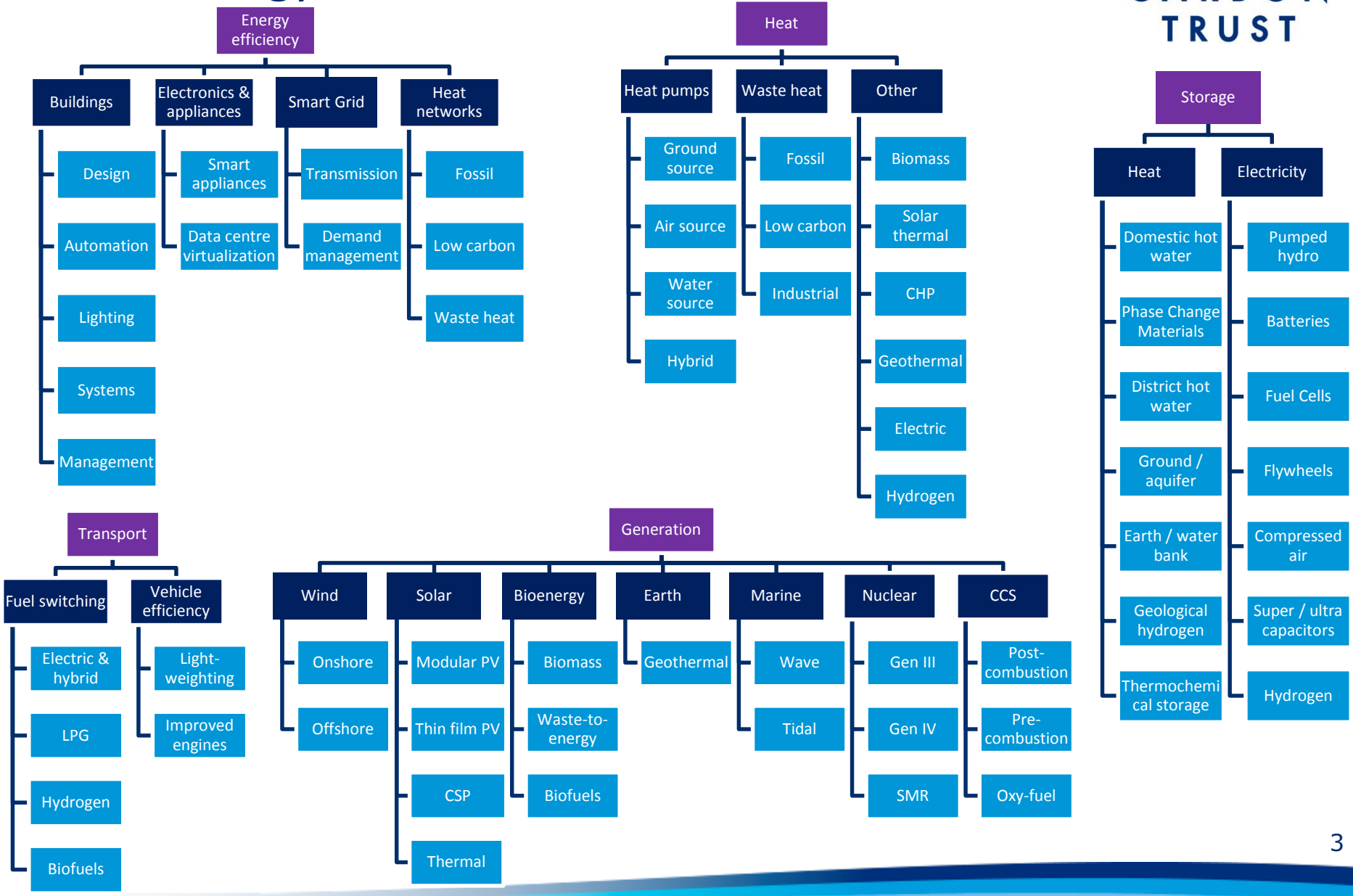
Carbon savings

- Helped customers save **53.5m tons of $C0_2$**

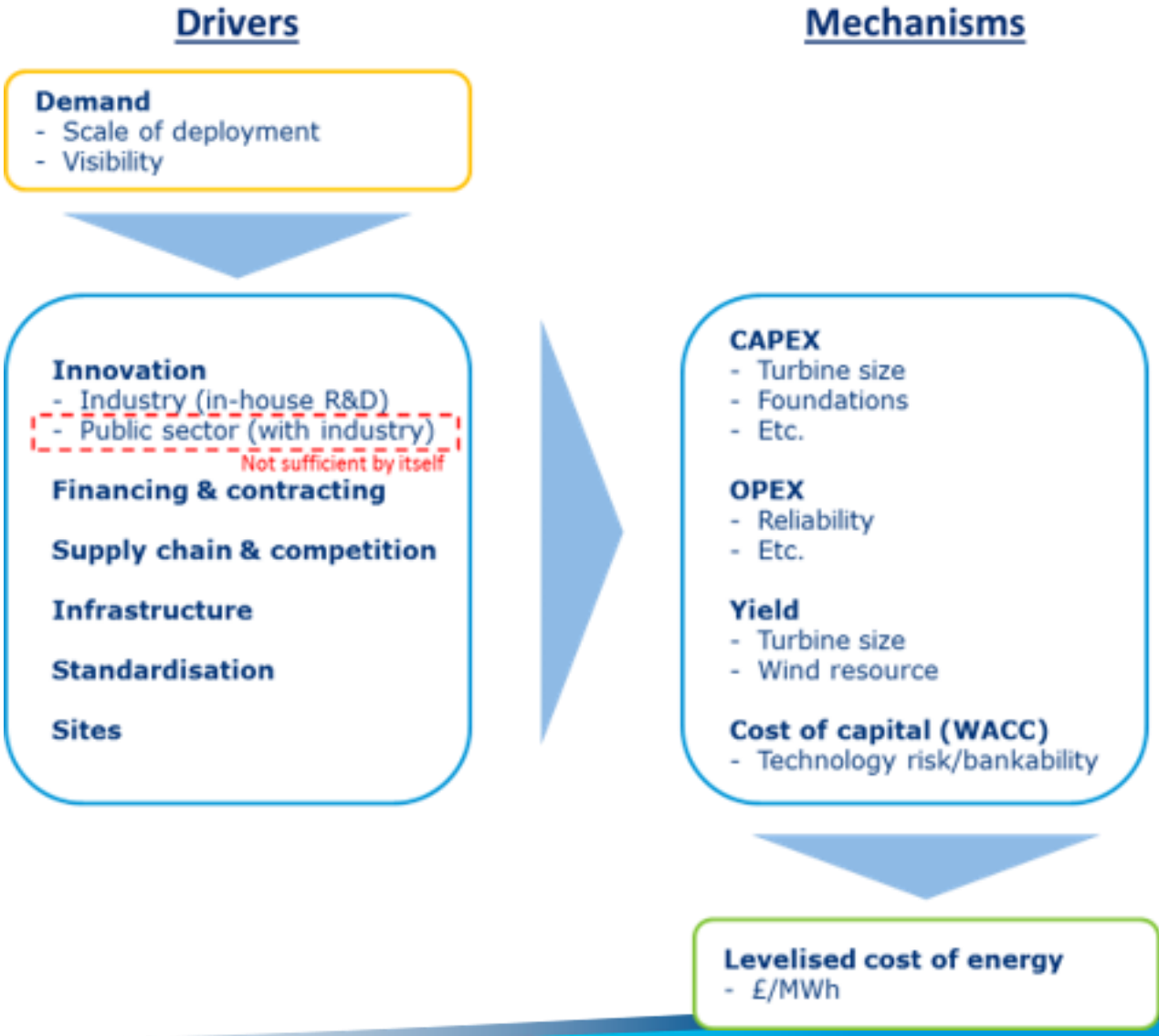
We employ our **integrated service offering to support clients around the world**

- Our 160 employees work around the world from offices in the UK, China, Mexico and Brazil
- We fully reinvest our profits into advancing our **mission to accelerate the move to a sustainable, low carbon economy**

A low carbon energy system encompasses lots of technology areas



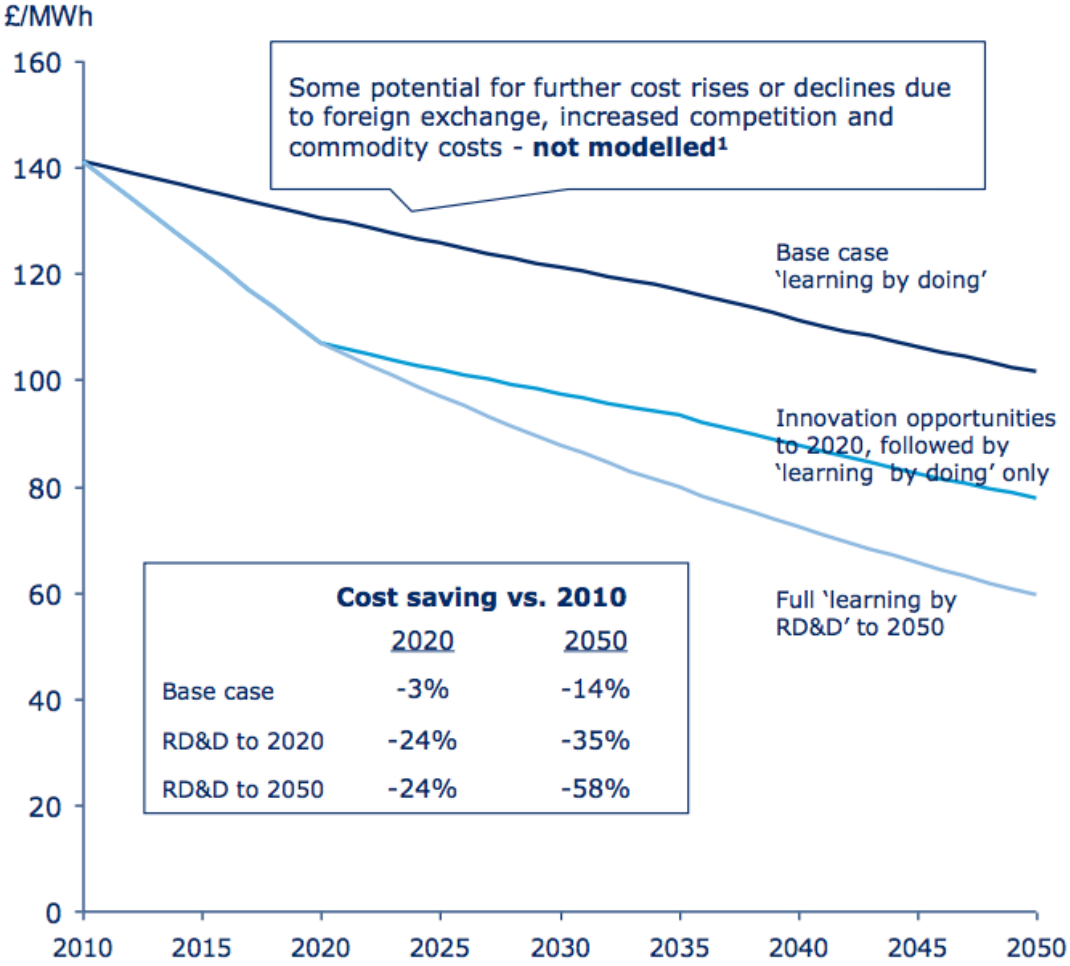
Market demand unlocks all other drivers of cost reduction



TINAs:
Technology Innovation Needs Assessments

- 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
- Developed and delivered by the Carbon Trust for the LCICG: Low Carbon Innovation Coordination Group – the UK's major public sector backed funding and delivery bodies in the area of 'low carbon innovation'

Offshore wind - significant opportunity for cost reduction through innovation



1 Such factors were taken as independent of innovation improvement potential, and its value. Hence the analysis normalises for these factors (i.e. holds them "constant"). For this reason today's levelised costs estimate of ~£140/MWh may be somewhat lower than current estimates. This has no impact on our main conclusions.

Source: Carbon Trust 'Offshore Wind: Big Challenge, Big Opportunity' (2008); DECC '2050 Pathways Analysis' (2010): ETI ESME; UKERC 'Great expectations: The cost of offshore wind in UK waters' (2010); Carbon Trust 'Focus for success' (2009); expert interviews; Carbon Trust analysis

TINA prioritisation criteria

- Value in meeting emissions targest at lowest cost
- Value in business creation (UK delivery and exports)
- Case for UK public sector support
  - Extent of market failure
  - Opportunity to exclusively rely on others

Opportunities beyond the turbine

Sub-area	Type	Value in meeting emissions targets at lowest cost £bn[1]	Value in business creation £bn[2]	Extent market failure	Opportunity to exclusively rely on others	Benefit of UK public sector activity/investment (without considering costs)
Turbine	▪ High yield/ reliability turbines	11 (5-19)	4 (1 – 7)	Critical	▪ No due to earlier & greater need	HIGH
	▪ High yield arrays	6 (2-10)			▪ No due to earlier & greater need	MEDIUM-HIGH
Foundation	▪ <30m depth	4 (2-3)	3 (1 – 5) [4]	Significant	▪ Yes for <30m	LOW
	▪ 30-60m depth	6 (2-6)		Critical	▪ No for 30-60m	MEDIUM
	▪ 60-100m depth	0[3] (0-13)			▪ No for 60-100m	MEDIUM
Collection & transmission	▪ Improved inter-array connections	4 (2-8)	1 (0.3 – 2)	Significant	▪ No due to earlier & greater need	LOW-MEDIUM
Installation	▪ Increased installation rate/deep water	7 (3-17)	2 (1 – 4)	Critical	▪ No for deep water	HIGH
O&M	▪ Improved access	5 (1-9)	9 (3 – 16)	Significant	▪ No for larger sites and for sites with a tough wave climate	MEDIUM-HIGH
	▪ Remote monitoring/ O&M planning	2 (1-4)				
TOTAL		**45 (18 – 89)**	**18 (7 – 35)**	**Significant -Critical**		**HIGH relative to other technology families**

[1] These values are potentially 65% lower according to alternative "perfect system optimisation" counterfactual;
[2] After displacement effects
[3] Innovation (e.g. floating foundations) may unlock economical high wind speed sites in +60m deep water, creating value in meeting emissions targets under the medium deployment scenario
[4] Value in business creation is not split by different depths. Data on the market sizes for different depths of foundation was not available.

Source: Expert interviews, Carbon Trust analysis

No one country has all the funds or capabilities to deliver innovation alone

UK example: TINAs and LCICG's strategic Framework

- 44* priority innovation needs across eleven technology families
- Delivering all of the innovation support activities identified would require the UK Government to invest somewhere between **£3bn and £4bn** over the next 5-7 years
- By comparison we estimate that the equivalent spend over the five years to 2016 is around **£1-1.5bn**

- Explore ways of working with partners to maximise the innovation impact of other public-sector budgets
- Work and encourage greater private-sector investment
- **Work in partnership with other countries to burden share and leverage each other's investments**

* This list is not intended to be an exhaustive or fixed list of everything that the UK public sector might support. A wide range of factors could potentially impact on the translation of the priorities described here into operational investment programmes. In addition to the priorities listed, LCICG members may choose to support other activities. For example, that may be in cases where UK companies have particular strengths in niche areas that if supported could create economic growth opportunities. At the earlier stages of the innovation journey, public-sector funding also needs to support a broad base of research, including highly speculative activities. The list of priorities is therefore focused primarily on applied research and beyond.

Source: LCICG Strategic Framework, February 2014

A solution could centre around areas of mutual self-interest

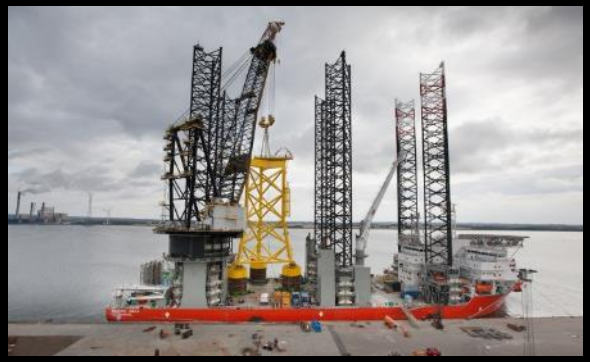
Collaboration example: Offshore Wind Accelerator

Joint industry project that aims to deliver >10% cost reduction in time for Round 3

- The Offshore Wind Accelerator brings industry together and leverages government funding to reduce the costs of offshore wind by 10% by 2015
- **Focus is on developing technologies energy companies need but don't want to own**
- Nine international energy company partners have 77% (36GW) of licensed capacity in UK waters
- Cost-effective for partners: £12 invested for every £1 they spent
- We prioritised five focus areas (foundations, access, wake effects, cabling and electrical infrastructure) and novel foundations have already been selected, de-risked and installed

Suction Bucket Jacket Installation





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TINA technology areas

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