Implementation of the EU 2020 Renewables Target in the UK Electricity Sector: RO Reform

No new nuclear build sensitivities

18th August 2009

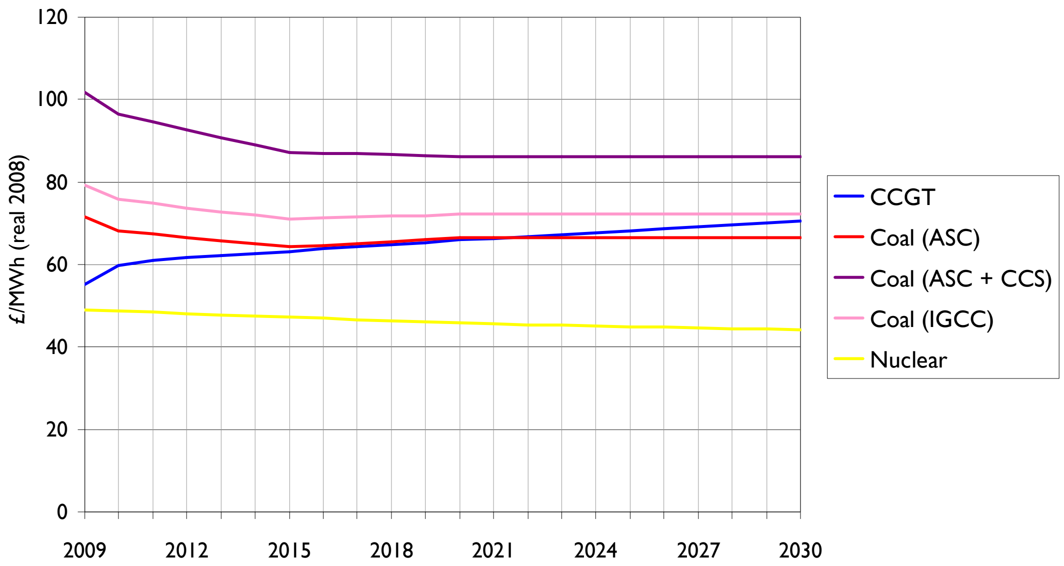
Date: 18-Aug-09 **Client:** Department of Energy and Climate Change

Introduction

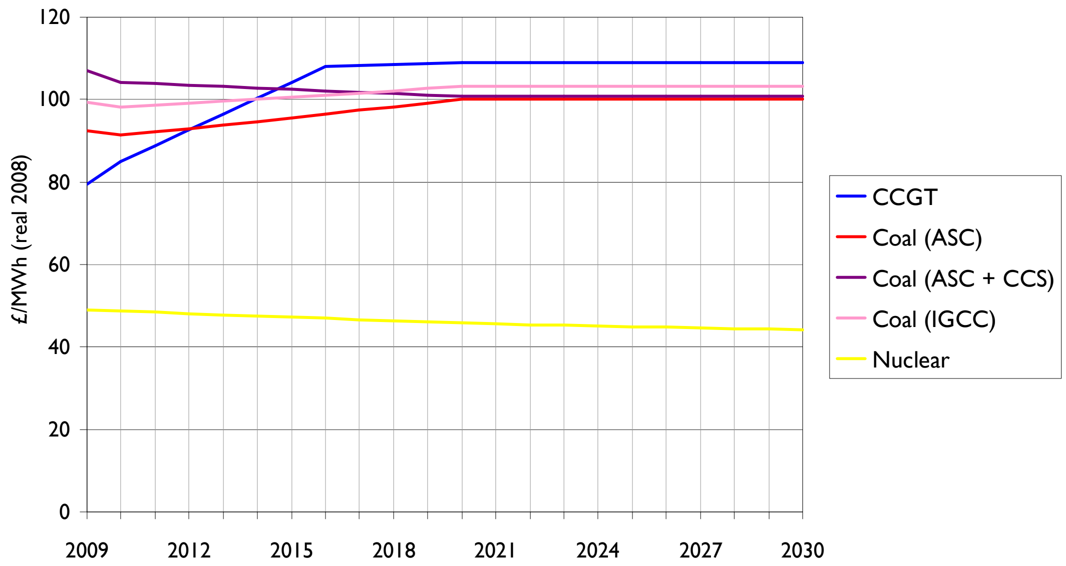
- The initial modelling, undertaken to analyse the impact of the changes to the Renewables Obligation, included new nuclear as an investment option
- The modelling suggested that under the Base commodity price case 9.6 GW of new nuclear capacity would be built by 2030, which is the limit imposed by build constraint assumptions
- DECC has asked Redpoint to run sensitivities on 2 cases with the assumption that there is no new investment in nuclear prior to 2030:
  - Minimum Change Base 29% Renewables (Min. Ch. Base 29)
  - Minimum Change High High 28% Renewables (Min. Ch. High High 28)
- Note that a Minimum Change High High 29% case has not previously been run, therefore it was not possible to use this as a basis for a High High commodity price sensitivity
- The key aim of the sensitivity analysis is to understand the impact on investment in new nuclear on investment in renewables
- Assumptions on existing nuclear plant remain unchanged

New Entry Costs (LRMCs)

Minimum Change Base 29

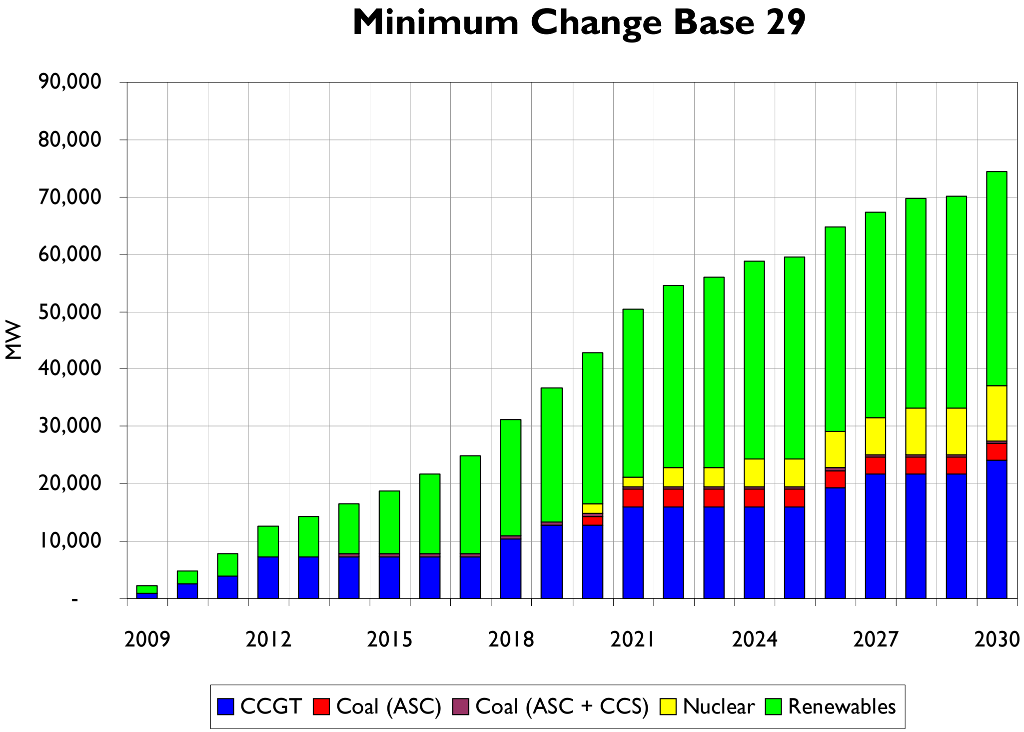


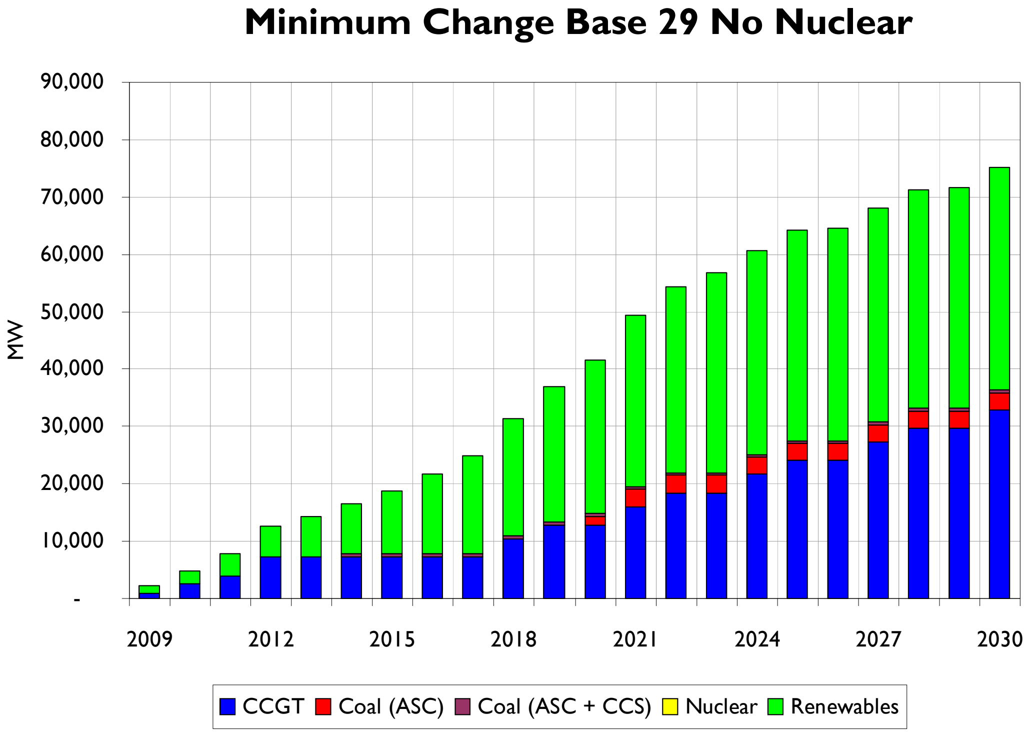
Minimum Change High High 28



- The graphs shows the new entry costs for thermal technologies under the Base and High High commodity price assumptions
- It is clear that nuclear is the Best New Entrant in both cases (by a very large margin in the High High case)
- Therefore the No Nuclear sensitivities are expected to show a net welfare disbenefit, resulting from the substitution of new nuclear capacity with a higher cost technology

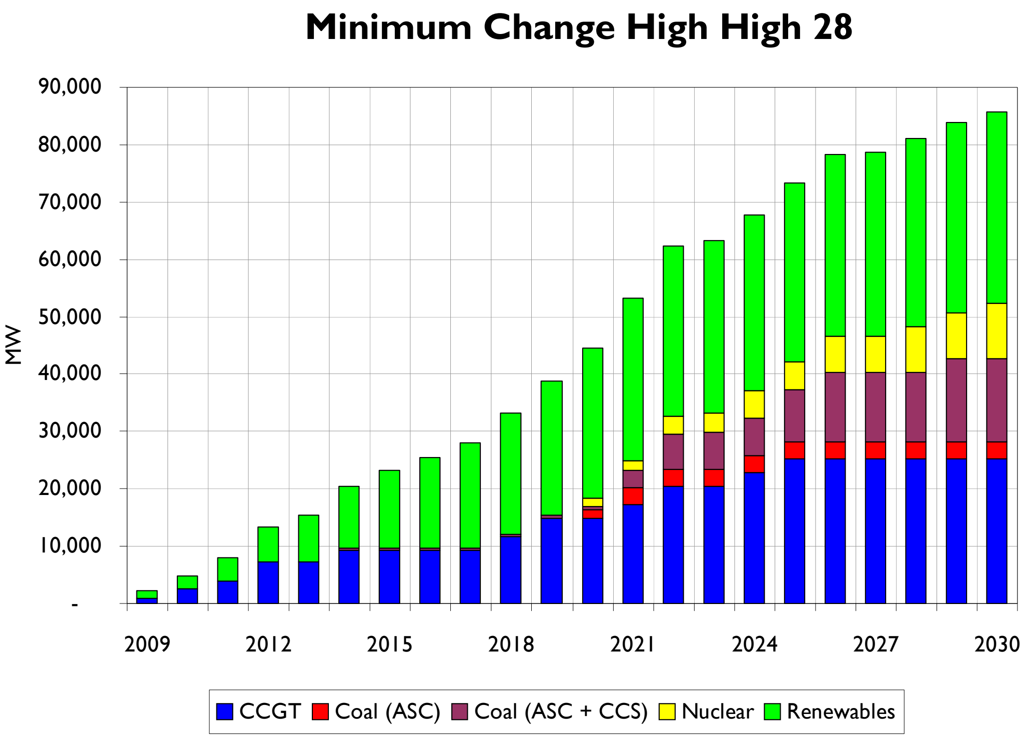
New plant build: Base

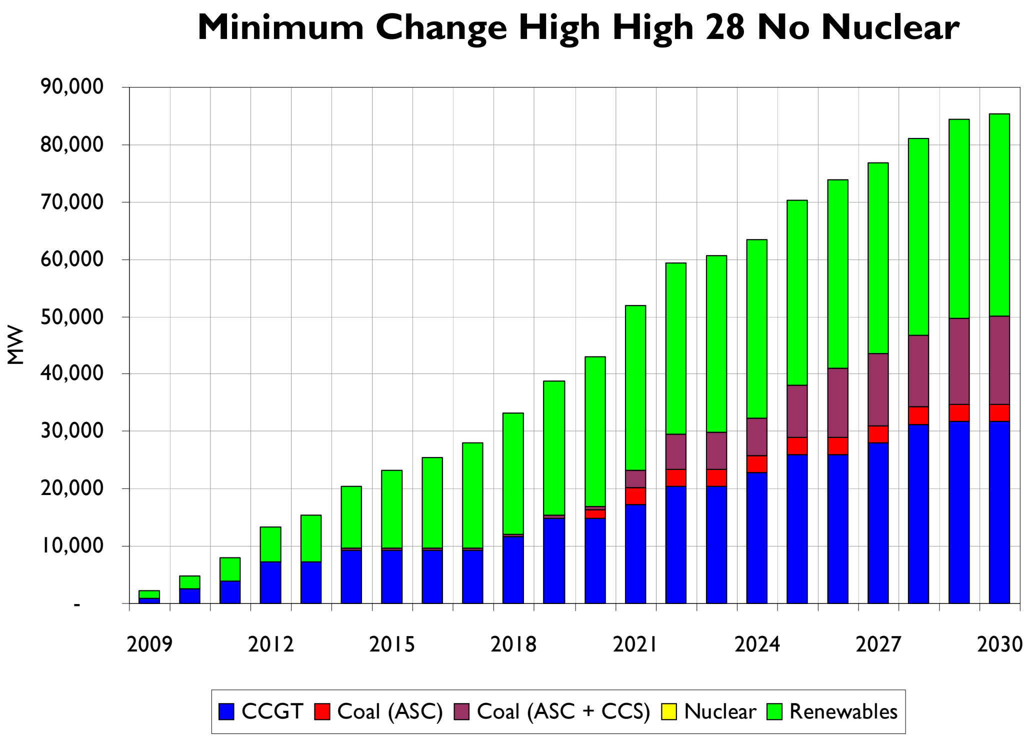




- The graphs shows the cumulative new build
- In the Min Change Base 29, new nuclear build reaches 9.6 GW by 2030
- In the No Nuclear run, CCGT build increases from 24 GW to 33 GW by 2030, therefore overall there is almost a one-for-one replacement of nuclear with CCGT capacity
- The effect on renewables investment is discussed in Slide 6

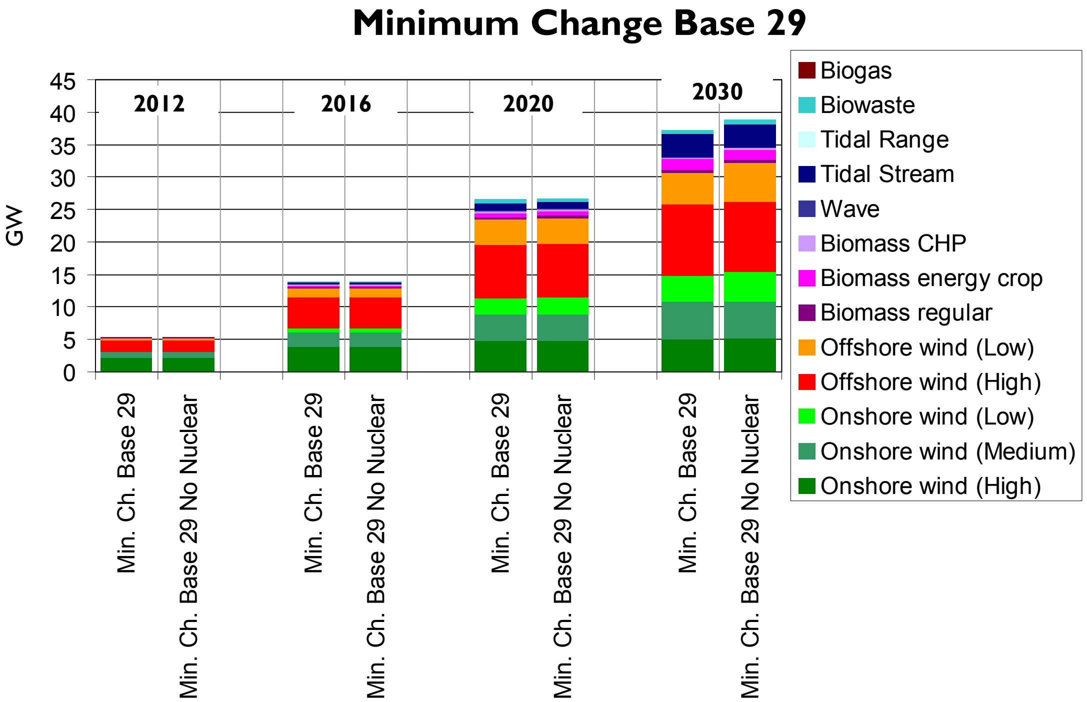
New plant build: High High

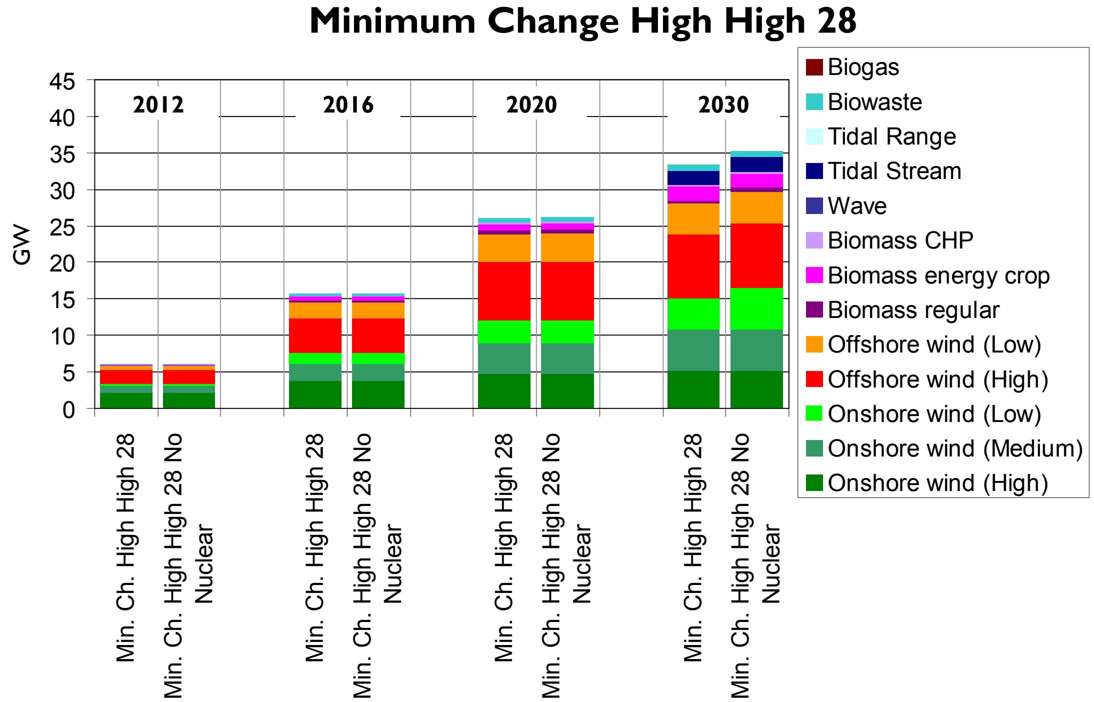




- In the Min Change High High, there is both CCGT and ASC Coal + CCS build in the post 2020 period
- During the first half of the 2020s, the total amount of new thermal capacity is lower in the No Nuclear Case as initially the investment in CCGT and ASC + CCS does not change
- By 2030, new investment in both these technologies has increased compared to the Min Change High High 28, from 25 to 32 GW for CCGT and 14.5 to 15.5 GW for ASC + CCS

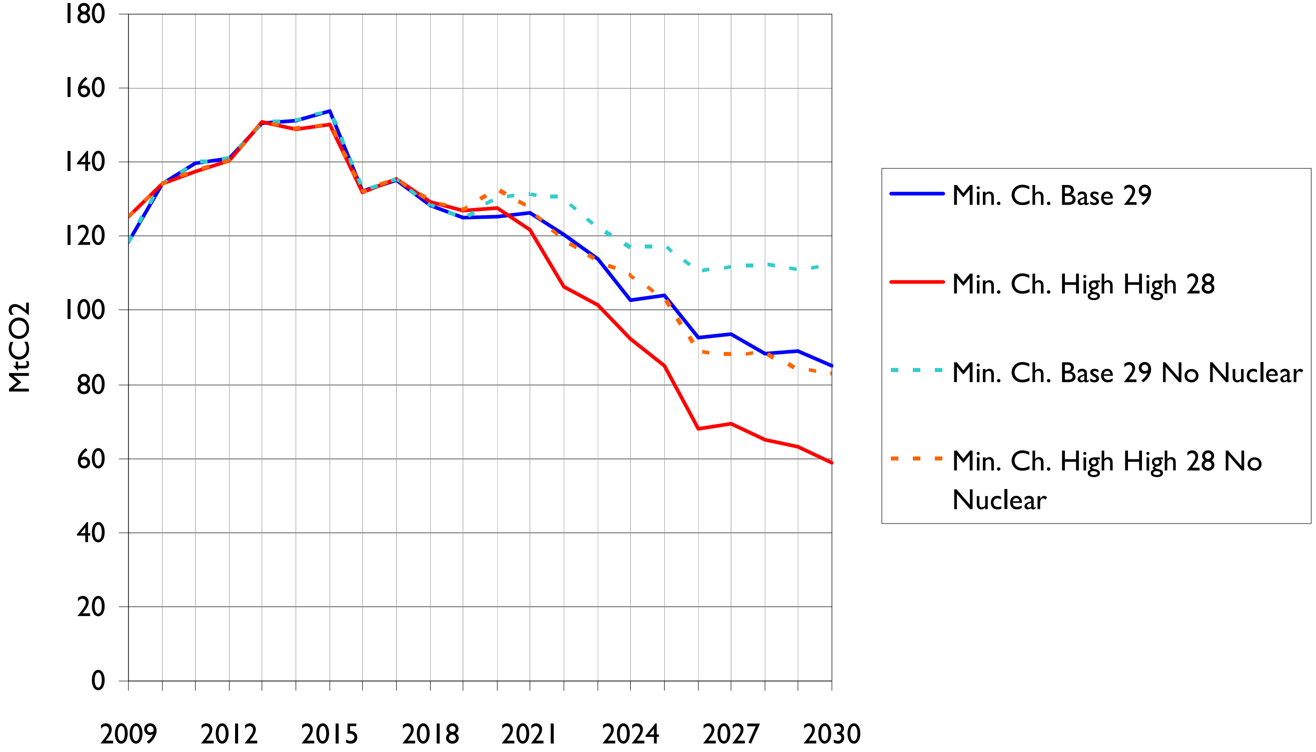
Renewables build





- The graphs shows the cumulative renewables new build in selected years
- Under both the Base and the High High commodity price assumptions, the target achieved in 2020 is little changed in the No Nuclear case
- In the Base Case the renewable target achieved increases marginally from 29.0% to 29.2%
- In the High High Case the renewable target achieved increases marginally from 28.1% to 28.2%
- By 2030, the difference has become more significant under both sets of commodity price assumptions

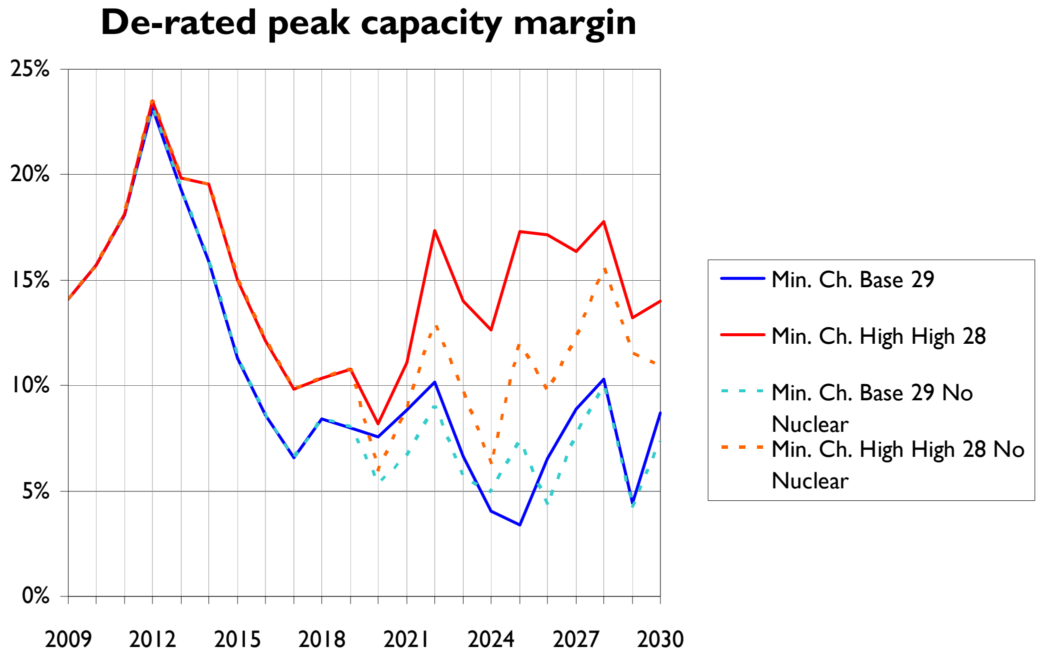
Carbon emissions

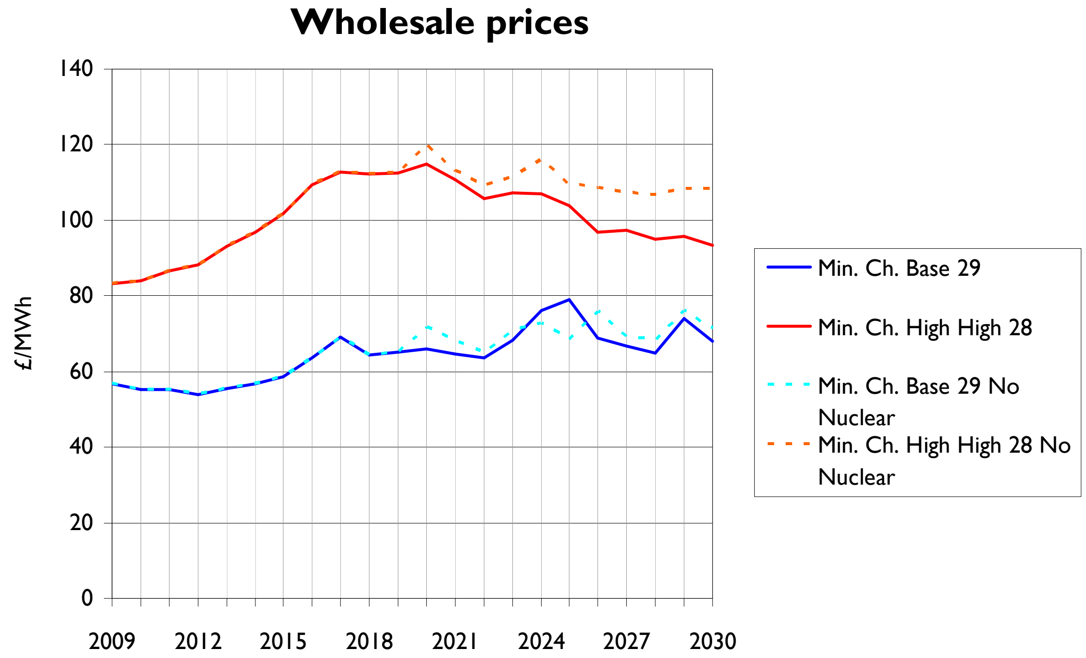


- In the sensitivities with no new nuclear, carbon emissions are higher from 2019 onwards
- This is because in the No Nuclear cases there is significantly more output from gas plant, due to the new CCGT capacity that has been built
- The overall increase in carbon dioxide over the modelling period is 164 million tonnes in the Base Case and 177 million tonnes in the High High Case
- The difference is larger in the High High Case because the substituted plant is built later, means that older, less efficient plant run at higher load factors in the interim

De-rated peak capacity margins and wholesale prices

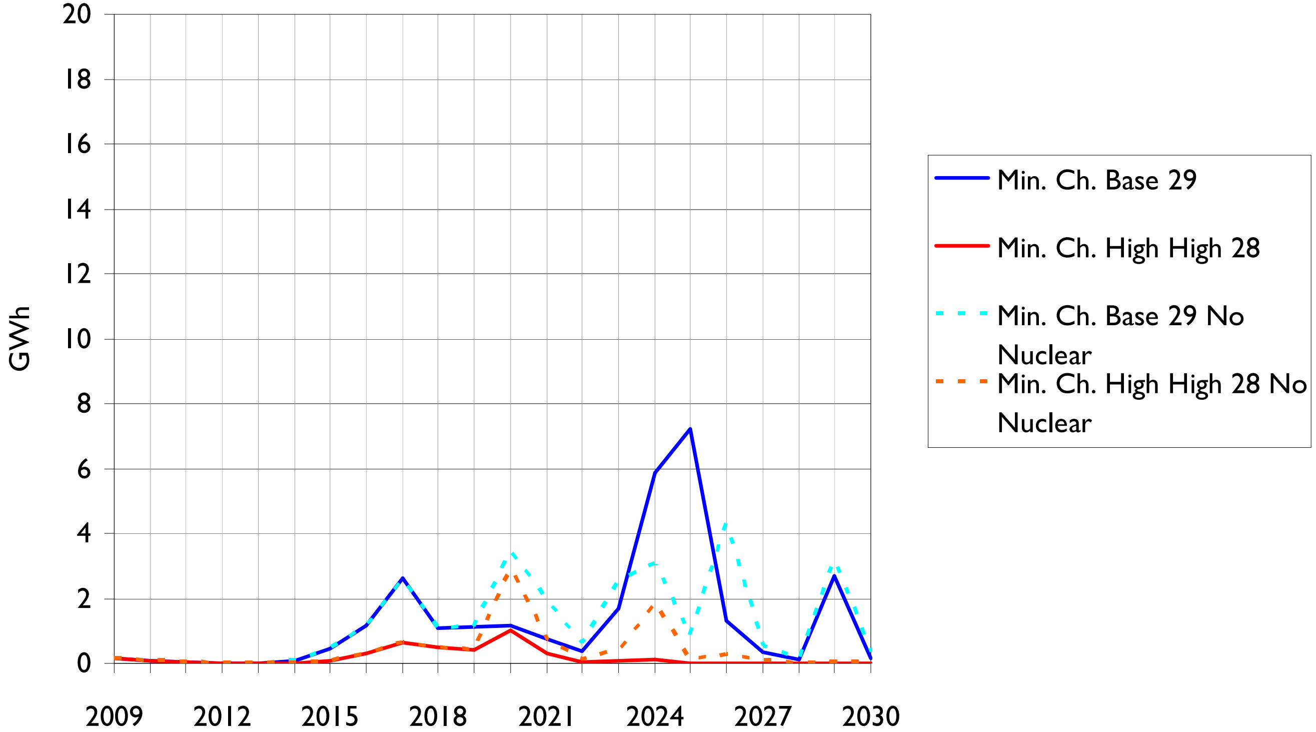
Trilemma UK REDPOINT





- Under the Base commodity price assumptions, the average level of the peak de-rated capacity margin is similar with and without nuclear build, and wholesale price levels are also similar
- Under the High High commodity prices, the average level of the de-rated capacity margin is lower in the No Nuclear case after 2020, due the lower level of thermal build
  - However the capacity margins are still at a reasonable level compared to the Min Change Base Case
- Both Base and High High No Nuclear cases show a reduction in capacity margin in 2020, the year when the first new nuclear plant comes on in the Cases where nuclear is allowed

Expected Energy Unserved



- The graph shows the Expected Energy Unserved in each Case
- These numbers do not include energy unserved due to outages on the Transmission and Distribution systems, which are of the order of 10 GWh/annum
- It is clear that under the High High commodity price assumptions, the No Nuclear shows an increase in expected energy unserved, however this is still below the level of the Base Case

Cost Benefit Analysis

Trilemma UK REDPOINT

- CBA shows significant net welfare disbenefit in both cases
- The key driver of this is the replacement of nuclear with a higher cost technology such as CCGT
- There is also some negative impact from the increased renewables investment after 2020 in the No Nuclear cases
- In the High High case, the overall amount of new thermal capacity is lower throughout the 2020s. If there had been a one-for-one replacement of capacity, the net welfare reduction would be much greater

Change in annual welfare, NPV £m (real 2008)		Min. Ch. Base 29 No Nuclear	Min. Ch. High High 28 No Nuclear
Net Welfare	Carbon saved	-1,952	-5,679
	Less increase in resource costs	-8,625	-7,121
	Less increase in unserved energy	-47	-29
	Less increase in demand side response	-5	-12
	Change in Net Welfare	**-10,629**	**-12,841**
Consumer Surplus	Change in wholesale price	-6,922	-19,634
	Change in balancing costs	-626	-126
	Change in unserved energy	-47	-29
	Change in demand side response	-5	-12
	Change in net renewables subsidy	-5,536	-57
	Change in administration costs	-2	0
	Change in CCL	267	52
	Change in VAT	-212	-328
	Change in Consumer Surplus	**-13,082**	**-20,134**
Producer Surplus	Change in wholesale price	6,922	19,634
	Change in balancing revenues	626	126
	Change in net renewables subsidy	5,536	57
	Change in generation costs	-10,575	-12,800
	Change in Producer Surplus	**2,508**	**7,017**
	Change in renewables rent	*3,218*	*4,783*
	Change in non-renewables rent	*-710*	*2,235*
Treasury Receipts	Change in CCL	-267	-52
	Change in VAT	212	328
	Change in Treasury Receipts	**-55**	**275**

Sensitivities: Key messages

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- Investment in new nuclear capacity has only a limited impact on investment in renewables
- When nuclear build is disallowed, other new thermal capacity (CCGT, ASC + CCS) is built instead
- Under the assumptions used in the modelling, preventing new nuclear build has a significant net welfare disbenefit because nuclear has a lower Long Run Marginal Cost (LRMC) than the other thermal technologies which are built instead
- The increase in carbon dioxide emissions due to disallowing nuclear is up to 20 mtCO2/annum in these sensitivities