

Delivering investments in low carbon technologies

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- **Challenges:** Future CO₂ price, market designs, funding
 - **Nuclear:** Lengthy **uncertain** construction time and cost
 - 40-60 yr life; Political risk of premature life curtailment
 - Action to mitigate climate change argues for higher investment and a **low discount rate**
 - **Macro:** discount rates have been falling for three decades
 - Are now at an **all time low**
 - Post-Covid stimulus should be **green to avoid lock-in**
 - Government: support the **RAB model** for **large, long-lived low-carbon investment like nuclear**
- => **Economic** at low WACC with carbon credit/tax



Challenges facing low carbon projects, particularly nuclear

- Dependent on **uncertain future** carbon price
- Revenue depends on rapidly **changing market** design
- **Nuclear**: lengthy uncertain construction period, political risk
- **Private sector unwilling to finance** lengthy uncertain projects at low WACC without credible guarantees and risk mitigation
- Pension funds **moving away** from long-term unregulated asset investment with shift to flexible defined contribution pension schemes
 - **But appetite for regulated assets**

Low discount rates: the *Stern Review*

- UK all-party commitment to **net zero CO₂ by 2050**
- *Stern Review* “The costs of stabilising the climate are significant but manageable; **delay** would be dangerous and much **more costly**.” Social discount rate is

$$\rho = \delta + \eta g,$$

- δ = pure time preference = 0.1%, g is p.c. growth = 1.3%
 - η rate at which marginal utility falls with consumption
Ethically = 1 **weights lives equally at different income levels**
- => Consensus that $\rho = 1.4\%$ for future climate **damage**
- HMG’s *Green Book*’s same approach proposes low discounting for **long-lived investment** projects, especially to **mitigate climate change**

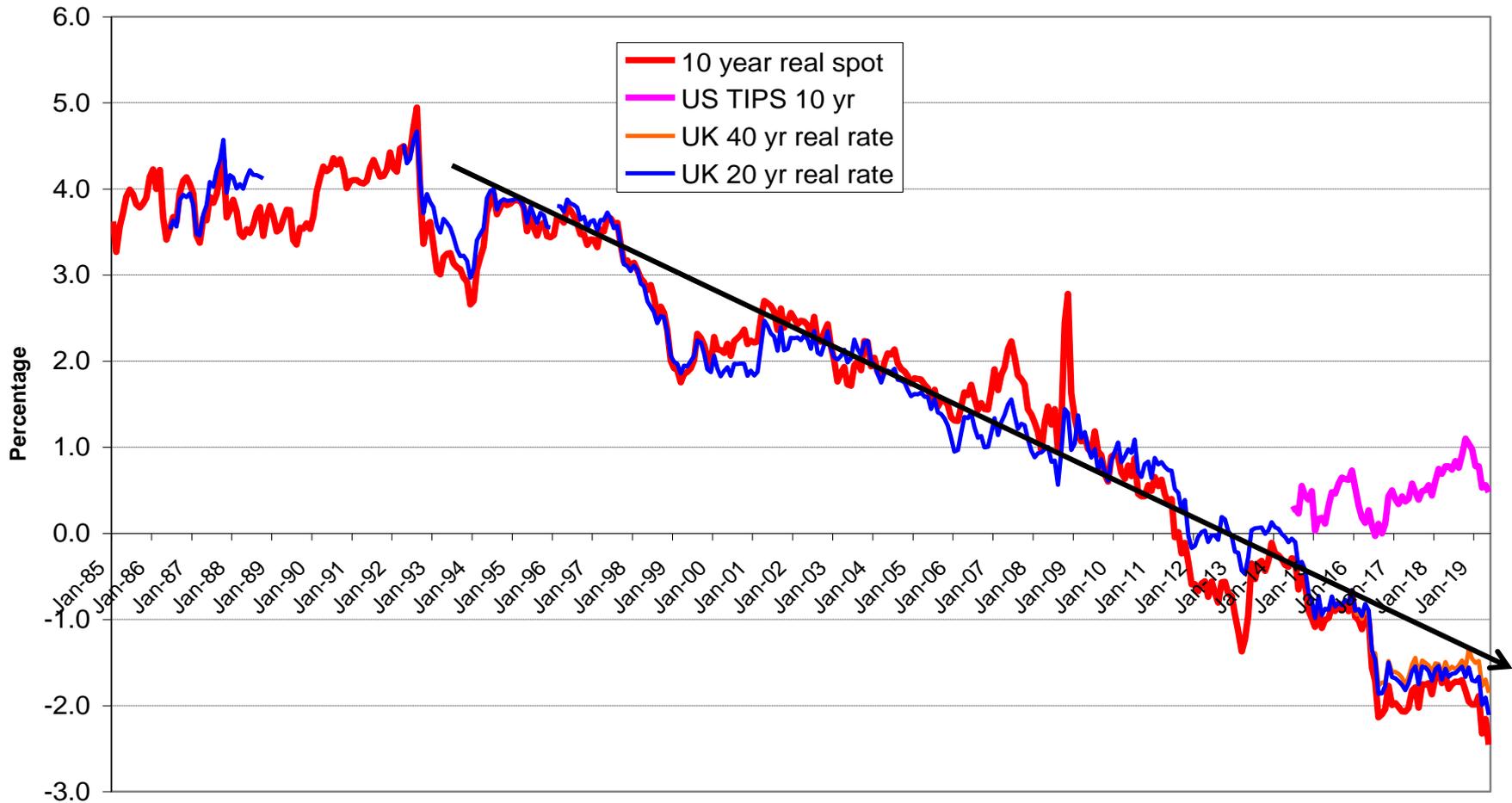
Macro case for infrastructure investment

- Zero carbon projects capital-intensive => high rates of investment needed to decarbonise
- Demography => savings glut => **real interest rates falling**
- **Cost** of public sector support for investment **very low**
- Monetary policy is weak, **fiscal stimulus** for public and private investment now **needed**

Need for zero carbon investment and potential supply of funds are aligned

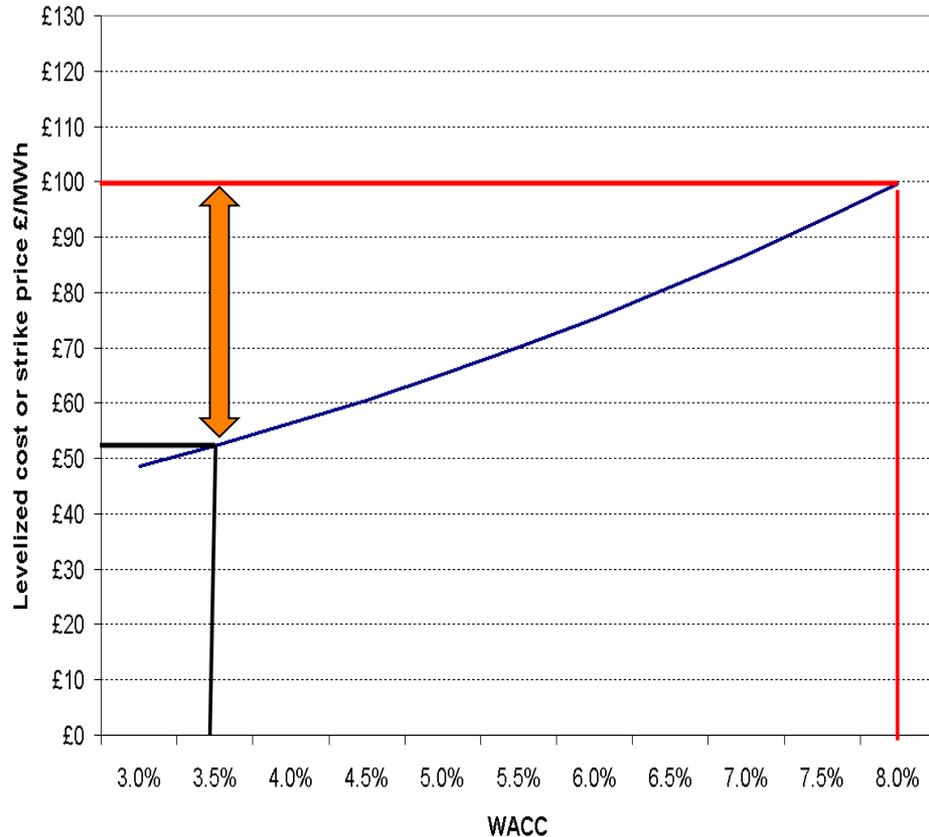
Real interest rates were falling before the financial crash

Real interest rates for UK indexed gilts and US TIPS



Problems of nuclear investment

A commercial rather than regulated WACC almost doubles the cost



Nuclear: lengthy uncertain construction period, high capital cost, low running cost, 60 years delivery of zero-carbon electricity, capital cost almost proportional to WACC

Private sector unwilling to finance lengthy uncertain projects at low WACC without credible guarantees and risk mitigation

- Low WACC requires **low risk and assurance of return**
- Benefits of placing risk on developer small, extra WACC cost high => **lowest WACC consistent with incentive**
- **Hybrid RAB model** (e.g. Thames Tideway Tunnel; **WACC=2.5%**)
 - with **excess cost sharing + cost cap** can reduce risk and WACC
 - Access **infrastructure funds** not requiring specialised knowledge.
- Payment on RAB during construction increases confidence, **reduces risk and WACC**
- Limit risk of cost over-runs, provide fairly predictable long term return => **investment attractive to institutional investors** seeking “infrastructure-like” returns

Case for RAB financed energy infrastructure

- **RAB model proven** for National Grid, water, gas pipes
- **Spread risk** over all consumers reduces total risk cost, each would bear negligible risk.
- Debt:equity 70:30, cost over-run by Co. 40% cap at 130%
- RAB interest on domestics about £4/yr during construction
 - Levelized price over the 60 year life could be as low as **£47/MWh** discounting at the **WACC of 3.5%** if built on time and budget.
- Worst case scenario - 8 yr delay, 30% cost over-run
 - levelized cost **£59/MWh** at the WACC of 3.5% .
- The resulting electricity cost is less than all fossil and most renewable generation on a total system cost basis.



- Rapid decarbonisation consistent with macro needs
 - Real interest falling, set to remain low
 - investment stimulus urgently needed
- Capital intensive durable low-C investment can be financed by a **hybrid RAB model at low WACC**
 - **nuclear, CCS, BECCS**
- Contract to **limit risk** of cost over-runs **lowers WACC**
- Ensure **attractive to infrastructure/pension** funds

BECCS	Bioenergy carbon capture and storage
CCC	Committee on Climate Change
CCS	Carbon capture and storage
CfD	Contract for Difference
CPS`	Carbon price support = carbon tax
ETS	Emissions trading System
RAB	Regulatory Asset Base (on which the WACC is paid)
RES	Renewable electricity supply
WACC	Weighted average cost of capital

David Newbery, Michael Pollitt, David Reiner and Simon Taylor (2019) Financing low-carbon generation in the UK: The hybrid RAB model, EPRG WP 1926 at

https://www.eprg.group.cam.ac.uk/wp-content/uploads/2019/07/1926-Text_REV.pdf

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<https://www.eprg.group.cam.ac.uk/eprg-working-paper-2013/>