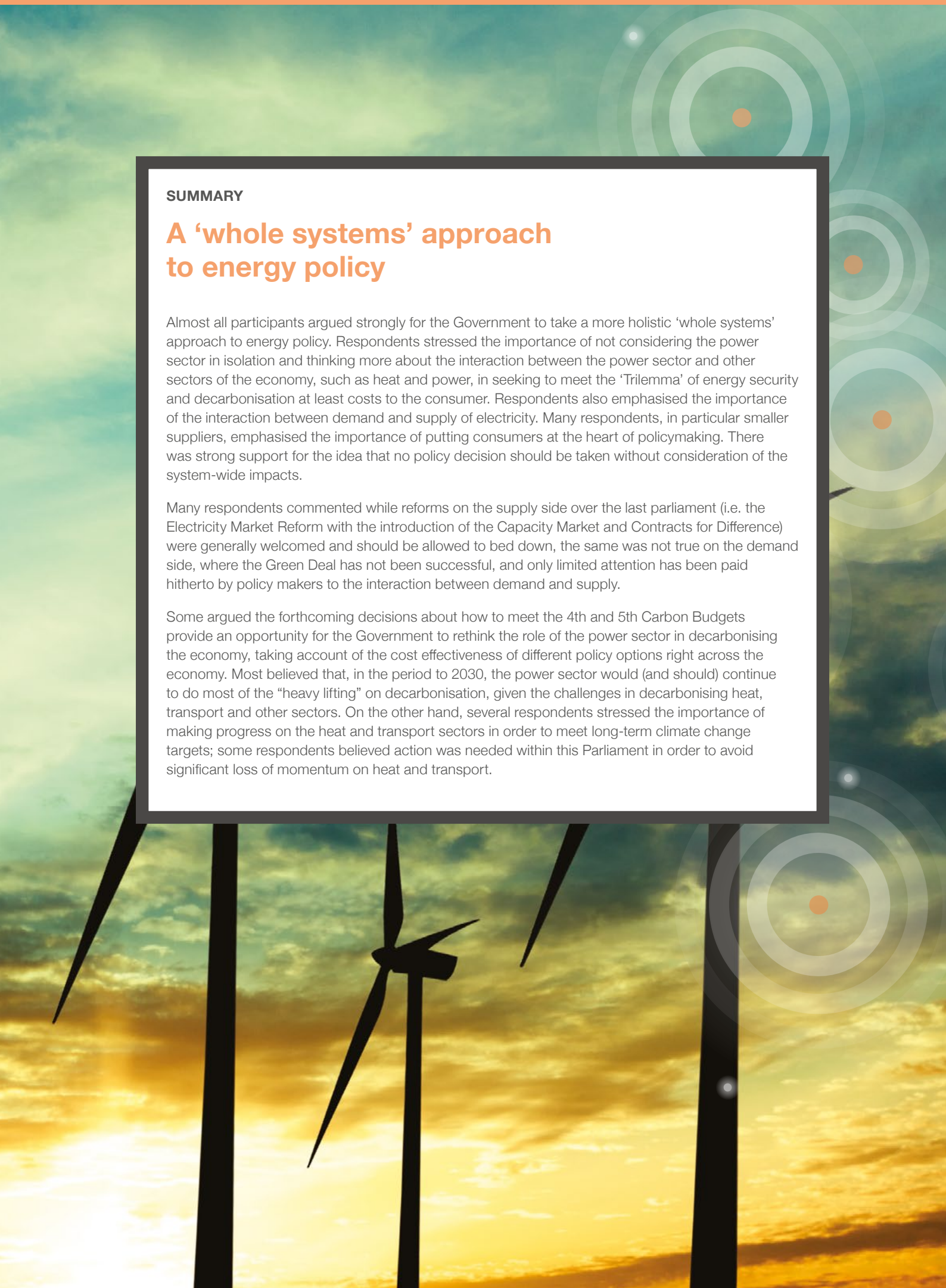
2. Whole system approach



SUMMARY

A 'whole systems' approach to energy policy

Almost all participants argued strongly for the Government to take a more holistic 'whole systems' approach to energy policy. Respondents stressed the importance of not considering the power sector in isolation and thinking more about the interaction between the power sector and other sectors of the economy, such as heat and power, in seeking to meet the 'Trilemma' of energy security and decarbonisation at least costs to the consumer. Respondents also emphasised the importance of the interaction between demand and supply of electricity. Many respondents, in particular smaller suppliers, emphasised the importance of putting consumers at the heart of policymaking. There was strong support for the idea that no policy decision should be taken without consideration of the system-wide impacts.

Many respondents commented while reforms on the supply side over the last parliament (i.e. the Electricity Market Reform with the introduction of the Capacity Market and Contracts for Difference) were generally welcomed and should be allowed to bed down, the same was not true on the demand side, where the Green Deal has not been successful, and only limited attention has been paid hitherto by policy makers to the interaction between demand and supply.

Some argued the forthcoming decisions about how to meet the 4th and 5th Carbon Budgets provide an opportunity for the Government to rethink the role of the power sector in decarbonising the economy, taking account of the cost effectiveness of different policy options right across the economy. Most believed that, in the period to 2030, the power sector would (and should) continue to do most of the "heavy lifting" on decarbonisation, given the challenges in decarbonising heat, transport and other sectors. On the other hand, several respondents stressed the importance of making progress on the heat and transport sectors in order to meet long-term climate change targets; some respondents believed action was needed within this Parliament in order to avoid significant loss of momentum on heat and transport.

2.1 Interview responses

One of the key themes that emerged from the interview process was a 'whole system' approach to energy policy was required. The concept of a whole systems approach was referred to in various ways from macro (the interaction between the power, heat and transport sectors) to sectoral (the interaction between and cost effectiveness of supply and demand measures); and technological (valuing the associated network and system costs[x] of different generation options). This section discusses macro and sectoral issues, i.e. the interaction between supply and demand and the interrelatedness of the power, heat and transport sectors. Issues of technological system costs and benefits are discussed in chapter 5.

Respondents emphasised the importance of energy policy not being developed in isolation. They felt policy makers should consider each issue and ask about the whole system impact in all policy making. Interviewees made statements such as:

"There needs to be a greater emphasis on a whole systems approach to energy policy."

"Consideration of the whole system costs is critical."

"A big push is needed on heat and transport to avoid losing momentum."

"The power sector will do the heavy lifting but the long-term targets need to consider the whole [system]."

"There needs to be a shift from thinking about capacity to thinking about the whole system."

"The supply-side has been a big area of focus but the demand-side will play an increasingly important role."

There needs to be a greater emphasis on a whole systems approach to energy policy.

The remainder of this section will discuss the key issues and interviewee responses regarding the challenges and opportunities presented by whole system costs. The 'whole system approach' principle applies to demand-side issues such as energy efficiency and DSR. For a detailed discussion of these issues, readers should refer to chapters 4 and 6.

[x] System costs are costs incurred to allow energy to be delivered from a generator an end user. They include the costs of maintaining backup up capacity, of system balancing, of connection to and transmission via the grid, and grid reinforcement and extension.

2.2 Analysis

Table 2: Government support for carbon budgets by sector

Budget	Carbon budget level	% reduction below base year
1st Carbon Budget (2008-12)	3,018 MtCO2e	23%
2nd Carbon Budget (2013-17)	2,782 MtCO2e	29%
3rd Carbon Budget (2018-22)	2,544 MtCO2e	35% by 2020
4th Carbon Budget (2023-27)	1,950 MtCO2e	50% by 2025

Source: Committee on Climate Change (2015), Meeting Carbon Budgets: Progress in reducing the UK's emissions, 2015 Report to Parliament, June 2015, https://www.theccc.org.uk/wp-content/uploads/2015/06/6.737_CCC-BOOK_WEB_030715_RFS.pdf

The analysis below considers the whole systems approach on three levels. The first level focuses on understanding the overall interaction between the power, heat and transport sector to determine the direction of policy needed to achieve cost-effective decarbonisation goals. Secondly, evaluating the interaction between supply-side and demand-side measures and how these would enable different policies to be compared to form a view on cost-effectiveness. The third level involves a detailed assessment into the 'true cost'[9] of the different technologies which will add value to key decisions by Government, industry and consumers on the desired generation mix in the UK.

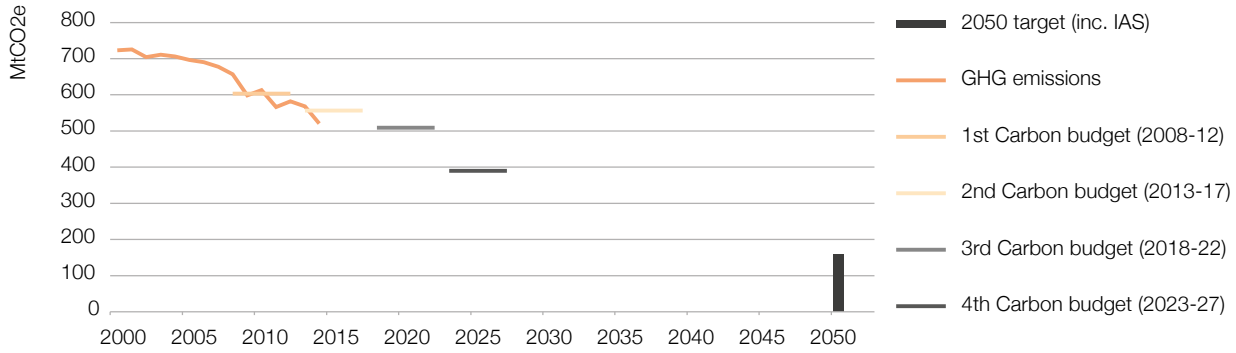
2.2.1 Decarbonisation: interaction between power, heat and transport

Many interviewees agreed that power sector should continue to do the 'heavy lifting' in meeting the UK's binding carbon budgets, given the significant challenges for decarbonising the heat and transport sectors. However, several respondents commented that decisions regarding how to meet the Fourth Carbon Budget and potential Fifth Carbon Budget were an opportunity for Government to assess both demand- and supply-side interaction and take a more 'whole system approach'.

The UK is committed to legally binding carbon reduction targets up to 2025 (see Table 1) as part of the Climate Change Act. These 'carbon budgets' are part of the country's long-term target to reduce emissions by 80% on 1990 levels by 2050. As well as the legislated carbon budgets, the Committee on Climate Change (CCC) has also recommended a Fifth Carbon Budget to Government of 1,765 $MtCO_2e$ for the period 2028-32, a 57% reduction on 1990 levels. The Government is now considering whether to accept this recommendation.

Based on the Carbon Budget, the CCC also measures carbon intensity as a decarbonisation target with a recommended level of 50-100 gCO_2/kWh. While all interviewees were supportive of significant decarbonisation, there were differing views on whether the power sector decarbonisation targets between 50-100g CO_2/kWh were appropriate or whether targets should be flexed instead. Some respondents supported current CCC power sector decarbonisation recommendations, while a few others supported a more lenient range of 100-150g CO_2/kWh. No respondents actively argued for a target of higher than 200g CO_2/kWh.

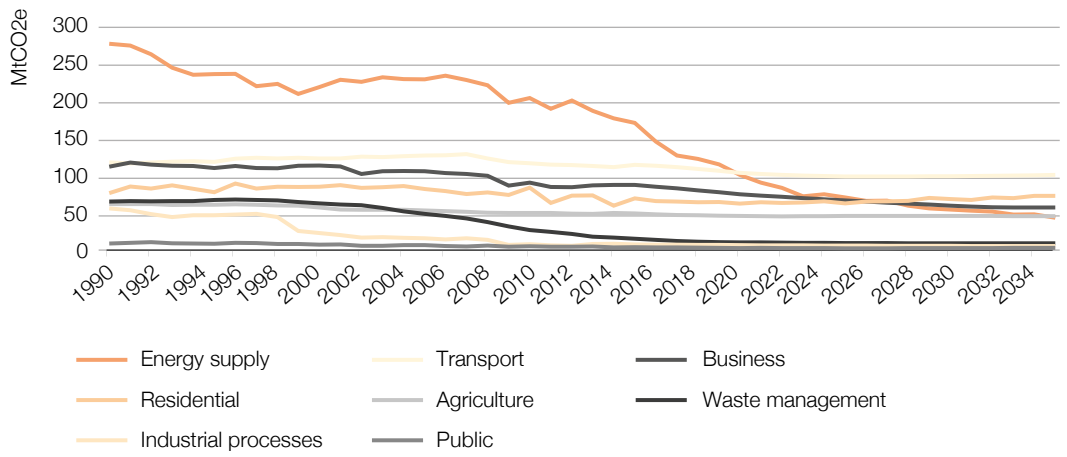
Figure 3: Progress against UK carbon budgets



Source: Committee on Climate Change (2015)

[9] The 'true cost' for each technology also includes any indirect benefits that should be considered in the assessment. The 'true cost' for each technology also includes any indirect costs and benefits that should be considered in the overall cost assessment.

Figure 4: DECC estimates for total GHG emissions by sector



Source: Department of Energy and Climate Change (2015), Updated energy and emissions projections 2015

The UK is on track to meet the First and Second Carbon Budgets, and is forecast to meet the Third Carbon Budget (see Figure 4). According to the CCC's latest estimates, total UK GHG emissions fell from 723 MtCO2e in 2000 to 520 MtCO2e in 2014, a reduction of approximately 28%.

To date, the majority of carbon savings have been achieved in the power sector, and forecasts by DECC and the CCC estimate significant continued decarbonisation of the sector up to 2030. Figure 4 shows DECC's latest emissions estimates for major GHG emissions contributors and its forecast reductions to 2035. Respondents to this report did not expect the take up of electric vehicles or low-carbon heat that many had predicted over the period to 2030 without further policy intervention. This will have an impact on the expectations of progress against future carbon budgets.

Although the CCC in its latest progress report notes there is significant 'under performance' in transport and heat sector decarbonisation, respondents believe the Government must continue to assess the potential for heat and transport to contribute to decarbonisation and the impact this would have on demand for electricity in their policy making.

As the different sectors become more intertwined, they should be considered together within a 'whole systems' approach.

For example, the effectiveness of decarbonising the heat and transport sectors is largely dependent on the extent to which the power sector is decarbonised. Additionally, a widespread electrification of these sectors could affect demand profiles of electricity significantly affecting the anticipated flat trajectory currently being anticipated by Ofgem and the market. Hence a 'whole-systems' framework across sectors would allow the cost-effectiveness of decarbonisation to be assessed more holistically across a wider pool of technologies and policies.

National Grid describes the importance of considering the interaction between heat, transport and power. In its 2015 Future Energy Scenarios, in the 'Gone Green' scenario (the only scenario to meet all decarbonisation targets), increased low-carbon heat adds over 30 TWh/year to power demand (see Figure 5). It forecasts that the contribution of low-carbon heat in 2035 to peak power demand "could be as much as 9.6 GW in Gone Green and around 2 GW" in other scenarios.

National Grid also forecasts in 2035, electric vehicles will account for an additional 14 TWh/year in the Gone Green and Consumer Power scenarios (see Figure 6). However, the burden of this increase on peak demand is less in the Gone Green scenario as a result of introduction of time-of-use tariffs, which helps shift this peak load.

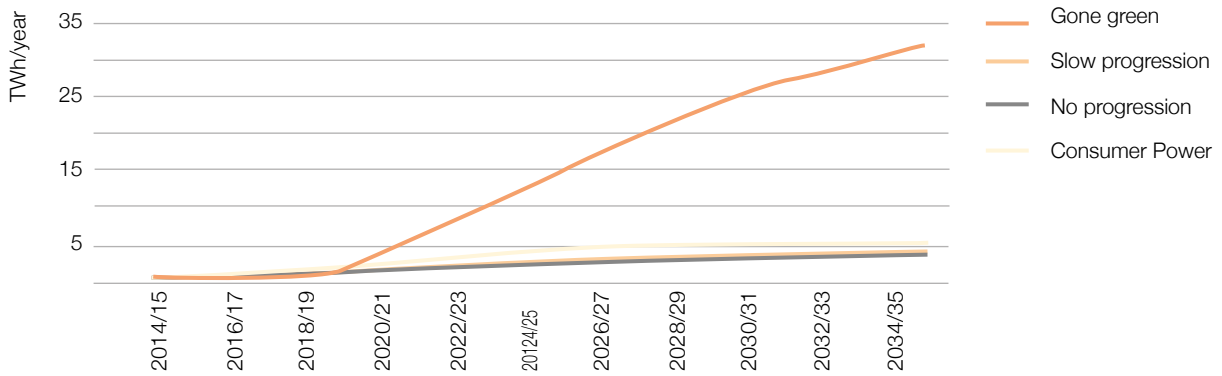
2.2.2 Cost of and interaction between supply-side and demand-side measures

There was widespread agreement among interviewees that increased attention was required on the cost of, and interaction between demand-side and supply-side measures. Respondents generally thought while the EMR package had been successful at delivering additional supply through the CfD and Capacity Market mechanisms, less success had been achieved in demand-side measures such as the Green Deal (discussed further in chapter 4).

Many respondents believed significant opportunities remained to exploit energy efficiency and other demand-side technologies. Marginal abatement cost (MAC) curves show some of the most cost-effective carbon reduction measures exist in the domestic retrofitting sector, and research by Energy UK suggests many of these measures remain under exploited (see Figure 7).

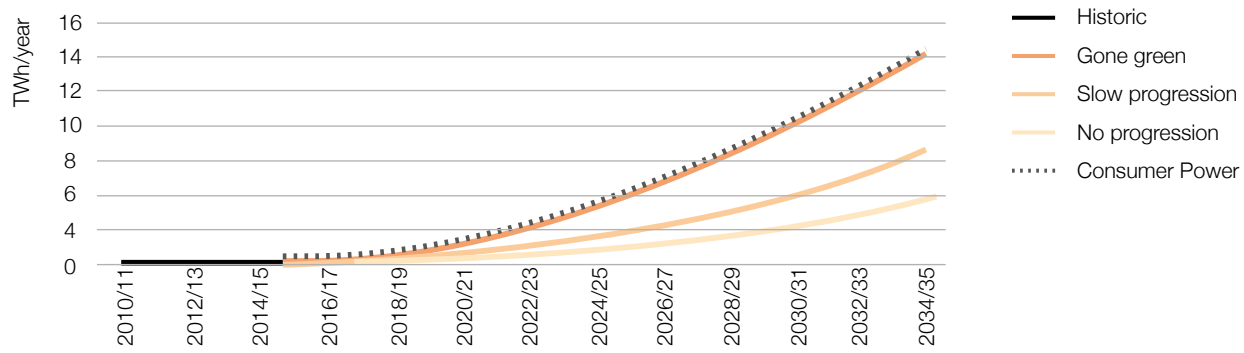
As there will be maximum deployment targets set by DECC for any one type of technology, updated MAC curves could also be used to determine the relative cost of these targets. This would help develop an informed decision-making process on what targets to set, or the best policies and technologies to pursue given these constraints.

Figure 5: National Grid projected annual power demand from residential low-carbon heat (excl. losses)



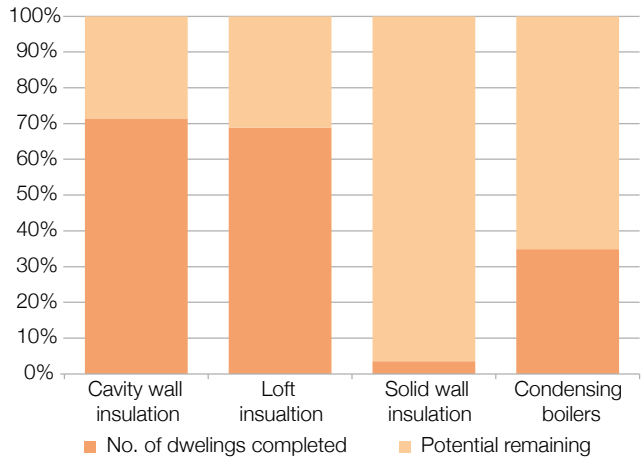
Source: National Grid (2015), Future Energy Scenarios 2015

Figure 6: National Grid projected annual power demand from electric vehicles (excl. losses)



Source: National Grid (2015), Future Energy Scenarios 2015

Figure 7: Energy UK estimated domestic retrofitting measures completed and remaining



Source: Energy UK (2015), based on ECO Compliance update (June 2015), final report of the Carbon Emissions Reduction Target (CERT) 2008-2012, and data tables for Green Deal, ECO and Insulation Levels (up to June 2014).

2.2.3 Considering the total system benefit or cost in calculating levelised costs

Some respondents used the term 'whole systems approach' when discussing the costs and benefits of different generation technologies, e.g. the additional costs of system upgrades/ balancing as a result of increased intermittent generation.

This section has focused on 'whole systems approach' with respect to the interaction between supply- and demand-side factors and the importance of considering the power sector along-side the heat and transport sectors. Comments regarding the system costs and benefits of different generation technologies is discussed in chapter 5.