

The myopic UKTM model (my-UKTM): lessons learned for reaching UK's climate targets

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UK's decarbonization goals

Climate Change Act:

- 80% GHG reduction by 2050

'Carbon budgets' strategy

- Four carbon budgets have been legislated, and the fifth is currently under review

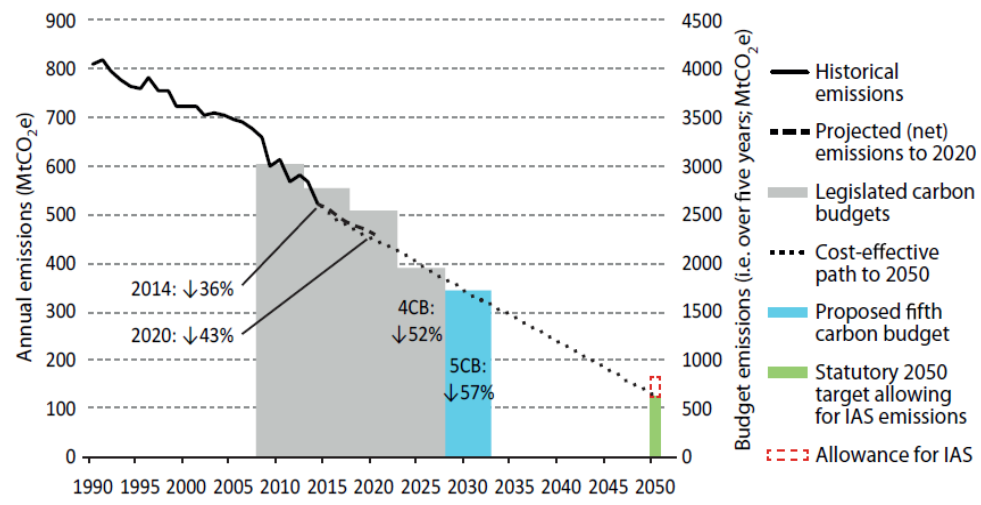


FIGURE 1 UK'S APPROVED AND UNDER REVIEW CARBON BUDGETS (Committee on Climate Change, 2015)

UKTM – The UK TIMES Model

- Continuously used for **policy support**
- Successor to **UK MARKAL**
- **Overview**
 - Integrated energy systems model
 - Perfect foresight
 - Least cost optimization
 - Partial equilibrium
 - Technology rich



Rationale for Myopic models

Optimization models useful for providing information regarding the cost-optimal pathway for reaching decarbonisation goals

HOWEVER

Governmental decisions are made with a **limited decision horizon** and imperfect knowledge of the long term developments of those decisions (Keppo and Strubegger, 2010).

Models with a **myopic foresight** could be useful to better **represent the shorter term focus of decision making** compared to perfect foresight models.

Myopic UKTM (my-UKTM)

- Same **technology detail** as UKTM
- **Myopic foresight**
- **Advantages:**
 - Comparable with UKTM → can be used in conjunction
 - Better represents myopic decision making
 - Lower computational times

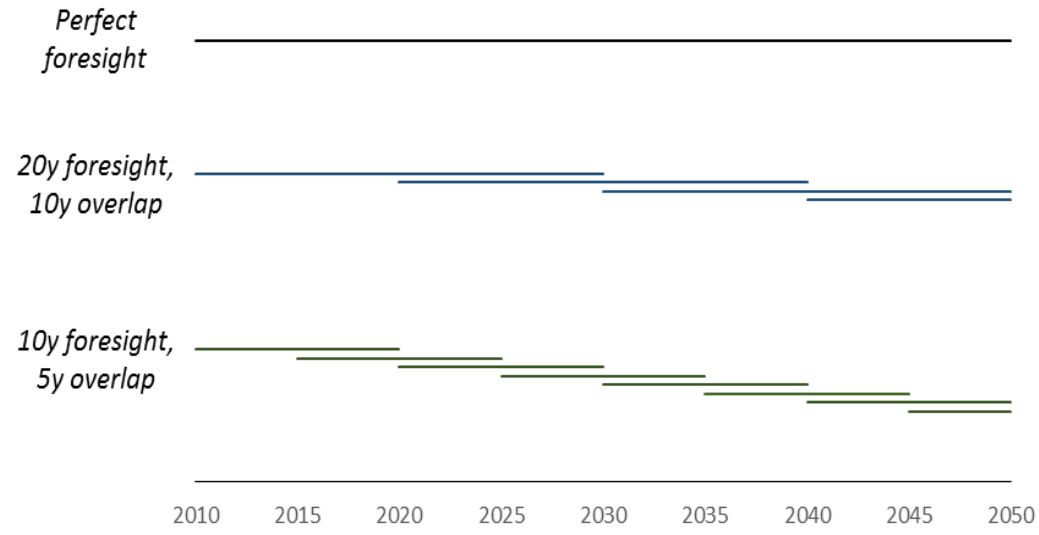


FIGURE 2 EXPLORED FORESIGHT OPTIONS

Why Myopic UKTM

- With the carbon budgets the UK is setting a **long-term vision**
- However, **changing circumstances** (e.g. governments), **uncertainty** regarding the future and the **high-capital requirements** of energy projects result often the adoption of short-term measures and in the **postponement of long-term strategic decisions**
- **Combining the usage of UKTM and my-UKTM** can help understand:
 - The **linkage between short- and long- term goals**
 - The effect of possible **path-dependencies** and **lock-ins** in the energy sector
 - How **insights** gained **from a perfect foresight** model (e.g. carbon prices) **could work** in world where decisions are made myopically

Scenario Analysis

PERFECT FORESIGHT-UKTM

- perfect foresight UKTM model for achieving 80% GHG reduction by 2050

MYOPIC-20 & MYOPIC-10:

- As PF-UKTM but with 20 and 10 years foresight respectively

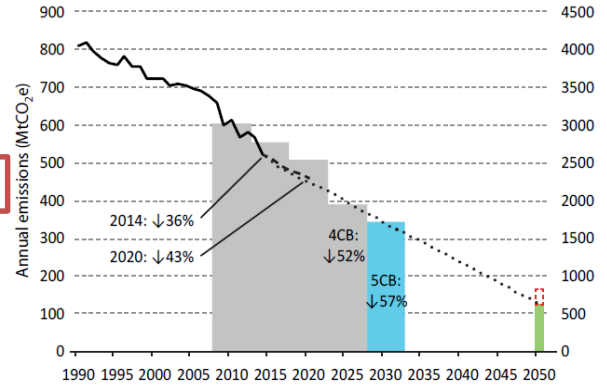


FIGURE 1 UK'S APPROVED AND UNDER REVIEW CARBON BUDGETS (CCC, 2015)

Marginal price of CO2eq

MYOPIC-20-CT & MYOPIC-10-CT:

- a carbon tax obtained from the PF-UKTM scenario is applied to the my-UKTM runs (20 and 10 years foresight)

The effects of myopic foresight

Structurally different investments

Perfect foresight UKTM

- Invests in long-term structural investments from year 1 (e.g. electricity and hydrogen-based transportation)

Myopic UKTM

- Invests in projects with a short-term view, with the result of having to invest in a range of technologies in the last model years

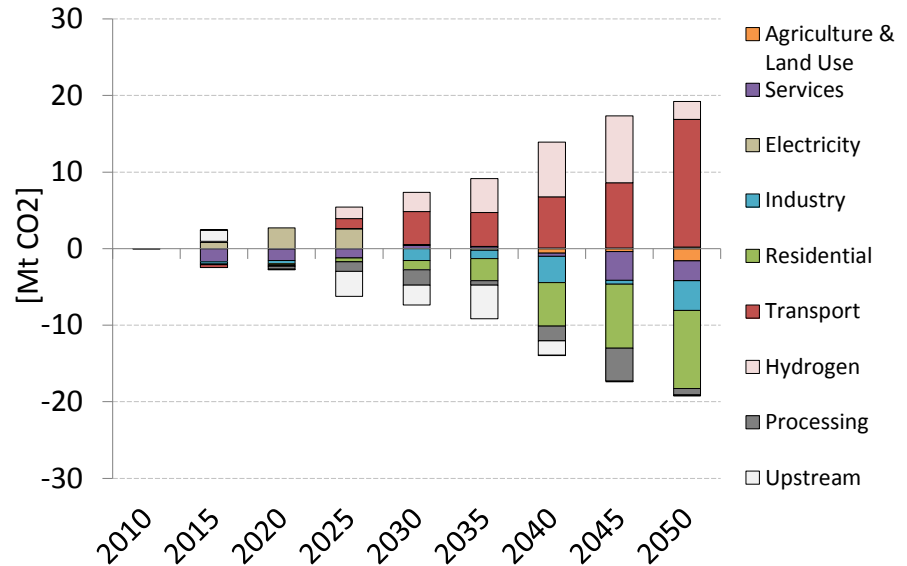


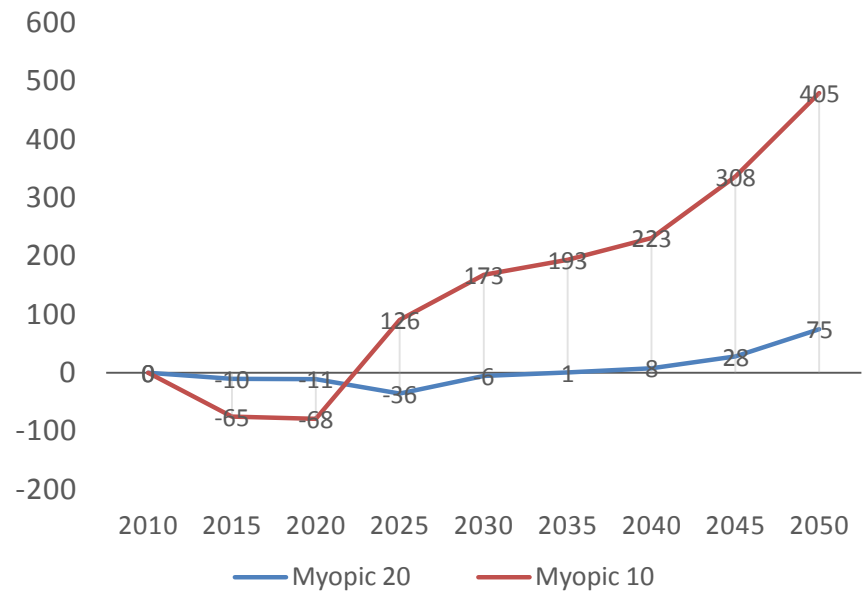
FIGURE 3 DIFFERENCE IN GHG EMISSIONS, MYOPIC 20 – PERFECT FORESIGHT

The effects of myopic foresight

Lower costs in the first model years

Considerably higher costs after 2025

FIGURE 4 CUMULATIVE COST DIFFERENCE BETWEEN PERFECT FORESIGHT AND MYOPIC UKTM RESULTS [BILLION £]



Effect of a carbon tax obtained from the perfect foresight model

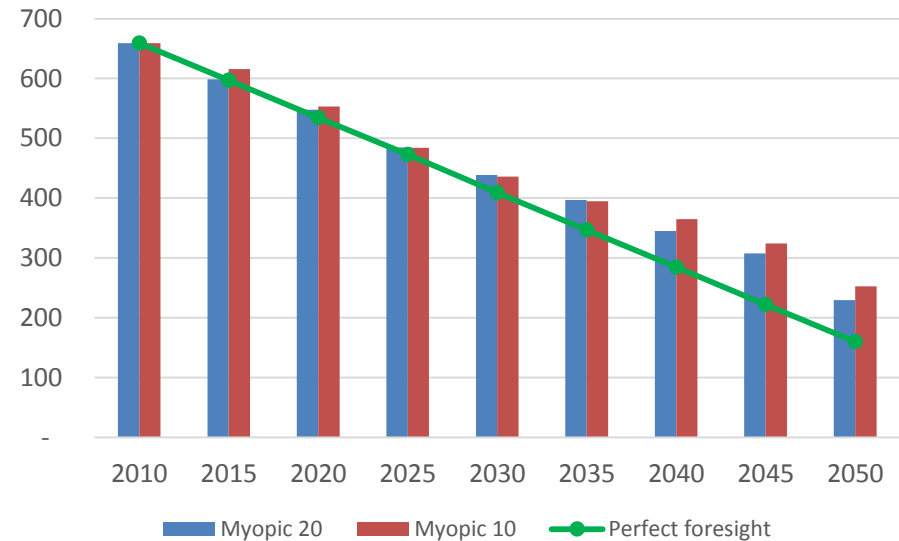
Carbon tax in my-UKTM as the marginal cost of GHG in perfect foresight UKTM:

	2020	2030	2040	2050
CO _{2eq} price [£/t CO ₂]	37	99	128	288

The myopic runs do not reach the target of 80% GHG reduction by 2050

- 70% reduction for the myopic20
- 65% reduction for the myopic10

FIGURE 5 TOTAL EMISSIONS APPLYING A CARBON TAX FROM THE PERFECT FORESIGHT MODEL [Mt CO_{2eq}]



Conclusion & way forward

- **Perfect foresight and myopic UKTM can be used in conjunction** to gain policy-relevant insights
- **'Myopic'** planning results in the **delayed adoption** of low-carbon technologies and **increased costs** for reaching UK's decarbonisation goals
- A **carbon tax** obtained from perfect-foresight optimization models may be under-valued

Ongoing work to look at the effect of late action on the achievement of the decarbonisation goals

Thank you for your attention!

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