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for energy consumers

Report

Net Zero Britain: developing an energy system fit for the future

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This paper sets out Ofgem's view on key aspects of Great Britain's energy system where we consider significant reform is required to deliver a resilient, low cost, low carbon power sector, as well as a proposed framework of consumer interests to help focus our actions. This is not intended to be a comprehensive vision for everything that needs to change in the energy sector but is focused on a set of issues we consider to be priorities for reform. We recognise that many of these proposals are for government to decide, and Ofgem will continue to work closely with governments and other stakeholders.

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Foreword

Energy systems across the globe are undergoing an unprecedented shock due to the extraordinary increase and volatility in the price of gas. This is putting huge pressure on our energy system and is driving the cost-of-living crisis and causing real harm. I talk to customers on a regular basis and understand the genuine distress and harm brought about by the price we now need to pay for our energy. In the short term, Ofgem is doing what we can to protect them. We can't bring down the price of gas, but the surge in gas prices highlights the importance of reducing our dependency on fossil fuels, and the need to accelerate the deployment of low carbon energy generation, delivering lower prices, energy security and enabling us to achieve net zero as early as possible. This will require a rethink of our energy system.

Last October, the government pledged to decarbonise electricity generation by 2035, and following Russia's invasion of Ukraine set even more ambitious targets to reduce reliance on expensive gas imports. Meeting these ambitions while maintaining security of supply at the lowest cost, will mean reforms to how we plan, operate and regulate our energy market. This discussion paper outlines Ofgem's proposals on potential reforms that will help deliver a low cost, secure net zero energy system:

- Establishing and making full use of a Future System Operator to lead national planning of the strategic electricity and gas networks that we need to transition to net zero, and to advise on the investments required to revolutionise our energy generation, heat and transport;
- Ensuring sub-national institutions and capabilities are in place to enable greater local and regional planning and coordination of local energy networks, and;
- Reforming the electricity wholesale market in the coming years, potentially making changes to address the issue of gas routinely setting the price for the whole electricity market, and investigating the introduction of locational and time based signals to the electricity market, to enable more efficient operation reducing day-to-day costs and investment requirements.

These reforms could save consumers billions of pounds a year. The report is intended to stimulate debate and we will continue to work closely with government, including through their review of electricity market arrangements, and with the energy industry and consumer groups to develop and co-ordinate the reforms needed to bring down energy costs.

The energy market is changing fast, with decarbonisation and digitalisation bringing new products and services to the market. Ofgem intends to facilitate these innovations and ensure that they work for consumers.

To support our continued focus on consumers, we are proposing a new framework for defining their interests. This will ensure that consumer needs are at the heart of all future reforms.

The challenges ahead are formidable, but so is the opportunity: to build a low-carbon, low-cost and resilient energy system that works for both consumers and the climate. I am determined that Ofgem play its part to the full in grasping that exciting opportunity.

Jonathan Brearley
Ofgem Chief Executive

Executive Summary

This paper sets out Ofgem's view on key aspects of Great Britain's energy system where we consider significant reform is required to deliver a resilient, low carbon power sector at lowest cost, as well as a proposed framework of consumer interests to help focus our actions. This is not intended to be a comprehensive vision for everything that needs to change in the energy sector, but is focused on a set of issues we consider to be priorities, and where reform could make the greatest difference.

The unprecedented rise in gas prices over the last twelve months has delivered a major shock to the energy system in Great Britain (GB) and across Europe. Ofgem has responded at pace to protect consumers, ensuring continued energy supply for customers of failed suppliers, and strengthening the resilience of the sector to better cope with volatility. We are also working to ensure the energy sector is fit for the longer term, bridging to a future market that is less subject to volatile natural gas prices, and makes efficient use of cleaner, greener, secure home-grown energy.

Our future energy system will be different to the system of the past. Electricity demand will grow strongly driven by the adoption of electric vehicles and heat pumps, and potentially production of hydrogen. Most of this demand will be met by cheap renewables which will transform the economics of the sector, delivering plentiful electricity when the wind is blowing and sun is shining, alongside higher cost reliable low carbon power such as nuclear, hydrogen power plants, and gas plants with carbon capture and storage to fill the gaps, with fossil fuels playing a diminishing role; there will be rapid growth in electricity storage which, with renewables, will transform the geography of the sector as traditional linear flows from large power stations to consumers turn into a more multi-directional system with new areas of high generation (eg. offshore wind) alongside more small-scale local power generation (eg. solar), with consumers increasingly able to adjust their energy use and even export power back to the grid when it is needed.

The transition is well underway, and is being driven by the GB governments' legislative commitments to net zero, the UK Government's Ten Point Plan, Net Zero Strategy and the British Energy Security Strategy. The unprecedented spike in gas prices only reinforces the need to accelerate the shift away from natural gas, strengthening the case for rapid decarbonisation.

Ofgem's principal objective is to protect the interests of GB energy consumers, both now and in the future. With that in mind, we have reviewed the current energy system and have concluded that significant reforms may be needed to ensure that it is not just low-carbon but also low-cost. The prize of getting this right is significant: the right investment decisions complemented by increased flexibility could reduce energy system costs by more than £10 billion per year by 2050, with less investment needed in new network and generation capacity.

Three areas of challenge have been identified that must be overcome to realise this prize and related opportunities.

Challenges to overcome: unlocking the opportunities

1. **The need for coordination:** Delivering a net zero energy system will require hundreds of billions of pounds of new infrastructure in the coming decades. The scale and pace of investment required will not be delivered by free markets alone. High levels of uncertainty, combined with long lead times, natural monopolies, new/emerging technologies, and dependencies between different energy assets,

mean a mixed approach is needed: with strategic planning and coordination alongside a vital role for competition and markets, to keep costs down. Greater strategic planning – across electricity, gas and emerging energy assets such as heat networks, at national and local levels – will help to ensure that major infrastructure assets are built in the right places at the right time. A key planning challenge is to determine the optimal balance between network capacity and greater use of flexibility, specifically, how much expensive new infrastructure is needed to take power generated from key areas of renewable generation to the areas of greatest demand.

2. **Optimising the energy system:** the wholesale electricity market, as currently configured, has served GB well for many years. But the market is changing: as wind and solar generation expands through the 2020s and 2030s, for a growing proportion of the time, GB will have a surplus of clean energy, driving down wholesale electricity prices. But when renewables are insufficient, we will need higher price sources of power – currently natural gas, but in future, low carbon alternatives. This gives us two challenges: first, that even if we only need a little gas (or low carbon alternatives), under current arrangements, that relatively costly power source will set the price for the whole electricity market, potentially leading to higher than necessary costs for consumers and returns for investors (the ***marginal price challenge***). Second, the rapid growth of onshore and offshore windfarms, our cheapest source of clean power, are likely to be concentrated in locations far from some of the largest centres of electricity demand. Increased network infrastructure will help manage this challenge, but that is costly. If we can flex electricity demand to more closely match the availability of cheap, clean power, we can reduce the amount of new network infrastructure needed and reduce system costs. Critically, the value of flexibility will differ by time and location. At present, there is a ***lack of granular market signals*** – varying by time and place. In the absence of such signals, the system operator has to actively intervene to balance the system, paying to stop (often cleaner) power generation in constrained areas and turn it on where it is needed. Unlocking this locational flexibility could save billions of pounds annually. The annual cost of managing transmission constraints has risen from £170mn in 2010 to £1.3bn this year and is forecast to rise further through the 2020s.

3. **Challenges facing energy consumers:** This is an incredibly tough time for many households and businesses. The unprecedented rise in wholesale energy prices over the last year has resulted in many more consumers struggling to pay their energy bills and placed enormous strain on the retail market. An evolving energy market will provide increasing opportunities for consumers - we want to maximise these benefits for consumers while also ensuring we protect the interests both of consumers who do engage with new opportunities, and those who choose not to or are unable to do so.

Reform proposals

In response to the above challenges, we propose the following reforms:

1. **Strategic planning, at national and local levels:** Working jointly with government, we will proceed with the establishment of a powerful Future System Operator (FSO). The FSO will be tasked with leading national planning of the strategic electricity and gas networks needed as we transition to a net zero energy system; advising governments and Ofgem as a key input into the planning of generation, heat and transport; and facilitating competition to deliver new infrastructure at least cost. Greater planning and coordination will also be needed at a sub-national level, to ensure strategic development of local energy networks, the facilitation of flexibility options, and to enable reliable, transparent operation of local energy systems. To deliver this, key energy system functions will need to be performed by a body (or set of bodies) with the appropriate capabilities, functions and incentives to drive net zero

at least cost. These institutions may have an important role to play in whole system coordination across electricity, gas and heat, alongside other bodies.

2. **Reforming the electricity wholesale market to bring down costs**: as we move to net zero, the current GB electricity wholesale market is unlikely to deliver a least cost system. The ***marginal pricing challenge*** could potentially be fixed by reforms to the wholesale market, for example splitting it into two markets: one for intermittent and/or green power (such as wind and solar), paid a fixed price per unit based on average costs; the other for firm power paid at market prices as now. This would be a major reform to a key component of the energy market, so would need careful consideration and will take time to implement. A faster and simpler alternative route to delivering much of the benefits of a split market would be to expand the use of Contracts for Difference (CfDs). ***More granular market signals***, to match demand more closely to the growing supply of cheap renewable power, could be delivered in a number of ways. One option is to split GB's electricity wholesale market into zones or nodes, allowing prices to differ by location. A move to 'locational marginal pricing', common in other countries, would encourage investments in flexible energy assets in the right places, as well as sending location specific signals to those assets in real-time, minimising the costs of keeping the system balanced. As with a split wholesale market, this would be a major market reform that will take time to develop and implement. Alternative options include: network charges varying through the day to incentivise a more efficient use of network capacity; the introduction of locational signals into the balancing market; and greater use of flexibility markets to relieve specific network constraints. More work is required to assess these options.

3. **Stabilising, reforming and transforming the retail market:** To address the current energy market situation, we are taking action to stabilise the market. We are ensuring suppliers deliver on their obligations to customers, and are supporting delivery of the government's energy bills support package. We are introducing a tougher regulatory approach to ensure suppliers pursue financially resilient business models and we are adapting the price cap to make it more resilient to market volatility. These measures will make a material difference, lowering the risk of energy suppliers failing and ensuring that, if it does happen, there is minimal disruption and cost for consumers. Alongside this, it is critical that we have a clear long-term vision for the future of the retail market and how to get there – decarbonisation, digitalisation and decentralisation will create new opportunities for consumers, with innovative products and services, which can reduce energy bills and support the transition to net zero. Ofgem will work to unlock these opportunities, alongside continuing to protect consumers' interests as the energy market evolves.

The reforms proposed in this document are not exhaustive. Change will also be needed to unlock the benefits of a digitally enabled sector, to better integrate smart technologies and continue to enable innovation.

Framework for consumer interests

To help provide clarity and focus to Ofgem's work, we are developing a framework of 'consumer interests' that Ofgem can help to secure: fair prices; a low-cost transition to net zero; ensuring all consumers, including vulnerable and disengaged consumers, receive a service that meets their needs; and resilience in the face of market shocks and volatility. We will be working with consumer groups and other stakeholders to gather feedback and further develop this framework.

Next steps

The proposed reforms span the breadth of the energy system, and many are for government to decide. They are at various stages of development: whilst some reforms, such as the creation of an independent system operator, are well underway, in other cases, there is not yet a definitive solution and further investigation and stakeholder engagement is needed. It will take time to deliver necessary reform, so it is imperative to begin the work now.

This document is not a formal consultation, but is intended to stimulate debate around how best to meet the challenges of delivering a low cost, net zero energy system. Ofgem is investigating the benefits and challenges of locational marginal pricing, considering reforms to network charges, and developing options for stronger local/regional energy planning capacities. We also intend to consult later this year on a proposed framework of consumer interests that will inform Ofgem's regulatory activity.[1]

We will continue to work closely with government, for example contributing to BEIS's ongoing review of electricity market arrangements. Ofgem will also continue to engage with the energy sector, with consumer groups, and with other stakeholders and actively welcomes views on the proposals in this document. Ofgem remains open to alternative approaches, where the way forward has not yet been confirmed.

[1] The proposed framework will help Ofgem focus its activity but will not override or substitute Ofgem's statutory principal objectives set out in section 4AA of the Gas Act 1986 and section 3A of the Electricity Act 1989 or other statutory duties.

1. Introduction

1.1. This publication sets out reforms Ofgem considers important to deliver a secure, low-cost energy system as we transition to net zero, alongside a proposed framework of consumer interests to better inform Ofgem activity.

1.2. The UK Government's legislative commitment to a net zero economy by 2050,[2] supported by achieving a fully decarbonised power sector by 2035,[3] sets the high level goal, with further direction provided by the Ten Point Plan, Net Zero Strategy and the British Energy Security Strategy.[4]

1.3. We are publishing this document against the backdrop of record high and volatile energy prices, recognising the challenges facing energy consumers, and the pressures on the energy sector. Ofgem is taking action to stabilise the market and support consumers and will continue to do so. The gas price surge provides an additional reason to accelerate the transition to net zero, to reduce our dependence on fossil fuels, and move ahead with reforms to deliver a more resilient, low cost energy system that works for consumers. The complexity of reforms, and lead-times for implementation and realisation of benefits underlines the need to make progress now. As the deployment of renewables and uptake of new technologies such as electric vehicles accelerates, we need to move fast to ensure the energy system adapts to a changing energy market.

1.4. Ofgem's principal objective is to protect the interests of GB energy consumers, both now and in the future, and this document is intended to highlight areas which could further those interests, including ensuring consumers benefit from a cleaner, greener environment. The reforms proposed in this document span the breadth of the energy system, and are not uniquely for Ofgem. We recognise that many of these proposals are for government to decide, with constructive input from Ofgem and other stakeholders.

1.5. The following chapter sets out some of the changes expected in the energy sector, and areas of ongoing uncertainty, and outlines emerging challenges and evidence that reforms are required. The subsequent chapter outlines reforms Ofgem considers necessary, followed by an introduction to a proposed framework of consumer interests. It is not a consultation document.

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[2] UK becomes first major economy to pass net zero emissions law - GOV.UK (www.gov.uk)
[3] (subject to security of supply) Net Zero Strategy: Build Back Greener - GOV.UK (www.gov.uk)
[4] The ten point plan for a green industrial revolution - GOV.UK (www.gov.uk); British energy security strategy - GOV.UK (www.gov.uk)

2. What does the future energy system look like, and what are the emerging challenges?

Great Britain's energy system is already undergoing rapid change. This needs to accelerate over the next decade to be on track to meet net zero. There are a range of potential decarbonisation pathways, but regarding our future energy system there are areas of relatively high certainty and key issues which remain uncertain.

It is increasingly clear that, without reform, the current energy market and governance arrangements will not deliver decarbonisation at least cost.

A rapidly changing GB energy system

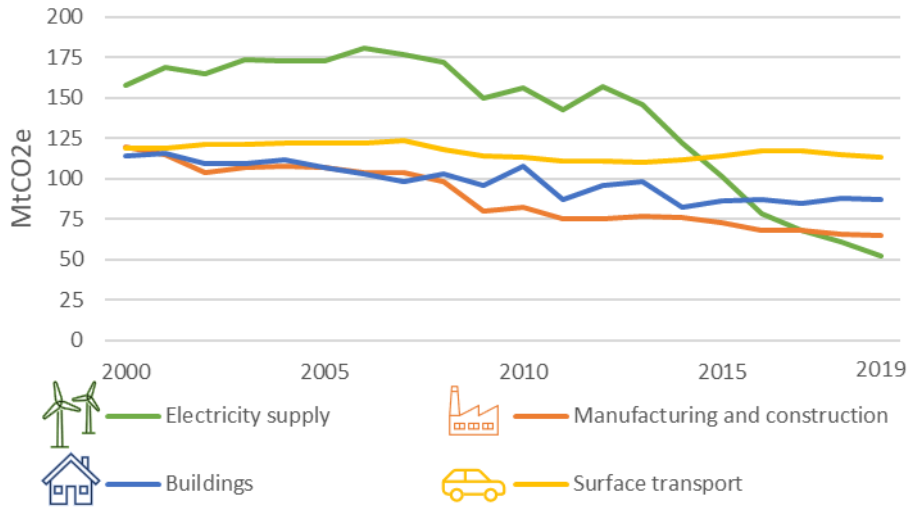
Progress to date

2.1. Great Britain has already made significant progress towards decarbonising the power sector, and overall economy. Security of supply has been maintained throughout this period.

2.2. The first phase of decarbonisation has successfully delivered a transition from coal to gas fired power generation, alongside a rapid growth in renewables. In 2020, 43.1% of UK electricity generation was from renewables, exceeding electricity generation from fossil fuels for the first time.[5] Decarbonisation of heat and transport has been slower to date, but is accelerating especially in transport with the increasingly rapid adoption of electric vehicles. There are close to 750,000 ultra-low emission vehicles already on the roads,[6] expected to increase to roughly 10 million by 2030.[7] A range of technologies may be important in decarbonising heat in both buildings and industry, including heat pumps, heat networks and hydrogen.

[5] Digest of UK Energy Statistics (DUKES): electricity - GOV.UK (www.gov.uk) This share fell slightly in 2021, with 2020 share higher due to decreased overall energy demand due to Covid-19, and windy conditions in Spring 2020.
[6] Vehicle licensing statistics data tables - GOV.UK (www.gov.uk)
[7] Taking charge: the electric vehicle infrastructure strategy (publishing.service.gov.uk)

Figure 1: Significant progress has been made decarbonising the power sector, but accelerated progress is needed in other sectors[8]



2.3. We believe that existing market, regulatory and institutional arrangements, whilst effective at delivering the first phase of decarbonisation, need to be reviewed as we move to the next phase of decarbonisation. We need reforms as we move to a system dominated by variable renewable generation and with more widely distributed small-scale energy assets such as solar generation and battery storage - a significant shift away from the traditional model of linear electricity flows, flowing from flexible, fossil-fuel generation to inflexible demand.

2.4. Simultaneously, high, volatile natural gas prices and the increased importance of GB energy independence require reduced use of imported fossil fuels across heating, industry, and electricity generation.

Expected changes and ongoing uncertainty

2.5. There is no single path to deliver net zero, with the Climate Change Committee's advice on the Sixth Carbon Budget (CB6) illustrating a set of scenarios to achieve net zero by 2050 at the latest.[9] GB governments' policies will further shape the composition of the energy system, setting ambition and targets, alongside targeted funding support, across different technologies.

2.6. We know that there will be a significant increase in overall electricity demand, as there is rapid growth in the number of electric vehicles on the road and expanding

[8] Data adapted from Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)
[9] Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

deployment of heat pumps. That demand will increasingly be met by low carbon, renewable generation. The British Energy Security Strategy[10] has set out the UK Government's expectations, including up to 50GW of offshore wind capacity (including 5GW of floating offshore) by 2030 and a five-fold increase in the deployment of solar by 2035. The British Energy Security Strategy included deployment plans for nuclear generation which could meet up to 25% of projected electricity demand in 2050. The use of natural gas in the gas grid and for unabated gas power generation will fall, potentially to zero.

2.7. However, there remain areas of significant uncertainty. In particular, it is unclear what the future balance of technologies will be for heating our homes and powering industrial processes. In particular, production of hydrogen, and its role in decarbonising heat remains uncertain. And there is an emerging set of technologies, including clean hydrogen-to-power, power CCS (carbon capture and storage) technologies, and long duration energy storage, which can provide new sources of low carbon dispatchable power - but the balance between them is not yet clear. In the retail market, there are already increasingly innovative technologies and services that provide opportunities for consumers to reduce their bills by changing their consumption patterns, but we are not yet clear on the full range of services that might emerge or how consumers will respond and engage with these.

Emerging energy system challenges

2.8. The speed and scope of expected changes to the energy market presents significant challenges to existing arrangements, including governance, markets and regulations. Key challenges are set out below.

Impact of high and volatile gas prices

2.9. The unprecedented rise in gas prices over the last twelve months has delivered a major shock to the energy system in Great Britain and across Europe. High and volatile gas prices[11] have triggered the exit of numerous energy retailers and are now feeding through to record high energy bills for domestic and non-domestic consumers, at the same time as wider cost of living pressures.

2.10. The gas crisis reinforces the need to accelerate the shift away from using natural gas, for both electricity generation and heat. Simultaneously, it strengthens the business

[10] British energy security strategy - GOV.UK (www.gov.uk)
[11] Interactive charts on GB gas prices can be accessed here: All available charts | Ofgem

case for decarbonisation. The economics have changed, and renewable options are increasingly the cost effective choice. Power can be cleaner and cheaper, whilst removing our dependence on foreign fossil fuels and increasing self-sufficiency, harnessing our natural resources.

Ensuring we have the right energy assets in the right place at the right time

2.11. Delivering a net zero energy system will require hundreds of billions of pounds of investment in new infrastructure in the coming decades, across the assets that generate, store and transport energy.

2.12. The challenge of delivering an optimal, efficient asset mix is complex, as we shift from fossil fuels to an uncertain mix of low carbon technologies, some of which are new. The energy system is characterised by significant dependencies between different energy assets, and inherent variability and uncertainty. Major investments are needed across different parts of the energy system, many with long lead times. For example, power CCS and blue hydrogen production won't be feasible until we have established carbon transport and storage facilities, new renewable projects can't come on stream until they have connections to the grid, and the mass adoption of electric vehicles and heat pumps will require upgrades to local electricity networks.

2.13. If we are to see the investment needed for the transition to net zero, it can't be left solely to markets – there is a need for coordination and strategic planning, at national and local levels, to ensure the system as a whole can transform. This must be accompanied by the use of competition and markets to help reduce costs and bring innovation.

2.14. Additionally, the energy system is a combination of markets and regulated natural monopolies, interacting with varying planning regimes across GB and our surrounding seabed. These also require coordination. New renewable generation capacity, including offshore wind and solar, are already facing long wait times (as much as 6-10 years) to connect to the grid, with some areas of the electricity network already constrained. Delays in transmission upgrades that are vital to connecting renewable generation to areas of demand, and challenges in accommodating connections to the distribution network for local generation and storage assets, are preventing renewable and flexible assets from coming online. The planning regimes need to work effectively to ensure that they safeguard environmental and other protections without unduly holding up important infrastructure

investments. Ofgem's network price controls (RIIO) are a key enabler of network investment, with significant funding available for new capacity through RIIO2.[12]

Opportunities for cost reduction in a renewables dominated system

2.15. We are moving towards a system dominated by low cost but intermittent renewable generation alongside higher cost dispatchable generation - in the near term the dispatchable generation is largely gas fired; in the longer term it will be replaced with low-carbon alternatives such as nuclear, power CCS, or hydrogen-powered gas turbines.

2.16. As the market changes, it is critical that the system evolves to ensure energy needs are met reliably and at least cost. This means considering how to tackle two challenges that are likely to be increasingly costly to energy consumers: the marginal pricing challenge, and the growing temporal and geographical imbalances between electricity supply and demand.

2.17. The gas crisis has crystallised a challenge with the way the electricity wholesale market works, with high-cost gas setting the price across the market even when it only provides a fraction of our electricity. This emerging ***marginal price challenge*** leads to significantly higher than necessary costs for consumers. We do not know whether recent high gas prices will be sustained, but the challenge it has highlighted is likely to be enduring: even if gas prices fall, investment in new low carbon generation capacity will be needed for times when renewables aren't able to meet our electricity demand. These new sources of power (such as nuclear, power CCS and hydrogen) are likely to be significantly more expensive to run than renewables, thus sustaining the marginal price challenge. Consumers are partially protected by the growing number of Contracts for Difference (CfDs) which pay low carbon generators a fixed price for energy and will pay back to consumers when, as now, the wholesale electricity price is high

2.18. As the level of intermittent renewable generation on the system grows, to keep costs down, we need to ***make best use of these cheap renewable sources of power when they are available*** and minimise use of more costly or polluting power sources when the sun isn't shining and the wind isn't blowing. The challenge is complicated by the fact that many of our best sites for renewable generation are geographically concentrated (eg. wind in Scotland and the North Sea, solar in south west England) away from some of the major

[12] The current RIIO-2 Gas Distribution and Transmission (Gas and Electricity) Price Control runs from 2021-2026, while RIIO-2 Electricity Distribution Price Control will cover the 5 year period from 2023 to 2028.

sources of electricity demand, and we do not currently have enough transmission capacity to transport all of today's renewable generation at peak output, let alone the expected future peak.

2.19. Currently, there is a single national electricity price across GB. As a result, on windy days, some areas produce more wind power than those areas can use or export, and the ESO (electricity system operator, currently National Grid) has to 'turn down' generation on one side of the the network constraint and pay to bring on additional generation at the other side of the constraint. In future, as the renewables build out accelerates, we are likely to face more geographic constraints across the country, adding to the cost of our low carbon energy system.

2.20. Balancing demand and supply at times of high renewable generation is becoming increasingly costly, and challenging. There has been a dramatic increase in the proportion of the market that has to be redispatched, with the ESO frequently redispatching more than 50% of the market in a single period, up from around 10% in 2008. Transmission constraint costs, which are a key component of balancing services costs, have risen 800% since 2010, and ESO's Network Options Assessment predict constraint costs could be up to £2.3bn/yr by 2026, even with network reinforcements.[13]

Ensuring positive outcomes for consumers

2.21. The above section highlights emerging issues which could prevent cost-effective delivery of a resilient and low carbon energy system. Ultimately, those costs are borne by the energy consumer. Energy is an essential service for homes and business around GB. The retail market acts as the primary interface between consumers and the wider energy system. It is critical that the retail market deliver positive outcomes and meets the needs of all GB consumers.

2.22. Over the last few decades, GB's energy system has been more reliable than ever before, while becoming more efficient and driving down costs. Ofgem promoted competition and sought to remove barriers to competitors entering the market. Increased competition in the retail market allowed customers to switch, improving standards and offering lower prices to more active consumers. The price cap was implemented to make sure that those customers who don't switch, for whatever reason, pay a fair price for their energy. This delivered major benefits for consumers, and energy suppliers' profit margins reduced

[13] Phase 3 Conclusions Net Zero market reform | National Grid ESO, based on Network Options Assessment (NOA) | National Grid ESO

following the introduction of the price cap. However, over the last year, volatile global gas prices have placed enormous strain on the retail market, and some suppliers have not been sufficiently resilient to these changes.

2.23. Looking forward, decarbonisation, digitalisation and decentralisation will fundamentally transform how consumers use energy and engage with their energy use. This could include new opportunities for domestic households and business-to-business arrangements. A well-functioning retail market will be critical to achieving our net zero goals. We need a retail market that consumers can engage with and benefit from, whilst maintaining consumer protections.

2.24. The current retail market continues to face challenges:

- Many consumers are currently struggling to pay their energy bills, against a backdrop of wider cost of living pressures.
- Not all consumers currently receive a good service that meets their needs (eg. on average energy consumers with a long-term illness, physical or mental health problem or disability, are less satisfied with the service that they receive).
- Looking forwards, market developments (eg. new, innovative products and services) will unlock new opportunities for consumers and the net zero transition. Regulation should facilitate these new opportunities and evolve at pace to ensure suitable protections are in place.
- The retail market is also not resilient to volatile wholesale market costs and may struggle to attract the investment needed to deliver an effective transition to net zero.

2.25. We are already working with government, industry and (domestic and non-domestic) consumer representatives to further address these issues and deliver for consumers.

The case for change

2.26. Given the challenges set out above we believe that, without significant reform, our energy system will be on a more costly pathway to decarbonisation than is needed, serving consumers less well.

2.27. Ofgem's principal objective is to protect the interests of existing and future consumers, but tackling these challenges requires collective effort and change which cannot be delivered by Ofgem alone.

3. Potential reforms

Ofgem consider there is a need for significant reform of energy markets and structures, to deliver a low-cost, low-carbon resilient energy system. A range of actors will be integral to any reforms, with many key decisions falling within the remit of government. We will continue to work closely with governments and other stakeholders.

We set out potential reforms in three areas:

- A Future System Operator driving strategic planning, alongside reformed sub-national energy institutions with roles in local energy planning and distribution system operation.
- Potential changes to the electricity wholesale market to address the marginal pricing challenge, and to introduce locational signals to the electricity market, to enable more efficient operation, reducing day-to-day costs and investment requirements.
- A retail market that is resilient, and can facilitate the transition to net zero, while meeting the needs of consumers as it evolves.

3.1. The set of reforms described in detail in this chapter are our proposals to address the strategic challenges as set out in the previous chapter. The reforms are intended to support a low-cost, low-carbon resilient energy system, but are not considered exhaustive or necessarily sufficient on their own. Many of the proposed reforms, which span the breadth of the energy system, are not for Ofgem, but are for decision by government.

3.2. The proposed reforms are intended to drive discussion and further consideration. We recognise that there are alternative options. Ofgem notes that new and alternative proposals will continue to emerge, which may warrant consideration.

3.3. Ofgem, in some cases in conjunction with BEIS, has already confirmed and committed to some components of these reforms. This document does not represent a change in official position from Ofgem on these matters. Other reforms are set out as proposals only, for further assessment, and if pursued will be subject to consultation and the full statutory and legislative processes required to implement changes.

Reforms

3.4. A set of reforms (across three inter-related areas) are identified as central to deliver a cost effective, secure pathway to net zero for the energy system as a whole.

3.5. A key challenge for policymakers and regulators is determining the right role for markets, and the right balance between competition and regulation. Market failures are pervasive in energy markets: intervention is needed to deliver decarbonisation, to guarantee security of supply, and to ensure consumers are protected, particularly the vulnerable. But competitive markets are also vital to deliver investment and innovation, and to drive down costs for consumers. The reforms proposed below seek to get the right balance: planning to ensure coordination of major infrastructure investments and system change at local levels, alongside the creation of effective market signals to facilitate the most effective use of that infrastructure, and reduce the scale of build required.

3.6. Given the expected increase in electricity demand and new low carbon generation, the optimal balance for the GB system will require both investment in physical network infrastructure upgrades and better optimising existing capacity and maximising the potential of smart, flexible technologies that can provide cost effective network solutions. Ofgem's network price controls (RIIO) will continue to balance these approaches and ensure investment in the new network capacity needed for net zero occurs at pace and at least cost to consumers.

Infrastructure & Governance

A powerful and independent Future System Operator, working as a strategic planner for the GB energy system, alongside a reformed set of local energy institutions, playing a key role in local energy planning and distribution system operation.

3.7. To better support and enable the transition to net zero, Ofgem considers that key changes are required to the institutional and governance arrangements for the energy system.

Future System Operator

3.8. Ofgem, the UK Government, National Grid and the Electricity System Operator have set out a commitment to create a Future System Operator (FSO) which is genuinely

independent, and able to provide expert advice to Ofgem and governments.[14] We expect the FSO to deliver unconflicted, efficient management of the electricity system and play an increasingly significant role in shaping the energy system and driving forward network competition. The FSO should take a whole system approach, including interactions across electricity and gas, and the implications of emerging markets such as hydrogen and power CCS. That whole systems approach will need to incorporate the implications of transport, heat and industry, with an increasingly electrified energy system.

3.9. The FSO will take on the main roles and responsibilities of National Grid Electricity System Operator, and the longer-term planning, forecasting and market strategy functions of National Grid Gas. The FSO, independent from National Grid, will not have any vested interests through asset ownership or commercial interest in the energy sector, removing the risk of any perceived or real bias in decision-making. To ensure that the FSO is capable of managing trade-offs and synergies, it will have a duty to facilitate net zero while maintaining security of supply and an efficient, coordinated and economical system.[15]

3.10. BEIS and Ofgem have consulted on the FSO and published a joint response in April 2022 following consultation feedback.[16] The response document contains details of the key policy decisions taken by government, with advice and assistance from Ofgem. Some of those decisions are contingent on the outcomes of legislative and regulatory changes. Ofgem's view on the key roles and activities we see the FSO performing is consistent with stated positions or commitments in the joint response and associated documents.

3.11. The expectation is for the FSO to take an increasingly significant role in shaping the energy system, as the strategic planner, developing system-wide network plans, in light of government policies, and recommending the strategic investment that is needed across the energy system – in particular transmission, interconnection and (in an advisory role) large-scale generation, to enable effective coupling of supply and demand, in the right places at the right times. Additionally, the FSO should provide advice to governments and Ofgem, to enable strategic policy decisions based on a whole-system view. That could include the implications of specific generation mixes on the electricity system, or the optimal quantity, location, and type of low carbon generation required to meet system needs at least cost, and could also include options for the decarbonisation of heat and potential decommissioning of network assets as system needs evolve. System operability needs will

[14] Joint Statement on the Future System Operator - GOV.UK (www.gov.uk)
[15] An additional duty is intended to ensure the FSO has regard to the need to facilitate competition, and innovation; impacts on consumers, and consumer behaviour; and whole system impacts.
[16] Proposals for a Future System Operator role - GOV.UK (www.gov.uk)

change, and the FSO will be critical to driving the changes required to operate our future low carbon system, with decreasing reliance on unabated fossil fuels.

3.12. Ofgem is focussed on ensuring the networks can support delivery of net zero through the efficient planning and progression of strategic transmission investments driven by future supply and demand through the Offshore Transmission Network Review and Electricity Transmission Network Planning Review. The ESO has recently announced its Pathway to 2030, including the Holistic Network Design, setting out the strategic approach to planning the offshore transmission network as well as the required related onshore reinforcements needed to meet the 2030 ambition of connecting up to 50GW of offshore wind to the electricity network.[17] Over the coming years network planning will evolve into a single Centralised Strategic Network Plan (CSNP) for the electricity transmission network. This will provide guidance to decision makers on the development of the wider energy system, including the policy targets for CCS, hydrogen and gas infrastructure alongside electricity infrastructure. Ofgem have proposed that the FSO lead the CSNP.

3.13. In addition to adopting the roles of the ESO, the FSO will undertake strategic and longer-term gas network planning. Through its whole system viewpoint, the FSO will be able to take a holistic approach to system planning, providing advice on gas network capability and future of gas. This could include advising on technical options approach to incorporate hydrogen into the GB energy system, and where this would be best placed.

3.14. This will create a more transparent and responsive picture of the gas system, with an institution able to provide technical and high quality advice on modernising energy (gas together with electricity) at a national level, guided by net zero.

Next steps

3.15. Not all the detailed design features of the FSO have been decided and there is further policy development needed from BEIS and Ofgem to create the FSO, implemented via a range of mechanisms. These aspects of detailed policy design and implementation are subject to ongoing engagement with stakeholders, and will follow the appropriate, established decision-making processes.

3.16. The independent FSO represents a significant step forward, but there are a number of other potential roles which the FSO could take on over time, for example in relation to

[17] ESO publishes Pathway to 2030 – major step to deliver 50GW of offshore wind by 2030 | National Grid ESO

distribution-level system planning or markets, data, heat, transport, hydrogen and CCS. Some potential future roles of the FSO may require further legislative change.

3.17. The next steps in implementation of the FSO, as set out by BEIS and Ofgem in the joint response, involve a phased approach. Dependent on a variety of factors, the FSO could be established by, or in, 2024.

Local energy institutions and governance

3.18. The FSO and reformed market signals will help plan, deliver and optimise transmission networks and the system nationally, but network constraints and the need for flexible responses will also occur at a much more granular level. At a sub-national level, it is clear that a new set of capabilities and functions will be required, with delivery potentially involving new institutions. Current arrangements are considered unsuitable to deliver requirements. This is due to the evolving energy system needs at the sub-national level, cutting across system planning, operation and market facilitation.

3.19. Electricity Distribution Network Operators (DNOs) have been building-in capabilities to drive more efficient development and use of the decarbonising electricity system, typically referred to as Distribution System Operation (DSO) roles. However, other institutions also play a role in facilitating the energy system transition at a sub-national level, including Gas Distribution Networks (GDNs) and local government, including local and combined authorities as well as other supporting bodies.

3.20. Ofgem has begun a review into the effectiveness of institutional and governance arrangements at a sub-national level to support delivery of net zero at least cost, and the case for alternative approaches. Ofgem recently published a Call for Input[18] which identified important challenges, and detailed sample framework models outlining a range of future potential arrangements. Some of the model options set out are not in Ofgem's regulatory remit to deliver, or will require primary legislation. Ofgem will continue to work closely on these issues with governments and other relevant stakeholders.

3.21. Across the range of models detailed, Ofgem considers it is imperative that key energy system functions are performed by institutions with the authority, appropriate skillset and incentives to drive net zero at least cost.

[18] Call for Input: Future of local energy institutions and governance | Ofgem

3.22. Those institutions should be properly equipped to plan strategic development of local energy networks in dialogue with those shaping the local energy system, facilitate flexibility to reduce network investment where this is most effective, and send the signals needed to optimise the use of distribution networks and potentially other assets.

3.23. Effective planning of local energy networks will involve a greater level of co-ordination than there is at present. This will include consideration of cross-vector aspects (including transport, gas, and decarbonisation of heat including heat networks) and between levels – in other words considering transmission and distribution.

3.24. Energy governance needs to better facilitate, via markets, flexible resources and non-network solutions. That means embedding simple, fair and transparent rules and processes for procuring flexibility services for different purposes, and this will only be delivered by the right governance nationally and locally. Market information should be open, accurate and comprehensive, allowing a diversity of flexibility providers to participate in multiple markets, nationally and locally and respond to various market signals.

3.25. Alongside having signals in place to allow flexibility providers to respond and participate, there needs to be a clear rule-based approach to handle conflicts, and ensure efficient system operation, capable of handling dynamic changes on the system.

Next steps

3.26. Ofgem will continue to evaluate reform options, including consideration of responses to the Call for Input, and further stakeholder engagement, with a view to arriving at conclusions by early 2023.

Reforming wholesale markets to reduce energy bills

3.27. As set out in the previous section, wholesale electricity markets may not be configured to deliver net zero at lowest cost to consumers. There is scope to reduce costs by tackling the marginal price challenge (where the price for the whole market is set by the most expensive fuel on the system – currently gas, in future low carbon alternatives); and by introducing greater price granularity to incentivise investment in the right assets in the right places, and for demand (and storage assets) to make best use of cheap renewable power when and where it is available.

Tackling the marginal price challenge

3.28. Having the marginal product set the market wide price is typical in energy (and other) markets, and is widely considered to be the most efficient pricing mechanism, providing high profits for the cheapest suppliers, encouraging them to expand to the point at which they set the marginal price, bringing that price down, reducing costs for everyone. But as the share of low cost renewables in GB electricity generation grows, we may be moving to a market where that traditional efficient approach is no longer optimal.

3.29. An alternative approach would be to establish a split wholesale market, proposed by some commentators.[19] There are different variants but, at their heart, they establish one market for intermittent renewable power, which gets paid its costs, and a second wholesale market for firm power, with prices set at marginal prices in the usual way. This would enable consumers to benefit from the lower costs of renewables, whilst simultaneously incentivising the dispatchable generation needed to balance the market.

3.30. This would be a novel approach, a significant reform, and would take time to implement. An alternative approach, with potentially faster impact, would be to increase the use of Contracts for Difference (CfDs), which pay a fixed price to low carbon power projects. These contracts essentially already deliver a key benefit of the split market proposal: CfD holders do not receive the marginal price in the wholesale market, but receive a fixed price which, at times of high market prices like now, will pay back to consumers, protecting them from market price volatility. CfDs were first awarded by the UK Government in 2014, but given long lead times for new projects, they are only now starting to account for a significant share of GB power generation, roughly one tenth now, due to rise rapidly through the 2020s.

Tackling geographical imbalances with locational signals

3.31. Greater flexibility will help to bring down system costs as we move to a low carbon system dominated by cheap renewable power – by minimising the costs of balancing the system and the amount of generation and network build required to meet increasing electricity demand. There are a number of options for delivering locational signals, each with pros and cons.

[19] The Decarbonised Electricity System of the Future: The 'Two Market' Approach - Oxford Institute for Energy Studies (oxfordenergy.org); UK Electricity Prices: competitiveness in a low carbon world – University College London

3.32. **Locational variation in wholesale market prices** (known as locational marginal pricing) can enable more efficient operation of, and investment in, system assets by sending accurate signals about network constraints which vary in time and according to the demand and supply available on the system. These signals can provide valuable information, driving efficient generation, demand and storage behaviours that take into account the physical constraints and characteristics of the network, and also for network planning and investors, highlighting where network reinforcement, generation, storage and demand could site to reduce system cost. This could be achieved in GB by splitting the market into zones or nodes (see box below), with participants at each node competing to set a price that takes into account any constraints on the flow of power between nodes.

3.33. Based on international experience and initial modelling, we would expect significant efficiency gains and consumer benefits from changing the way that network constraints are valued and managed, versus today. The ESO reached a similar conclusion in its 2022 Net Zero Market Reform program[20], which assessed the locational and dispatch elements of market design. A recent study by Energy System Catapult also found that wholesale market reform of this nature could save energy billpayers around £30bn off the cost of electricity in the period out to 2035.[21]

Nodal and zonal markets at a glance

Nodal pricing, is used in several electricity markets in the USA, in New Zealand and Singapore and is currently being implemented in Ontario, Canada. In a nodal market, the price in each network location (also known as a 'node') represents the locational value of energy. The number of 'nodes' can vary from a few hundred to a few thousand, with this typically influenced by network size and the level of congestion. The wholesale market itself resolves any network congestion, with the physical constraints of the network – capacity and losses – reflected in the market clearing process.

Design varies significantly across jurisdictions. For example, New Zealand and PJM expose both demand and supply to granular locational prices, while in Texas and California only supply is exposed to locational prices with demand able to 'opt-in'. A common feature of nodal markets is some form of central dispatch for market clearing, with some jurisdictions such as New Zealand and PJM opting to co-optimise energy and ancillary service markets.

Zonal pricing is the established arrangement in the European internal energy market (IEM). A zonal wholesale market splits the electricity network into defined zones with boundaries usually drawn to reflect where major transmission network constraints occur. Each zone operates like the current national market, with a single price that does not reflect network constraint costs within the zone. Transmission constraints between zones are priced by the wholesale market, while constraints within zones are not. In the IEM, most member countries represent one zone, while Italy, Norway, Sweden and Denmark each contain multiple internal zones.

3.34. The benefits of locational marginal pricing are highest in more 'constrained' systems - those that frequently have insufficient network capacity to most efficiently connect

[20] Net Zero market reform | National Grid ESO
[21] Locational pricing could save £30bn for electricity consumers in the switch to a net zero grid, finds new study - Energy Systems Catapult

electricity supply to demand, so the interaction with increased network build in GB will be an important determinant of the benefits. Benefits are also limited if generation locations are fixed which, with renewables, nuclear and CCS, is to some extent the case, which will leave the benefits case more dependent on the potential to optimise investments in other asset classes (such as battery storage) and the operational benefits of more accurate signals for flexibility.

Alternatives to locational marginal pricing

3.35. Splitting the GB wholesale market into zonal or nodal markets would deliver significant benefits, but is also a significant change that would take time, and would come with transition costs that merit careful assessment. There are alternative options that could generate useful locational signals, without a similar level of reform to network access rights or dispatch arrangements. These options include:

- Introducing greater locational and temporal granularity into **network charges**. This could be done for both transmission and distribution networks, with charges varying most between areas that are heavily constrained, versus having excess capacity. The charges could vary in real time, in response to network conditions, to enable market participants to decide whether to face charges to utilise limited capacity. Dynamic charging of this nature could provide more accurate incentives for new generation and storage investments to locate in unconstrained parts of the network, compared to today's charges. To deliver an effective investment signal, the charges would have to be 'administered', or calculated, based on a transparent methodology that allowed participants to manage their risk of paying high costs to use the network. There is an inherent tension in the design of this type of charge, where a more accurate and cost-reflective methodology tends to deliver a volatile charge that makes this risk more difficult to manage. Regardless of methodology, dynamic network charges are likely to deliver a less efficient indicator of the value of the network, than if it were uncovered through competition between network users. Having market participants compete to purchase transmission rights, for example through regular auctions, could provide more efficient network pricing than an administered charge.
- Introducing **locational signals into the balancing market** is another option for increasing the accuracy of how network conditions and constraints are signalled. Under today's arrangements, the ESO calculates national balancing prices, by settling all actions that are required to rebalance the system, based on bids and offers from market participants - parties offering to balance are

competing with each other on price regardless of their location in the network and the constraint or other system issue that they are able to alleviate. This could be reformed by splitting the balancing market into zones or nodes.

- Network operators could also expand the use of **flexibility contracts and markets**, that are being used today to mitigate congestion in parts of the distribution network. In the long run, as the opportunities and challenges of optimising the system grow in complexity, there may be limitations to the efficiency of this approach.

3.36. The options above would enable locational signalling without major reforms to the wholesale market, to dispatch arrangements or network access rights. In any reformed arrangements, the design of the network access and charging regime should complement wholesale market and balancing arrangements, to ensure that signals are consistent and investors have reasonable options for assessing and managing their risk. A combination of locational marginal pricing with auctioned financial transmission rights (which provide a hedge against network constraints) is used in several markets internationally to seek to achieve this optimisation.

Distributional impacts

3.37. More accurate locational signals are likely to deliver a significant reduction in system costs, but the impact will vary in different parts of the country. We are undertaking modelling to better understand the nature and scale of the distributional impacts – it is likely that electricity costs would be lower for everyone. Alternatively, energy consumers (or groups of them) could be exempt from locational signals, although that would limit the ability of consumers to gain the benefits of flexing their demand, and would reduce the reductions in energy system costs that locational signals can bring.

Other market reforms

3.38. In addition to the areas of potential reform set out above, there is an increasingly strong case to consider other reforms to wholesale markets:

- A common feature of most nodal markets is some form of **central dispatch and settlement** of the market. The GB wholesale market currently operates a system of self dispatch, where market participants notify the ESO of their intended output, up until one hour before time. At this point, the ESO then decides what additional 'rebalancing actions' are required to keep the system stable and in balance. Under central dispatch, participants submit bids to the system operator, typically at the day ahead stage. This allows the operator to

optimise generation dispatch according to these bids and network constraints, with all participants paid the market clearing price (either nationally, or for their zone/node). Depending on the market design, this can remove the need for a separate balancing market. Even without a move to locational pricing, central dispatch could be more efficient than existing arrangements. England and Wales previously had a centrally dispatched market, the 'Pool' from 1990 to 2001. Compared to modern markets, the Pool had a complex settlement process which was considered opaque and open to gaming. Experience in other centrally-dispatched markets suggests that market rules and design can ensure that bids are generally efficient and reflective of marginal costs.

- Support for **long duration storage**: locational reforms proposed above would provide an incentive for investment in electricity storage assets where they are most needed, but the most commercially viable storage investments are likely to be those that provide short term storage, charging and discharging on a regular basis. The GB system may also need more long duration storage, to support the system during windless winter weeks, and potentially to store some of the likely summer power surpluses for use in winter. There is a wide range of potential technologies, including green hydrogen, pumped hydro power, and other more innovative technologies. Market signals alone may be too uncertain to bring forward such investments.

Next steps

3.39. We have set out a range of proposals above aimed at reducing wholesale market costs as we move towards a net zero energy system. They vary from relatively minor interventions to significant reform. And the reforms are interconnected, including the two main proposals (a split market and locational marginal pricing). A reform programme could involve a combination of these reforms, or a selection – there is a degree of substitution, for example, locational marginal pricing plus a growing use of CfDs would reduce the impact of high gas prices on electricity costs.

3.40. Given the complexity of the issues, and risk of unintended consequences, considerable further work is needed. Ofgem is, for example, already undertaking a detailed technical assessment of the potential benefits, costs, and implementation requirements associated with a transition to a zonal or nodal market design. This will consider several design options in a GB context including the potential distributional impacts. It will consider the key risks associated with such a move, including potential impacts on investor confidence and market liquidity. This will report in Autumn 2022.

3.41. These questions of market reform are primarily for government. Ofgem continues to support government in considering a wide range of potential reforms to current market arrangements. The UK Government intends to set out high-level options for reform in the coming weeks.

3.42. Ofgem is also undertaking a significant programme of work looking at the longer-term purpose and structure of transmission network use of system charges,[22] and review of distribution use of system charges.[23]

Stabilising, reforming and transforming the retail market

A retail market that is resilient, and can facilitate the transition to net zero, while meeting the needs of consumers as it evolves

3.43. The retail market is the main interface between the consumers and the wider energy system, delivering an essential service for homes and businesses across the country. It is critical that we deliver a sustainable retail market where successful retailers can make reasonable returns, that facilitates the transition to net zero, and that delivers positive outcomes and meets the needs of all GB consumers.

Making the retail market more resilient

3.44. The unprecedented increase in global gas prices has placed the retail market under considerable strain over the last year. To protect consumers, we have acted fast to respond to emerging issues, stabilise the market, and we are making further reforms.

3.45. The Default Tariff Price Cap has protected 23 million households from even higher price rises, and our processes have protected over 4 million consumers whose suppliers exited the market.

3.46. We are implementing stronger financial regulation to improve supplier resilience to volatile wholesale prices and ensure that risks are not inappropriately passed onto consumers.[24] Ofgem has already implemented a number of changes to make the price cap more adaptable to volatile markets, such as the introduction of a price cap reopener in

[22] TNUoS Call for Evidence - Next Steps | Ofgem
[23] Distribution Use of System Charges: Significant Code Review Launch | Ofgem
[24] Ofgem announces tough new financial measures to ensure energy suppliers can withstand future shocks - including protection for customers' credit balances | Ofgem

exceptional circumstances[25] and the proposed move to quarterly updates of the price cap so that consumers can see benefits quicker once prices fall from the current record highs, and it is more resilient to variable energy prices.[26] We are ensuring suppliers are fulfilling their obligations to consumers, especially the vulnerable. And we are working with government to support the rollout of their Energy Bills Support Scheme to help make energy bills affordable.[27]

3.47. These steps will make a material difference to improving outcomes for consumers and reducing the risks facing energy consumers.

An evolving retail market

3.48. Whilst we have prioritised our short term response to the gas crisis, we have continued to develop our thinking on longer term reforms. The retail market is seeing accelerating change: decarbonisation of heat and transport will change how domestic and non-domestic consumers use energy; digitalisation of the energy system and new smart technologies will drive the development of new and innovative products and services that will give consumers more control over their energy consumption, with increasing opportunities for decentralisation. Some of these changes are already happening, for example the growing number of new flexible tariffs designed specifically for electric car drivers.

3.49. Decarbonisation, digitalisation and decentralisation provide a unique opportunity for consumers to not only benefit from better service, lower costs and a greener future, but also play a more active role. Ofgem will work to unlock wider opportunities for consumers to be active participants in the energy system, delivering a 'win-win-win' – that is, through optimising their own energy use (and potentially providing energy back to the system at certain times), consumers can lower their own bills, reduce system costs paid for by all consumers, and bring down carbon emissions. We will also ensure that all consumers who are unable to participate, including disengaged consumers and vulnerable consumers, benefit from these changes.

3.50. We recognise that Ofgem has a critical role to play in the energy transition. We are committed to enabling decarbonisation at lowest cost to energy consumers, as set out in

[25] Price Cap – Decision on the process for updating the Default Tariff Cap methodology and setting maximum charges | Ofgem
[26] Ofgem backs consumers with price cap update | Ofgem
[27] Energy Bills Support Scheme explainer - GOV.UK (www.gov.uk)

our Decarbonisation Action Plan.[28] In support of delivering net zero, our role is to facilitate the emergence of new and innovative products and services that will accelerate the transition to net zero at lowest cost; whilst updating our regulations to ensure that all consumers are protected as these new products and services emerge.

Next steps

3.51. We recognise that the current market situation is volatile and we will continue to respond quickly to any emerging issues. However, it is also critical that we identify how to best deliver our long-term vision for consumers. We are working with governments and industry stakeholders to develop our thinking. We intend to publish an update on our retail strategy later this year.

Critical enablers

3.52. In addition to the specific reforms discussed above, there will need to be a significant number of complementary reforms and developments, delivered by Ofgem, governments and across the sector, which will be needed deliver an effective transition. This includes:

- regulating to ensure the delivery of key enablers for a more innovative and **smart retail market** that supports the transition to net zero including the rollout of smart meters, and introducing mandatory half-hourly settlement – providing more granular consumption data which can support suppliers offering tariffs that encourage consumers to be flexible with their energy use. In the future, shorter settlement periods, potentially every 5 minutes, could further encourage more flexible use of energy;
- overhauling **energy code governance** to facilitate the delivery of more efficient and dynamic processes across the energy sector that work more effectively to support the transition to net zero. As part of energy code governance reform[29] Ofgem will publish an annual strategic direction setting out how codes should evolve over the following year. Energy code arrangements underpin the market's operation, and these reforms are key to ensuring codes can respond effectively to the significantly changing sector, in the interests of consumers, and ensure that new technologies, business models and ways of managing the system are supported;
- delivery of a **digital** architecture for the energy sector, including open **data** standards, protocols and platforms. This will deliver benefits across the energy

[28] Ofgem's Decarbonisation Action Plan | Ofgem
[29] Energy code reform: governance framework - GOV.UK (www.gov.uk)

system, from more stable and efficient system operation, to unlocking the full benefits of flexibility, integrating the proliferating number of energy assets, and creating a more seamless consumer experience. As the sector digitalises, Ofgem is updating its regulatory approach to keep pace: identifying and (where necessary) regulating new data monopolies; strengthening and broadening cyber security standards to ensure confidence and security in this increasingly digital system; and building our own in house capabilities, including data platforms to improve the quality and timeliness of our regulatory information;

- supporting the infrastructure, standards, and innovation necessary for electrification of transport and heat, including: delivery of **EV smart charging and vehicle-to-grid** at scale; establishing a new regulatory regime to protect customers of heat networks; and the supply chains for massive deployment of smart heat pumps, and improving energy efficiency of buildings;
- ensuring that the energy system is well-prepared for, and **resilient** to, severe weather events, which are likely to become more common due to climate change; and
- ongoing support for **innovation**, including through the network funded Strategic Innovation Fund, our Innovation Link advisory service and Regulatory Sandbox in which innovators can test new approaches.

4. A framework for defining consumer interests

4.1. It is crucial that we remain focussed on achieving an energy market that can deliver positive outcomes for all consumers, and routinely refresh our understanding of consumer interests as the market changes. A report commissioned by Ofgem into our regulation of the energy supply market,[30] recommended that we develop 'a 'living' framework for how consumer interest is defined and measured'.

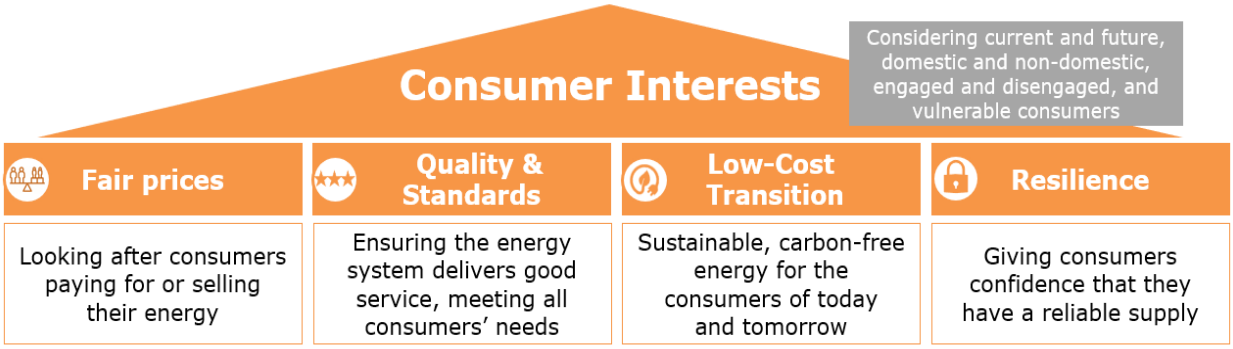
4.2. We are developing a new framework of consumer interests, to help focus our actions, enable the assessment of policy trade-offs and consider costs and benefits to consumers of activities.

4.3. As this work progresses, we will engage with consumer groups to better identify what consumers value. We intend to consult on this proposed set of consumer interests later this year.

4.4. Our initial work has identified four proposed key components of an energy system working in consumers interests, that it:

- Delivers **fair prices** for consumers;
- Supports a **low-cost transition** to net zero;
- Provides **quality and standards** so that all consumers, including vulnerable and disengaged consumers, receive good service that meets their needs; and
- Is **resilient** to volatile wholesale prices, attractive for long-term investment and ensures reliable supply for consumers.

Figure 2: Proposed set of consumer interests



[30] Review of Ofgem's regulation of the energy supply market | Ofgem

4.5. As we further develop this articulation, it could provide us a framework through which to answer difficult questions and challenging trade-offs about how best to protect consumers' interests, across all our regulatory work.[31] For example:

- What is the most effective way of delivering 'fair prices' for consumers?
- How can we best deliver a resilient retail market, without disproportionately increasing barriers to innovative products and services?
- To deliver a low-cost transition, how can we encourage consumers to be flexible with their energy use, whilst still protecting those consumers that are unable to participate flexibly?

4.6. We intend to consult on this proposed framework, and will be working with governments, consumer groups and industry participants to identify what further reforms are needed to deliver against the framework of consumer interests, and to protect consumers' interests as the energy market changes.

[31] The proposed framework will not override or substitute Ofgem's statutory principal objectives set out in section 4AA of the Gas Act 1986 and section 3A of the Electricity Act 1989 or other statutory duties.

5. Have your say

5.1. This publication has outlined a package of significant potential reforms of energy markets and institutions, that Ofgem consider could enable a cost-effective transformation of the sector in the coming years, delivering an energy market that works for consumers and the climate.

5.2. We recognise that some of the reforms proposed in the paper are for government rather than Ofgem to decide. We offer the paper as a useful contribution to the debate, a stimulus for discussion. A number of these proposed reforms require further consideration and examination, which Ofgem will undertake in collaboration with government bodies, the energy sector, consumer groups and other stakeholders.

5.3. The paper is not a formal consultation. Where Ofgem has consulted on topics discussed in this document, there is no need to re-submit material.

If you would like to provide views or feedback on this document, please email NetZeroBritain@ofgem.gov.uk; or write to Net Zero Britain, Strategy & Decarbonisation, Ofgem, 10 South Colonnade, London E14 4PU, by 8 August 2022.