

Innovation in the power sector Why? How are we doing?

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**CEEPR-EPRG European Energy Policy
Conference**

Berlin, 3rd July 2018

<http://www.eprg.group.cam.ac.uk>

Learning justifies support, mostly in production and deployment

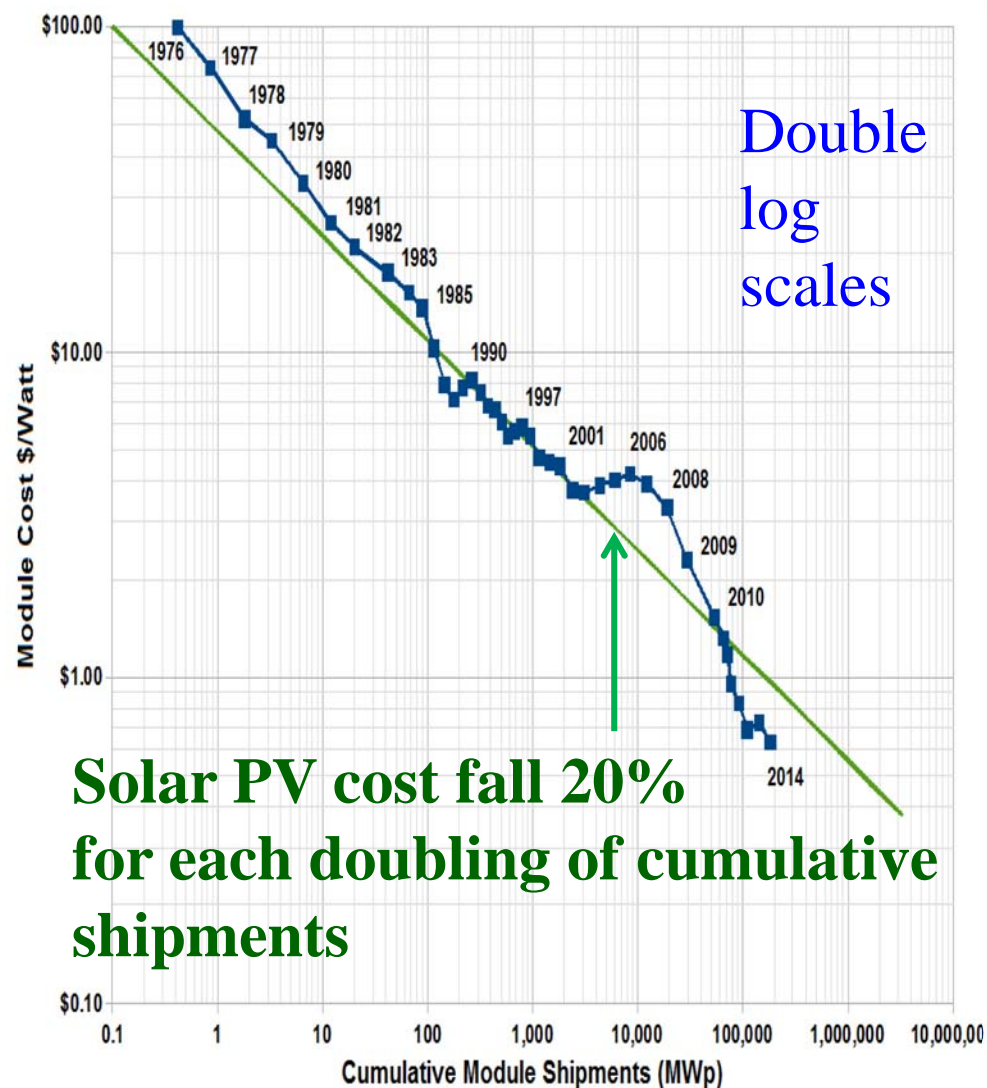
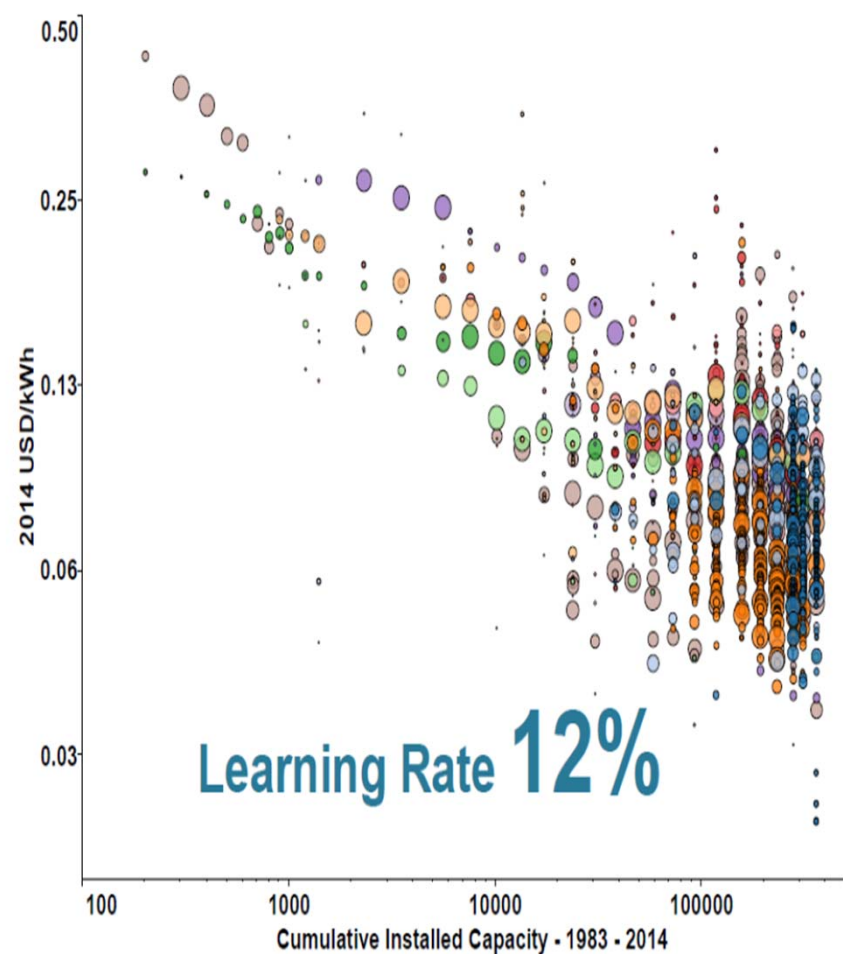


FIGURE 8: IRENA ONSHORE WIND LEARNING RATE



Contributions to global cumulative capacity

Justified maximum subsidy per kW installed

	GWp cumulative					
Country	2010	2011	2012	2013	2014	2015
China	0.8	3.3	6.8	19.7	28.2	43.5
Germany	17.4	24.9	32.5	35.8	38.2	39.8
Japan	3.6	4.9	6.6	13.6	23.3	34.2
USA	2.5	4.4	7.3	12.1	18.3	25.6
Italy	3.5	12.8	16.5	18.1	18.5	18.9
UK	0.1	0.9	1.9	3.4	5.1	8.9
France	1.2	3.0	4.1	4.7	5.7	6.6
subtotal	29.1	54.1	75.6	107.3	137.2	177.5
Global cumulative capacity	47.0	78.0	110.0	144.0	184.0	234.0
spillover per kWp	\$911	\$822	\$740	\$664	\$595	\$531

Source: Newbery (2018)

Justifies £20/MWh for first 20,000 MWh/MW_p

Spill-over *value* by country

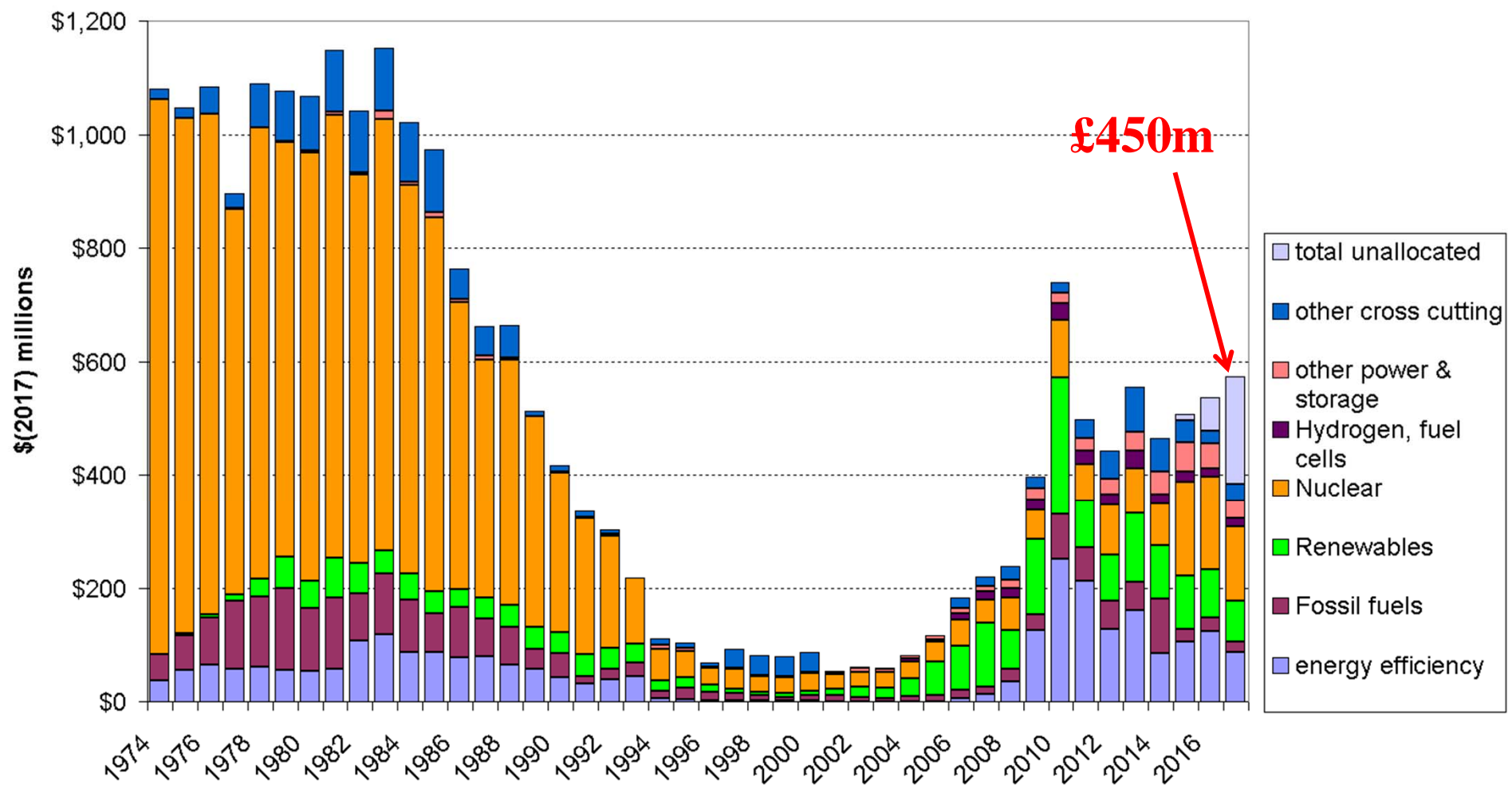
Table Spillover contributions by country					total \$ million/yr		
Country	2010	2011	2012	2013	2014	2015	cumulative
China	\$729	\$2,055	\$2,588	\$8,579	\$5,041	\$8,135	\$27,127
Germany	\$15,833	\$6,152	\$5,624	\$2,194	\$1,447	\$829	\$32,079
Japan	\$3,297	\$1,065	\$1,271	\$4,626	\$5,768	\$5,758	\$21,784
USA	\$2,304	\$1,524	\$2,137	\$3,192	\$3,687	\$3,884	\$16,728
Italy	\$3,192	\$7,649	\$2,696	\$1,076	\$229	\$246	\$15,087
UK	\$70	\$680	\$737	\$980	\$1,027	\$2,023	\$5,517
France	\$1,097	\$1,455	\$825	\$427	\$551	\$493	\$4,848
subtotal	\$26,522	\$20,579	\$15,877	\$21,073	\$17,750	\$21,369	\$123,170

80% of total

Justifies *Project Apollo*, now *Mission Innovation*

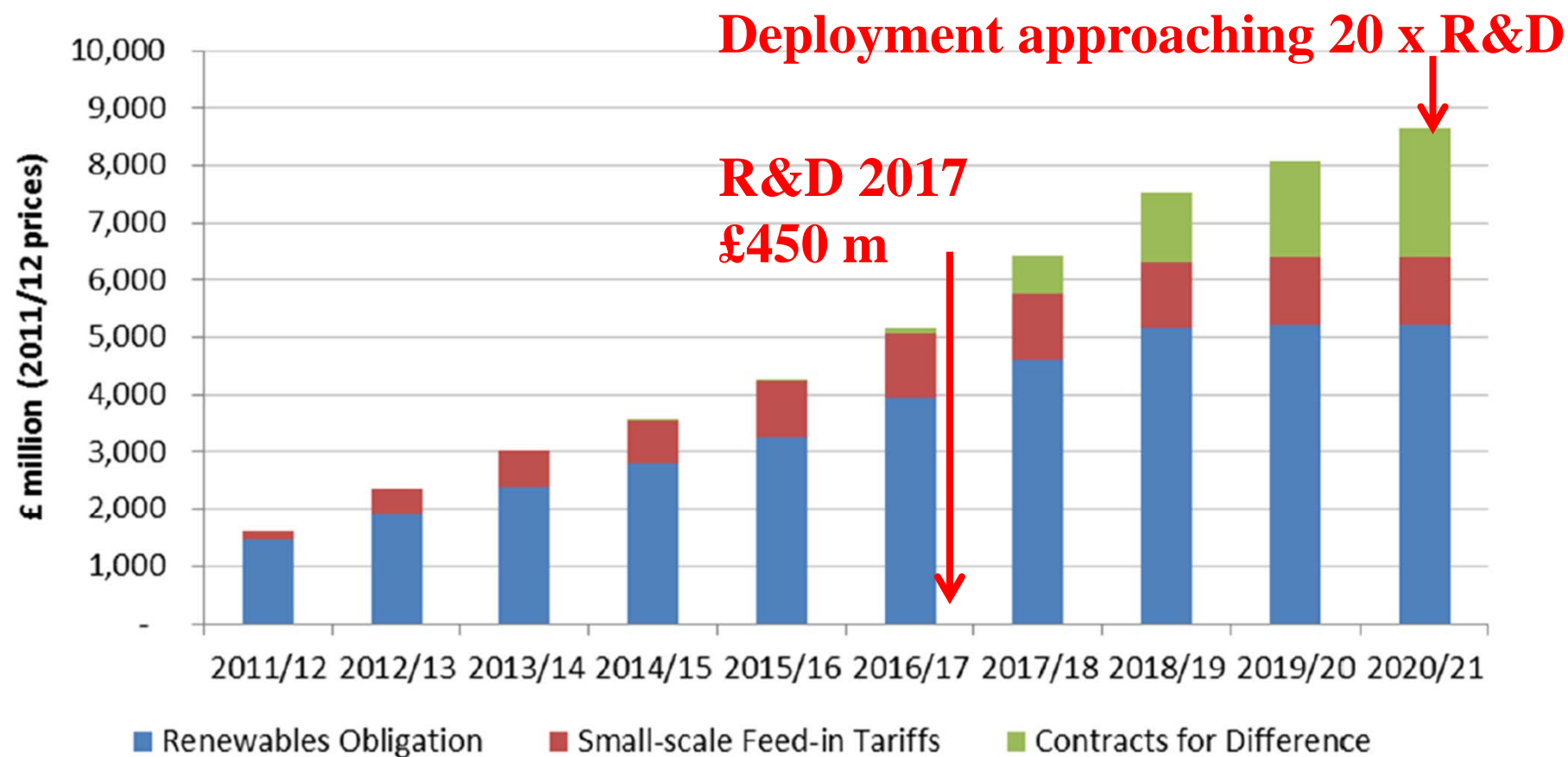
UK collapse and partial recovery post-privatization

UK Energy R&D at constant prices



Big shift to deployment support – is the balance with R&D right?

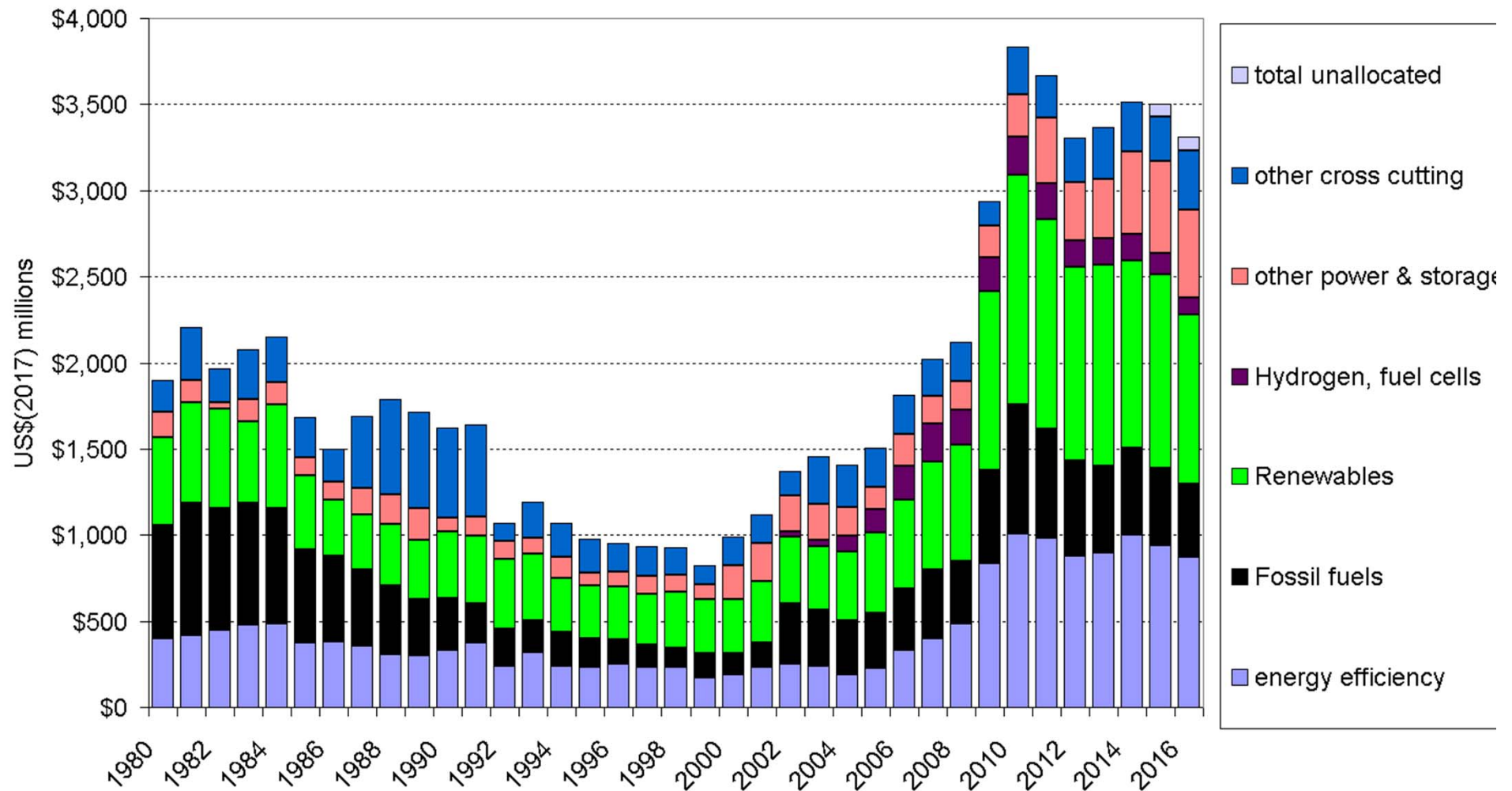
FIGURE 22: LEVY CONTROL FRAMEWORK AND PROJECTIONS



Helm Report

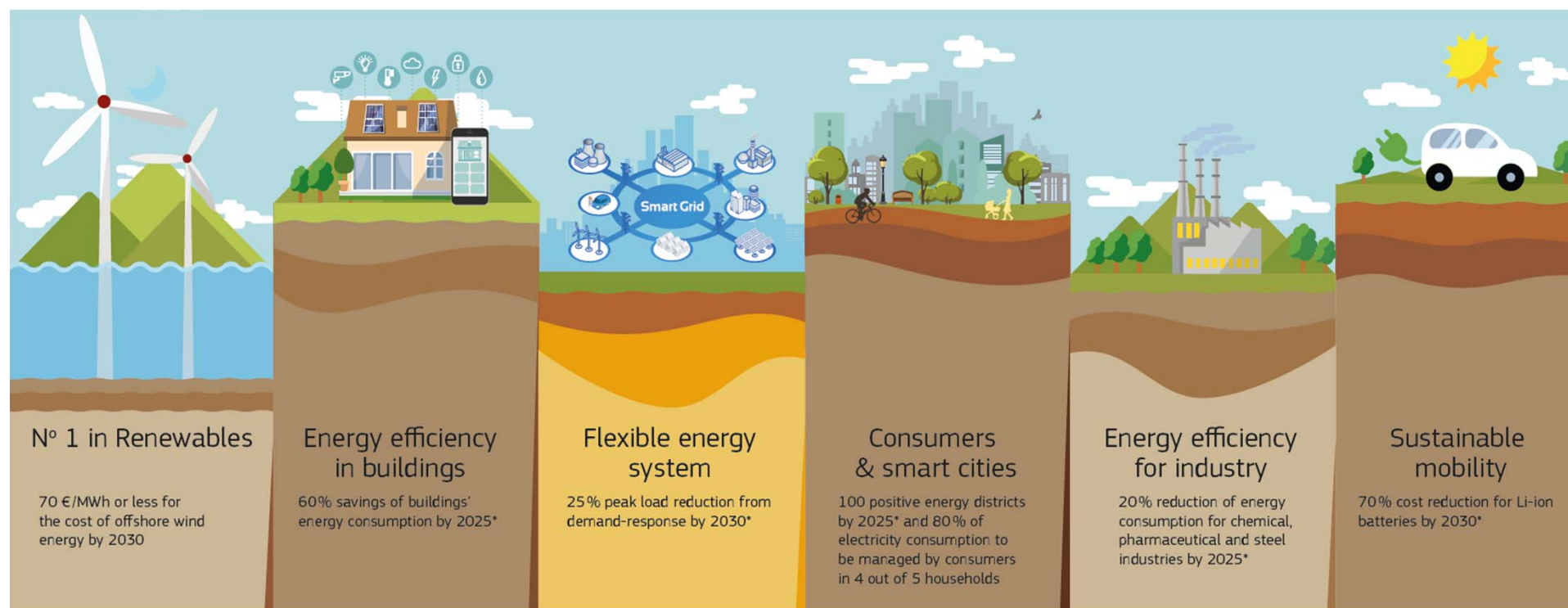
EU + NO non-nuclear R&D x 4 since 2000; UK contributes 9% in 2016

EU-11 Energy R&D excl nuclear



EU's SET Plan is much wider than energy R&D

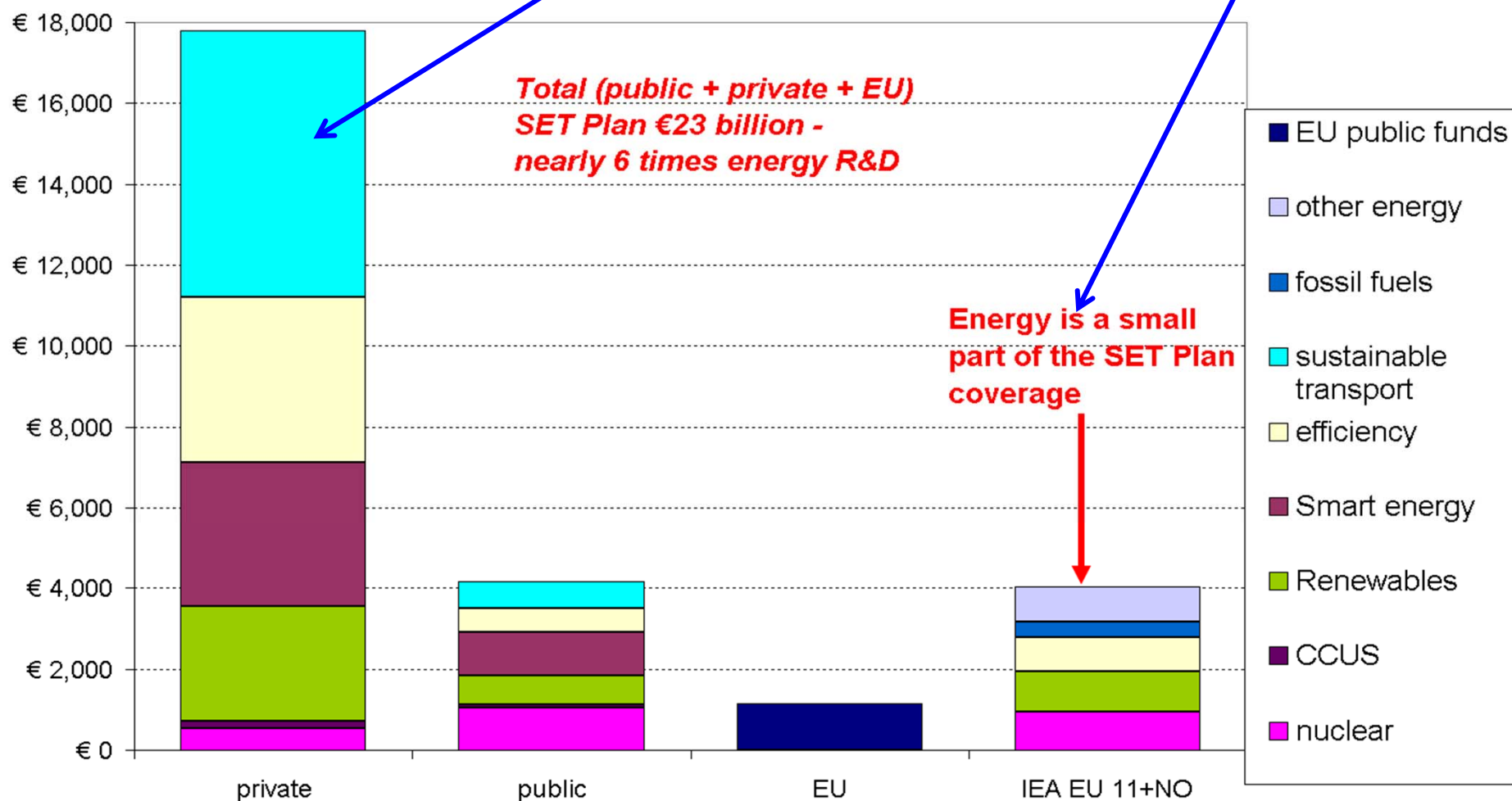
Strategic Energy Technologies programmes





SET Plan - mostly private, mostly transport & not “energy R&D”

SET plan expenditures 2015



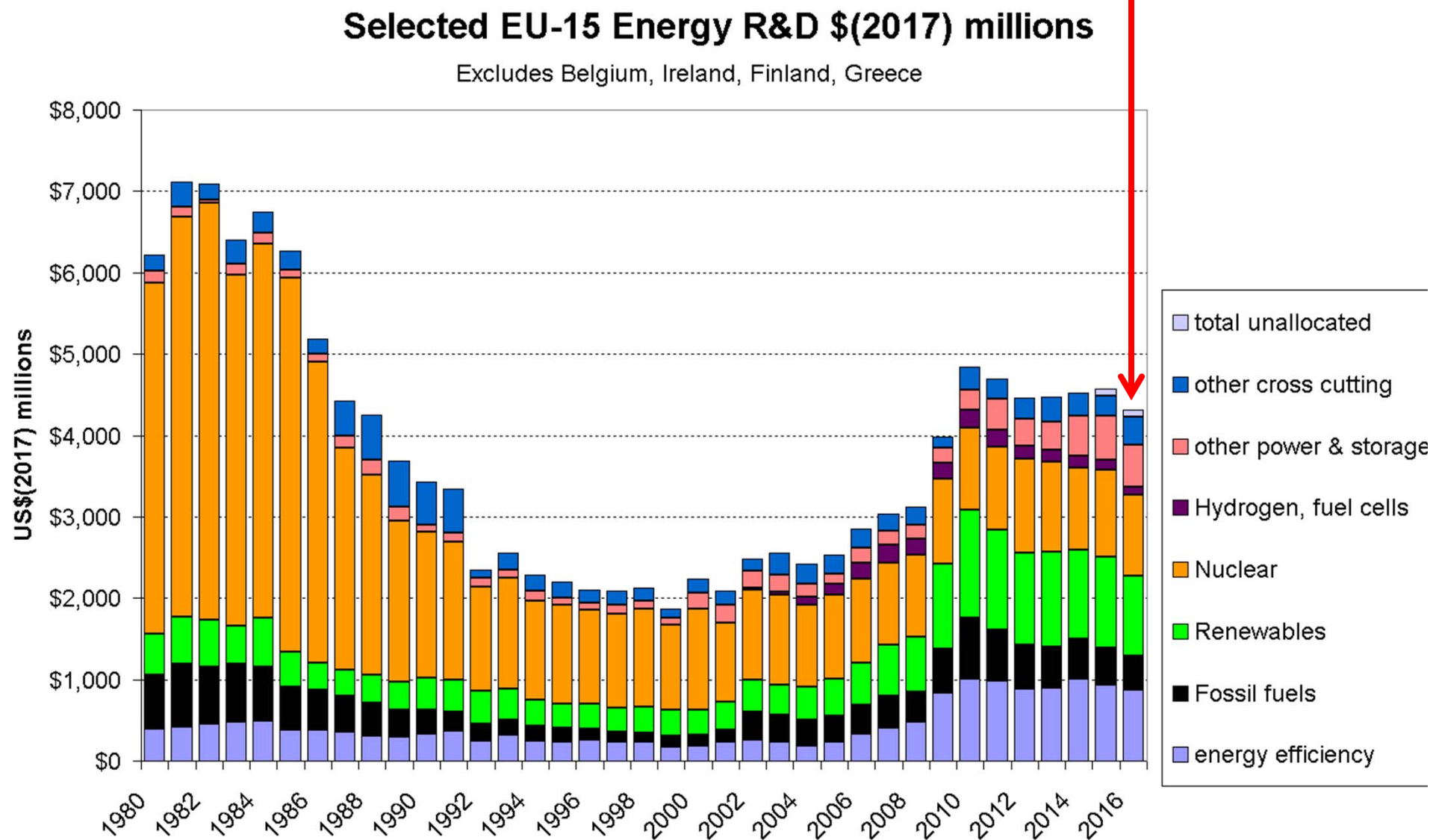


Lessons and questions

- Support for demo and deployment important
 - Ofgem spent £500 million of consumers' money on **Low Carbon Network Fund** – with a **benefit-cost ratio of 4.5-6**
 - **Mission Innovation** could justify a massive global support fund
- Demo and deployment **much more expensive than R&D**
 - Non-R&D support dwarfs R&D (SET plan x 6, GB x 10-20)
- **Key questions:**
 1. how to fund innovation with global spill-overs
 - SET-Plan is hardly ARPA-E, public funds modest
 2. How to allocate those funds
 - Competition superior, national interests intervene

- EC, 2017. *The Strategic Energy (SET) Plan* at <https://publications.europa.eu/en/publication-detail/-/publication/771918e8-d3ee-11e7-a5b9-01aa75ed71a1/language-en/format-PDF/source-51344538>
- Newbery, D., 2018. Evaluating the case for supporting renewable electricity, *Energy Policy*, 120, 684–696.
<https://doi.org/10.1016/j.enpol.2018.05.029>
- Newbery, D., 2018. Policies for decarbonizing a liberalized power sector, *Economics: the Open-Access, Open-Assessment E-Journal*, 12 (2018-40).
<http://dx.doi.org/10.5018/economics-ejournal.ja.2018-40>
- Poyry (2016) AN INDEPENDENT EVALUATION OF THE LCNF: A report to Ofgem, at https://www.ofgem.gov.uk/system/files/docs/2016/11/evaluation_of_the_lcnf_0.pdf

UK contributes 12% to total in 2016



Top four countries dominate

EU-11 + NO Total energy R&D by country

