Europe Economics

Impact of COVID-19 Crisis on Appropriate Risk Allocation Mechanisms for Highly Anticipatory Infrastructure Investments in the Energy Sector

9 June 2020

Contents

1 Introduction

1.1 Purpose of this note

This note provides follow-on analysis to a previous report by Europe Economics. It discusses the impact of the COVID-19 crisis on our previous analysis of the most appropriate approach to risk allocation for highly anticipatory infrastructure investments in the energy sector.

Europe Economics' previous report was submitted to Citizens Advice on 9 March 2020.[1] It discussed how risk should be dealt with in the case of highly anticipatory infrastructure investments in the energy sector in order to protect energy bill payers.

Since Europe Economics submitted its previous report, the context in which we carried out our analysis has been changed dramatically by the COVID-19 crisis. In particular, the UK lockdown introduced on 23 March 2020 to control the spread of coronavirus is expected to lead to a very deep recession.

The changed economic landscape makes the issues discussed in our previous report even more important. The economic crisis has increased the uncertainty around anticipatory investments, and energy bill payers may require more protection going forward given that significant numbers of energy bill payers have lost their jobs or seen their incomes fall.

This note supplements our report by setting out how the COVID-19 crisis affects our previous analysis. Below, we first provide some background on the COVID-19 crisis and then explain the structure of this note.

1.2 The COVID-19 crisis

The COVID-19 pandemic has led to lockdowns being imposed around the world to control the spread of coronavirus. These lockdowns have led to severe economic impacts.

In the case of the UK, the Office of Budget Responsibility (OBR) has published a coronavirus reference scenario in which the UK lockdown leads to a 35 per cent contraction in GDP in Q2 2020.[2] This reference scenario also shows UK unemployment rising to 10 per cent in Q2 2020. The OBR's scenario is based on the assumption that the economy will then bounce back in Q3 2020. However, over the year as a whole the scenario would still imply a large fall in GDP of 12.8 per cent.

The loss of jobs caused by the crisis has been reflected in an unprecedented rise in claims for Universal Credit. Government statistics show that 2.8 million people applied for Universal Credit from 16 March to 19 May 2020.[3]

Alongside the rise in unemployment, 8.4 million workers in the UK have been furloughed by their employers under the UK government's Coronavirus Job Retention Scheme.[4] Under this scheme,

1 Europe Economics, "Risk Allocation Mechanisms for Highly Anticipatory Infrastructure Investments in the Energy Sector", 9 March 2020

2 https://obr.uk/coronavirus-analysis/

3 https://www.gov.uk/government/publications/universal-credit-declarations-claims-and-advances-management-information

the UK government pays 80 per cent of the furloughed worker's salary up to a monthly cap of £2,500. While employers can provide top-up payments to their employees, they are not obliged to do so. Hence, many furloughed workers will have seen a reduction in their income. Further, it is likely that some workers currently on furlough may become unemployed when the scheme ends.

There is a high degree of uncertainty about how quickly the economy will recover and what the long-term economic impacts will be. This reflects:

- Uncertainty over how long the health crisis will last. At this stage, we do not know how soon an effective treatment or vaccine for COVID-19 will be developed. The sudden discovery of an effective treatment could bring the health crisis to a rapid end. On the other hand, an influential paper by Imperial College suggested that lockdowns might need to be applied on and off until a vaccine is developed, and that this might take 18 months or more.[5]
- Uncertainty over the economic scarring caused by the recession. It is unclear whether the economy will bounce back once restrictions are lifted, or whether the recession will lead to longer-lasting negative effects on the economy (known as "economic scarring"). It is likely, however, that the extent of economic scarring will depend on how long the health crisis lasts.

In advising clients on the potential economic impacts of the COVID-19 crisis, Europe Economics is using three scenarios to reflect uncertainty around how the crisis will evolve. The three scenarios are as follows:

- Our "Shorter" scenario assumes that the COVID-19 health crisis ends after 3 months and after 6 months almost all restrictions are lifted. Under this scenario, the COVID-19 crisis has no enduring economic impacts after 6 months.
- Our "Extended" scenario in which the restrictions associated with the health crisis last on-and-off over an 18-month period. This period is sufficiently long to create enduring economic impacts (i.e. economic "scarring") even after 18 months. These scarring effects taper away gradually over time.
- Our "Medium" scenario is assumed to be a more moderate version of the Extended scenario in which the health crisis lasts a year and the enduring economic impacts after one year fade away somewhat more quickly than under the Extended scenario.

As the crisis has developed, the Shorter scenario has become less likely (though still not impossible if a successful treatment for COVID-19 were to be discovered soon), while the Medium and Extended scenarios have become more likely. Nonetheless, the three scenarios illustrate the high degree of uncertainty that currently exists.

1.3 Structure of this note

The rest of this note analyses the impact of the COVID-19 crisis on risk allocation mechanisms for highly anticipatory investments in the energy sector. It uses the following structure:

- Section 2 discusses impacts of the crisis that are relevant to assessing the case for highly anticipatory infrastructure investments;

---

[4] HM Treasury data for 24 May 2020 https://www.gov.uk/government/collections/hmrc-coronavirus-covid-19-statistics

[5] Imperial College COVID-19 Response Team, "Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand", 16 March 2020 https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf

- Section 3 discusses impacts of the crisis on the most appropriate allocation of risk;
- Section 4 discusses impacts on the relative advantages and disadvantages of different risk allocation mechanisms; and
- Section 5 sets out our key conclusions.

2 Impacts on Assessment of Case for Highly Anticipatory Investments

In this section, we discuss possible impacts of the COVID-19 crisis that may be relevant to companies seeking to justify highly anticipatory investments in energy infrastructure. In particular, we consider in turn possible impacts of the crisis on:

- The demand for energy infrastructure;
- Customer willingness to pay for improvements to quality of service and the environment;
- Affordability issues;
- Political sensitivities;
- Analysis of risk and uncertainty;
- The relevance of real options analysis;
- The return that regulators need to allow companies to earn.

2.1 Reduced demand may weaken the case for highly anticipatory investment

By definition, a highly anticipatory investment is an investment for which there is a very high level of uncertainty about future use of the infrastructure. Hence, demand risk is likely to be the key risk for this kind of investment project.

The lockdown has led to a substantial reduction in demand for energy in the UK, as well as changes in the time profile of consumption. This has been driven by large reductions in the demand for energy from industrial customers due to the closure of parts of the economy during the lockdown. This has been partially offset by an increase in domestic consumption as people spend more time at home.

As the economy comes out of lockdown over the coming months, the demand for energy is likely to increase again. However, under the Medium and Extended scenarios discussed in Section 1, demand may not return to its previous level for a number of years. This is due to the prolonged health crisis and the economic scarring caused by the recession under these scenarios.

Overall, this means that the case for highly anticipatory investments has weakened. The demand needed to make such investments viable is less likely to materialise, or may take longer to materialise, as a result of the crisis.

Further, it is possible that investment proposals which were not previously considered "highly anticipatory" may now fall into this category. This is because the assumed demand for energy infrastructure which was used to justify these investments may now be much more uncertain. Hence, the case for going ahead with such investment projects may need to be revisited.

2.2 Customer willingness to pay for quality improvements may be lower

In order to justify investment proposals, regulated companies are typically required to carry out cost-benefit analysis. Key benefits from energy infrastructure (e.g. the benefit of a cleaner environment or improved quality of service) may be valued on the basis of customer willingness to pay for these benefits. Regulated firms will often assess willingness to pay for such benefits by carrying out consumer surveys.

However, the value that people place on environmental benefits and improvements to quality of service are likely to depend on their income. Indeed, it is possible that a better quality of service or a cleaner environment may be luxury goods, which are defined in economics as goods where demand increases more than proportionally with higher income.

The COVID-19 economic crisis is likely to lead to significant reductions in real income for many people under the Medium and Extended scenarios set out in Section 1. This is due to job losses as well as reduced incomes for furloughed workers. Even among workers who retain their jobs, there may be slower growth in real earnings following the crisis.

Consequently, under the Medium and Extended scenarios it is likely that customer willingness to pay for quality improvements may be lower.

This implies that cost-benefit analysis that has already been undertaken to justify proposals for investment in energy infrastructure may need to be revisited. In particular, previous analysis of customer willingness to pay may need to be updated to reflect customers' new willingness to pay in a post-COVID world.

If cost-benefit analysis for proposed investment in energy infrastructure is not updated in this way, there is a danger that consumers will end up paying for infrastructure investment which costs more than the resulting customer benefits.

It is also possible that the environmental benefits of some investment proposals may be lower in a post-COVID world due to lower baseline environmental damage caused by lower energy consumption. For example, some investment projects that were being considered to reduce carbon emissions may no longer be needed in order for the UK to meet its carbon emissions targets.

2.3 Consideration of affordability issues may be more important

Companies may need to give greater attention to affordability issues in assessing highly anticipatory investments. This is because there are likely to more customers struggling to pay their bills under the Medium and Extended scenarios, due to job losses and reduced incomes.

The COVID-19 crisis has hit lower income groups particularly hard, as these groups are less likely to be doing jobs that they can continue to do from home. On the other hand, some higher income households have gained financially from the lockdown, as their income has remained the same but their spending has gone down. Hence, it may be important for firms to consider the distributional impacts of investment proposals on different income groups.

2.4 There may be greater political sensitivity to higher bills or high company returns

The COVID-19 crisis changes the political context in which decisions about investment in energy infrastructure are being made.

On the one hand, the government may be keen to encourage investment in infrastructure at this time, as a way of stimulating the economy.

At the same time, there is likely to be increased political sensitivity to increases in customer energy bills, given that many households and businesses are facing financial difficulties.

There may also be political sensitivity about risk allocation mechanisms that create a prospect of energy firms earning high returns if projects are successful, even if the firms are taking on significant risk. There may be public outrage if energy firms are seen to be earning high returns and paying out large dividends to shareholders at a time when many energy bill-payers are struggling financially.

Similarly, there may be political sensitivity about managers at energy companies being given large bonuses (which is relevant to the discussion of management incentives in Section 4).

2.5 Analysing risk and uncertainty has become even more important

As discussed in Section 1, there is huge uncertainty about how long the COVID-19 health crisis will last and about the economic impact of government restrictions aimed at controlling the spread of the virus.

In this context of increased uncertainty, analysis of the risk and uncertainty around highly anticipatory investments becomes even more important.

In the current context, firms proposing highly anticipatory investments should carry out analysis of the costs and benefits of the proposed investment under different scenarios for how the COVID-19 crisis may develop. The Shorter, Medium and Extended scenarios set out in Section 1 illustrate the kind of scenarios that companies should consider.

Ranges for the estimated net benefits of investment proposals are likely to be wider, reflecting the increased uncertainty that exists at the present time.

2.6 The value of the real option to wait is now likely to be higher

In our previous report for Citizens Advice, we explained that real options analysis is relevant when assessing the case for highly anticipatory investments. Real options analysis uses the same techniques that are used to value financial option contracts, but applies them to options that exist in the context of investment planning.

One kind of real option that is relevant to highly anticipatory investments is the real option to wait. The real option to wait is relevant in cases where investment is irreversible, there is uncertainty about returns from the investment, and the firm has the possibility of waiting before committing to the investment. All of these conditions will typically apply to highly anticipatory investments in energy infrastructure. Most (if not all) investment in energy infrastructure is likely to be irreversible. For example, once an energy network has been reinforced or a power station has been built, the firm cannot reverse the project to get back the original funds. By definition,

highly anticipatory investment takes place in the context of uncertainty about future demand. Further, in most cases firms will have the option of deferring investment.

This value of the real option to wait is likely to be greater at the current time. This is because there is a currently a very high degree of uncertainty about future demand due to the COVID-19 crisis. Firms need to take account of this higher value of the option to wait when deciding whether or not they should go ahead with investment projects at the current time.

For some projects, the higher value of the real option to wait is likely to mean that it is appropriate for firms to defer a decision about whether to go ahead with the investment until some of the current uncertainty has been resolved. This will reduce the probability of firms committing irreversibly to investment projects that turn out not to be needed.

If highly anticipatory infrastructure projects do go ahead at the current time, firms will need to demonstrate that the benefits of investing at the current time exceed the value of the real option to wait.

In either case, real options analysis is especially important at this time of heightened uncertainty.

2.7 There may be impacts on the return that regulators need to allow companies to earn

It would be outside the scope of this note to analyse the impact of the COVID-19 crisis on the cost of capital for highly anticipatory infrastructure investments in the energy sector. The heightened demand risk caused by the crisis is likely to be systematic in nature (and thus potentially relevant to the cost of capital), but at the same time energy networks may be less affected by such demand risks than most sectors of the economy.

We note, however, that if more demand risk is allocated to companies rather than customers (see discussion in Section 3.1), then this will increase the cost of capital compared with what it would otherwise have been.

In our previous report, we noted that where firms are exposed to downside demand risk, they would need to be allowed to earn more than the cost of capital when investment projects are successful. This is so that the overall expected return to investors (taking both the upside and the downside into account) equals the cost of capital.

In the current context, regulators might need to allow companies a greater wedge above the cost of capital if they wish to provide incentives for firms to go ahead with highly anticipatory investment in cases where some of the demand risk is allocated to companies. The reason is that the downside demand risk faced by firms is likely to have increased as a result of the COVID-19 crisis. Consequently, firms would need to be able to earn a higher return when the project is successful to offset this greater downside risk. This consideration would apply to an even greater extent if an increased share of the demand risk is allocated to companies rather than customers (see discussion in Section 3.1).

It should be noted that allowing a higher return for highly anticipatory infrastructure investments does not mean that regulators need to allow a higher return for all assets in the Regulatory Asset Value (RAV). Instead, a different allowed return could be applied to highly anticipatory infrastructure investments in cases where companies have taken on demand risk. This would reflect the special circumstances surrounding such investments.

3 Impacts on the Most Appropriate Allocation of Risk

In this section, we consider what impacts the COVID-19 crisis might have on the optimal allocation of the demand risk associated with highly anticipatory infrastructure investments. We consider in turn:

- The allocation of risk between energy companies and their customers; and
- The allocation of risk between different customer or citizen groups.

3.1 Companies may need to take on a higher share of demand risk than previously[6]

In our previous report for Citizens Advice, we suggested that the optimal approach would be for the demand risk associated with highly anticipatory infrastructure investments to be shared between energy companies and their customers.

We identified the following factors as potentially relevant when deciding on the precise allocation of risk between companies and customers in any specific case:

- Ability of either side to control the risk
- Ability of either side to bear risk / potential effects of the risk allocation;
- The risk aversion of the parties;
- Interaction with incentives; and
- The party responsible for "triggering" the risk.

The risks created by the COVID-19 economic crisis are outside the control of both energy companies and their customers. Hence, both the first factor (ability to control the risk) and the last factor (who "triggers" the risk) are not relevant to thinking about allocation of the risks created by the COVID-19 crisis.

However, the COVID-19 crisis has potential effects on the other three factors in the above list. In particular:

- The COVID-19 crisis may reduce the ability of some household and business customers to bear risk. This reflects the fact that many households and firms are struggling financially as a result of crisis. By contrast, energy network companies are better able to bear risk during the crisis, given that that their revenue controls provide them with relatively stable revenues.
- The COVID-19 crisis may increase the risk aversion of some households. Economic theory suggests that the absolute risk aversion of households is likely to increase when their wealth falls. Hence, households that have lost jobs and income as a result of the crisis may be more

[6] To avoid misunderstanding, we are not saying that firms need to bear more than 50 per cent of the demand risk. Rather, we are saying that they should bear a higher percentage of the demand risk than might previously have been considered appropriate.

averse to taking on risk. (The opposite may, however, be true for households that have gained financially from the crisis due to stable income and reduced expenditure.)

- The COVID-19 crisis increases the importance of firms having the incentives to make the right investment decision. Given the increased uncertainty about future demand caused by the crisis, there are increased benefits from firms having a strong incentive to make the right decision about whether and when to invest. For example, it is likely to be more important for firms to carry out real options analysis to determine whether investment should go ahead at the current time (see Section 2.6). Allocating more of the risk to firms is likely to give them stronger incentives to carry out robust analysis before making investment decisions.

These considerations suggest that somewhat more of the risk might appropriately be allocated to energy companies in the current crisis, compared with the risk shares that might previously have been appropriate. Hence, while we would continue to recommend risk-sharing for highly anticipatory infrastructure investment, the appropriate allocation of risk between energy companies and their customers may now be different.

In order to implement our recommendation that firms should bear a greater proportion of demand risk for highly anticipatory investments than in the past, it is useful to be able to measure how much risk is being allocated to firms.

Traditionally, if capex has been approved in advance by a regulator at a price review, a price regulated firm is guaranteed recovery of that approved capex through the Regulatory Capital Value (RCV). The amount of risk that is allocated to the firm could therefore be measured in terms of the percentage of the investment cost that is subject to risk, rather than being guaranteed through the RCV mechanism.

Some infrastructure may generate its own revenue stream, while being owned by a firm which has a wider customer base. In this context, another way of measuring risk allocation would be in terms of the sharing factors that are used to share any surplus or shortfall of revenue from the new infrastructure between the firm and its wider customer base.Other standard tools for measuring risk exposure (e.g. volatility of returns, asset beta) may also be relevant in some cases.

3.2 Firms need to think about how to allocate risks between customer groups

The COVID-19 crisis may also have implications for the appropriate allocation of risk between different groups of customers or citizens. In particular:

- It may be appropriate to allocate more risk to future customers rather than to current customers. This is because of the affordability issues currently being experienced by households which have lost jobs and income, and by business customers that have been hit by the crisis. Such customers may have less ability to bear risk at this point in time and may have become more risk-averse. By contrast, future consumers may be better able to bear risk due to the economy recovering over time.
- There is an argument for allocating more risk to citizens in general (through general taxation) rather than to energy bill-payers. As discussed in Section 2.3, the economic crisis is hitting low-income groups harder than high-income groups. Energy bills may be regressive (i.e. low income households may spend a higher proportion of their income on energy bills). This means that allocating risk to energy bill-payers will potentially allocate a higher proportion to

the risk to those least able to bear it. By contrast, general taxation may be more progressive, so allocating risk to taxpayers may allocate more of the risk to those better able to bear it.

- More risk should be allocated to better off energy customers, with protections in place for fuel poor consumers. Given that low income households are being worst hit by the crisis, it can be argued that companies should use their tariff structures to allocate more risk to better-off energy customers rather than fuel poor customers. This could be done, for example, through the use of social tariffs to protect fuel poor customers from the risks associated with highly anticipatory investments. (We note that there are wider arguments for making greater use of social tariffs to assist households that are struggling financially due to the crisis, quite apart from this discussion of highly anticipatory infrastructure investments.)

4 Impacts on the Relative Merits of Different Mechanisms for Allocating Risk

In this section, we discuss how the COVID-19 crisis may affect the relative merits of different risk allocation mechanisms.

Our previous report for Citizens Advice contained a compendium of 15 risk allocation mechanisms. The compendium identified the advantages and disadvantages of each risk allocation mechanism, along with the circumstances in which it was most relevant.

In the specific context of the COVID-19 crisis, some of the risk allocation mechanisms we discussed become more suitable, and some become less suitable. In the table on the next page, we set out the potential impact of the COVID-19 crisis on the appropriateness of using each risk allocation mechanism.

Table 4.1: Impact of COVID-19 crisis on the relative merits of each risk allocation mechanism

Category	Risk allocation mechanism	Impact of COVID-19 crisis on appropriateness of mechanism
Mechanism to defer decision till information is better	Price control reopeners or interim reviews	This mechanism is highly relevant in the current context. This is because of the increased uncertainty caused by the COVID-19 crisis and the increased value of waiting till information is better before committing to an irreversible investment (see discussion of the real option to wait in Section 2.6).
	Ex post prudency test	Our previous report recommended against use of this risk allocation mechanism. This conclusion is unchanged by the COVID-19 crisis.
	Capex trigger	A capex trigger based on meeting construction milestones could have harmful incentives in the current context. In particular, it could encourage companies to go ahead with investment projects even when it would be optimal to defer investment in light of the current uncertainty (see discussion of the real option to wait in Section 2.6). A capex trigger based on demand or usage exceeding a specified threshold could potentially be useful in the current context as a way of allocating more demand risk to energy companies (see discussion in Section 3.1).
Regulatory mechanisms based on ex post information	Ex post removal of stranded assets from RAV	Our previous report recommended against use of this risk allocation mechanism. This conclusion is unchanged by the COVID-19 crisis.
	Error correction mechanism	This mechanism could potentially be useful in the current context as a way of allocating more demand risk to energy companies (see discussion in Section 3.1).
	Caps and collars on return on investment	Caps on the return earned by companies from highly anticipatory infrastructure projects could be useful given the potential political sensitivity around firms earning high returns during a time when many energy bill-payers are struggling financially (see discussion in Section 2.4). Collars might need to be applied as well so that the firm is not left with high downside risk but no potential for upside gain.
	Funding through outcome delivery incentives	An outcome delivery incentive which allows the firm to earn rewards when the investment project delivers a wider customer benefit (e.g. fewer interruptions) may continue to be relevant in some cases. However, the level of rewards may need to be recalibrated to reflect lower customer willingness to pay for such benefits when their incomes have fallen (see discussion in Section 2.4).
Mechanisms affecting allocation between customer groups	Ring-fenced funding from customers who use the new infrastructure	This mechanism could be relevant in cases where infrastructure will be used only be a certain group of customers, and the value that this group place on the infrastructure is sufficient to justify going ahead at this point in time. This mechanism would help to protect the wider customer base from bearing additional risk during a period when many bill-payers may be less able to bear risk and may be more risk-averse (see discussion in Section 3.1).
	Economic depreciation	A version of this mechanism may be useful, in which firms are still guaranteed full recovery of investment once it is in the RAV but depreciation payments from customers are profiled over time

Category	Risk allocation mechanism	Impact of COVID-19 crisis on appropriateness of mechanism
		according to the time profile of asset use. This would allow bills to be lower during the current COVID-19 crisis when consumption has fallen, with firms able to earn more depreciation revenue in the future when consumption has risen again. This would allocate more risk to future customers rather than current customers, assisting customers who are currently struggling with affordability issues (see section 3.2). However, regulators would need to carry out financeability analysis to check that energy networks are still able to sustain strong enough financial ratios during the crisis.
Market-based mechanisms	Negotiation between infrastructure provider and customers	This mechanism has the advantage of providing a market signal as to whether infrastructure investment should go ahead at the current time or be deferred. However, energy companies would face higher counterparty risk in the current context. This is because the COVID-19 crisis increases the likelihood that industrial customers signing the infrastructure contract may go bankrupt.
	Market-based investment incentive	This mechanism has the advantage of providing a market signal as to whether infrastructure investment should go ahead at the current time or be deferred.
Mechanisms involving subsidy	Capital grants from government	Fully funding highly anticipatory infrastructure investment from capital grants may not be appropriate. It would mean that all risk is allocated to citizens (in their role as taxpayers) and no risk is allocated to energy companies (contrary to the discussion in Section 3.1). However, partial funding from capital grants rather than through the RAV could have advantages in the current crisis. This is because, as discussed in Section 3.2, general taxation may be more progressive than energy bills (i.e. higher income customers may pay more as a share of their income).
	Demand assurance	The COVID-19 crisis makes this mechanism less suitable for use. There is an increased likelihood of demand not materializing as a result of the crisis. This mechanism could encourage firms to go ahead with infrastructure investment even where it is not appropriate, and to leave citizens (in their role as taxpayers) to pick up the costs of any demand shortfall.
	Management incentives	Our previous report identified serious problems with the use of this mechanism in the context of highly anticipatory infrastructure investments. An additional problem with this mechanism in the current context is that large bonuses to management may be politically controversial at a time when many energy bill-payers are struggling financially (see discussion of political sensitivities in Section 2.4).
Other risk allocation mechanisms	Availability-based payments (for generation capacity)	Our previous report identified that the level of availability-based payments could either be fixed or be determined through an auction for the provision of capacity. The need for additional generation capacity is likely to have fallen due to reductions in electricity demand caused by the crisis (see Section 2.1). Fixed availability-based payments could encourage firms to go ahead with the construction of additional capacity even where it is no longer needed. By contrast, availability-based payments determined in auctions for the provision of required capacity may provide better signals as to how much additional capacity is now required.

5 Conclusions

This note has identified a number of ways in which the COVID-19 crisis affects our previous analysis of risk allocation mechanisms for highly anticipatory infrastructure investments.

In Section 2, we identified a number of implications for firms seeking to justify highly anticipatory investments. In particular, we found that:

- Reductions in the demand for energy caused by the COVID-19 crisis may weaken the case for highly anticipatory investment;
- Customer willingness to pay for improvements to quality of service or the environment may be lower;
- Consideration of affordability issues is especially important, given that many households are struggling financially;
- During the crisis, there may be greater political sensitivity to any investment proposals that increase customer prices or allow companies to earn high returns;
- Highly anticipatory investments need to be analysed against different COVID-19 scenarios, and ranges for estimated impacts are likely to be wider;
- The case for applying real options analysis is especially strong in the current context, with the value of the real option to wait now likely to be higher; and
- There may be impacts on the return that regulators need to allow companies to earn.

In Section 3, we discussed possible impacts on the most appropriate allocation of risk. We found that:

- Companies may need to take on a higher share of demand risk than previously, as many customers may be less able to bear risk due to the crisis, and may have become more risk averse; and
- Firms need to think carefully about how risks should be allocated between customer groups, including whether relatively more of the risk borne by customers can be allocated to future customers and to higher income customers.

Finally, in Section 4 we considered potential implications for the suitability of the 15 risk allocation mechanisms covered in the compendium contained in our previous report. Based on this analysis, we conclude that the following risk allocation mechanisms may be particularly suitable in the light of the current COVID-19 crisis:

- Price control reopeners or interim reviews, to reflect the potential advantages of waiting till more information is available before firms commit to large irreversible investments;
- Mechanisms that allow demand risk to be shared with firms, such as error correction mechanisms or capex triggers based on demand exceeding a specified threshold;
- Caps and collars on returns from highly anticipatory investments, to avoid companies earning excessive returns during a time when many energy bill-payers are struggling; and
- Economic depreciation (in which depreciation revenue from customers is profiled over time in line with usage), to allocate more risk to future customers rather than current customers.

Some of the other risk allocation mechanisms may continue to be relevant in specific circumstances. For example, ring-fenced funding from customers that use the new infrastructure

may continue to be relevant in cases in which the infrastructure is discrete, with scope for separate user charges.