AEMC

REVIEW

Australian Energy Market Commission

FINAL REPORT

REVIEW OF DECARBONISATION IN ENERGY REGULATORY DECISION-MAKING

AUGUST 2022

INQUIRIES

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ABOUT THE AEMC

The AEMC reports to the Energy Ministers' Meeting (formerly the Council of Australian Governments Energy Council). We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the Energy Ministers' Meeting.

EXECUTIVE SUMMARY

The Australian Energy Market Commission's (AEMC or Commission) 2021 graduate cohort has undertaken a review on decarbonisation in energy regulatory decision-making (Review). The Review examined how energy market bodies in other jurisdictions account for carbon in their regulatory and decision-making frameworks, and has supported the AEMC's decision-making framework project team to better articulate how carbon considerations might feature in the Commission's future decisions.

This report has assessed eight jurisdictions and their respective energy regulators. The jurisdictions were selected to provide a broad and diverse spectrum of examples. The report provides information on the operation of their energy markets and governance structures, applicable legislation and guiding energy objectives, and draws comparisons with the Australian energy market. The report sets out how the jurisdictions and regulators account for carbon in their decision-making and outlines the mechanisms and programs used to establish and implement decarbonisation policies.

The Review found that there are a number of factors that contribute to the wide variation in structure, operation and regulation of each jurisdiction's energy markets, and their approach to decarbonisation. These include (but are not limited to) the following:

- political, economic, social, technological and environmental determinants
- commitment to international climate change agreements
- setting of national emissions reduction targets
- import and export agreements
- geographical location, natural resources and generation fuel mix.

The report is intended to be used as a reference document and enhance AEMC staff understanding of global efforts to decarbonise the energy sector. Key findings of the report are outlined in the table below.

Table 1: **Summary of findings**

JURISDICTION	REGULATOR ENERGY OBJECTIVE	DECARBONISATION POLICIES AND TOOLS	EMISSIONS REDUCTION TARGETS
Canada	The federal regulator is not obliged to adhere to an objective equivalent to the AEMC energy objectives. The decisions made by the regulator are influenced by laws passed by the federal government and the provincial and territorial governments	• Carbon tax • Trading scheme	• *Net Zero Emissions Accountability Act 2021* - 40-45% reduction below 2005 levels by 2030 and net zero by 2050
Germany	*Energy Industry Act 2005* - provide the most secure, inexpensive, consumer-friendly, efficient and environmentally friendly line-based supply of electricity and gas which is increasingly based on renewable energies	• Carbon budget • Energy efficiency scheme • Renewables incentive • Trading scheme	• At least a 65% reduction below 1990 levels by 2030 and achieve net zero by 2045
Ireland	*Electricity Regulation Act 1999* - take account of the protection of the environment and encourage the efficient use and production of electricity	• Carbon budget • Climate action plan • Energy efficiency scheme • Renewables incentive (government support scheme)	• Reduction of 51% below 2018 levels by 2030 and achieving net zero by 2050
New Zealand	*Electricity Industry Act 2010* - promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers	• Carbon budget • Trading scheme • Emissions reduction plan	• Reduction of 50% below 2005 levels by 2030 • *Climate Change Response Act 2002* - achieve net zero by 2050
Singapore	*Electricity Act 2001* - to implement (whether through regulation or otherwise) policies,	• Carbon tax • Singapore Green Plan 2030	• Reduction of 36% below 2005 levels by 2030 and aims to

JURISDICTION	REGULATOR ENERGY OBJECTIVE	DECARBONISATION POLICIES AND TOOLS	EMISSIONS REDUCTION TARGETS
	strategies, measures, standards or any other requirements on any matter for or connected with the reduction in emission of any greenhouse gas in the generation, transmission, import, export or supply of electricity	• *Four Switches*	achieve net zero as soon as practicable in the second half of the century
South Africa	*National Energy Act 2008* - adopt measures to provide for the universal access to appropriate forms of energy or energy services...that take into account the safety, health and environmental suitability of such energy	• Carbon budget • Carbon tax • Licencing standards • The Integrated Energy Plan • The Integrated Resource Plan	• Limit emissions to 350-420 $MtCO_2e$ by 2030 and achieve net zero by 2050
United Kingdom	*Electricity Act 1989* - protect the interests of existing and future consumers in relation to electricity conveyed by distribution systems or transmission systems...their interests taken as a whole [include]...the reduction of electricity-supply emissions of targeted greenhouse gases	• Carbon budget • Carbon value • Impact Assessment • Trading scheme	• Reduction of at least 68% below 1990 levels by 2030 • *Climate Change Act 2008* - achieve net zero by 2050
United States	The federal regulator is not obliged to adhere to an objective equivalent to the AEMC energy objectives. The decisions made by the regulator are influenced by laws passed by Congress	• Clean Electricity Performance Program • Impact Assessment • Trading scheme	• Reduction of 50-52% below 2005 levels by 2030 and aims to achieve net zero by 2050

Source: AEMC created based on information publicly available on May 2022.

1 INTRODUCTION

In August 2021, the Australian Energy Market Commission's (AEMC or Commission) 2021 graduate cohort received the terms of reference (ToR) for the review on decarbonisation in energy regulatory decision-making (Review).

The Review examines how energy market bodies in other jurisdictions account for carbon in their regulatory and decision-making frameworks. The outputs from the Review have also assisted the AEMC's decision-making framework (DMF) project team to better articulate how carbon considerations might feature in the Commission's future decisions.

This report provides information on a broad range of jurisdictions and forms a comprehensive index of global regulatory decision-making in the energy sector. Additionally, the report details the wide range of mechanisms used to establish and implement decarbonisation policies.

This chapter introduces the Review and outlines:

- the context of the Review
- the purpose and focus of the Review
- the structure of the report.

For ease of reference, the report uses the following terms:

- 'Carbon' refers to carbon dioxide equivalent (CO_2e) emissions which is a common scale for comparing emissions from different greenhouse gases.
- 'Decarbonisation' refers to the reduction or removal of carbon emissions from a process, such as manufacturing or producing energy, and achieving a lower carbon output.
- 'Greenhouse gases' refers to gases that cause the greenhouse effect and contribute to global heating. The primary greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).
- 'Greenhouse gas emissions' refers to the release of greenhouse gases into the atmosphere as a result of an activity.
- 'Emissions reduction target' refers to a short or long-term set quantitative goal to reduce greenhouse gas emissions measured against specific levels.
- 'Net zero' refers to reducing greenhouse gas emissions to achieve a state of balance in the amount of anthropogenic emissions produced and removed from the atmosphere.

1.1 Context for this Review

In August 2021, the AEMC launched its 2021/22–2024/25 Strategic Plan. It outlined the AEMC's plan to tackle key uncertainties regarding the level of coordination of Australia's response to climate change and the pace and scale of disruption that new technologies bring to the Australian energy sector.[1] The Strategic Plan identified a set of priority initiatives and one of these is the development of a new DMF.

1 Australian Energy Market Commission, *Strategic Plan 2021/22 - 2024/25*, August 2021, pp. 3-7, available here.

The new framework will allow the AEMC to take a practical and transparent approach to decision-making that works to deliver a decarbonising, affordable and reliable energy system for all consumers.[2] The new DMF is intended to guide and support AEMC staff and the Commission in making informed and reasoned trade-offs between different policy options having regard to key economic and other practical considerations.

As outlined in the ToR, the development of the DMF has been separated into three phases. Phase 2 is about landing 'house views' on a number of 'key fundamentals' that are relevant to the AEMC's decision-making. The research findings from the Review have assisted the DMF project team on the topic of 'benefits of decarbonisation' and supported the completion of Phase 2 in December 2021.

The 2021 graduate cohort has prepared this report to be used as a reference document and enhance internal understanding of global efforts to decarbonise the energy sector.

1.2 Purpose and focus of this Review

As stated in the ToR, the purpose of this Review is to:

- perform a detailed review of the policies and decision-making frameworks of energy market regulators in other jurisdictions, with a specific focus on how they take decarbonisation into account in their regulatory decisions, and
- support the DMF project team and provide the Commission with:
  - an overview of how other regulators take carbon into account in the context of energy wholesale and retail markets (with consideration of decarbonisation)
  - a summary of ways in which regulators with, and without, specific energy and environmental objectives have addressed decarbonisation in their decision-making.

This report sets out:

- the jurisdictions and regulators that have been assessed, and the operation of their energy market and governance structure
- the jurisdictions' climate change commitments, including emissions reduction targets, and their guiding energy objective/s
- whether and how the jurisdictions and regulators account for decarbonisation in their decision-making, and the instruments and processes used to implement decarbonisation policies.

The report uses data and information publicly available on May 2022.

1.2.1 Jurisdictions reviewed

The Review investigated eight jurisdictions and their relevant energy regulators. These are:

- Canada and the Canadian Energy Regulator
- Germany and the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway

2 Australian Energy Market Commission, Priority Initiatives, viewed 14 February, available here.

- Ireland and the Commission for Regulation of Utilities
- New Zealand and the New Zealand Electricity Authority
- Singapore and the Energy Market Authority
- South Africa and the National Energy Regulator of South Africa
- United Kingdom and the Office of Gas and Electricity Markets
- United States and the Federal Energy Regulatory Commission.

The jurisdictions were selected to provide a spectrum of examples based on their differing economies, climate change commitments, energy market structures and regulatory frameworks.

1.2.2 Out of scope of this Review

There are several areas that are out of scope of this Review. This is because they are either outside the AEMC's responsibilities or are not captured by the scope of the ToR. The following will not be included in this report:

- other environmental issues that contribute to climate change, including, but not limited to, biodiversity and habitat conservation; renewable sources of energy such as biofuels, wind or solar generation; waste management; land and water pollution
- whether the implementation of any carbon or climate change targets, mandates or policies have been effective in curbing carbon emissions in a jurisdiction
- proposals on how Australian federal and state governments could initiate and implement decarbonisation policies and mechanisms
- recommendations on ways in which the Commission should take into account and consider carbon issues in their decision-making.

1.3 How the report is structured

The remainder of the report is structured as follows:

- Chapter 2: provides an overview of the Australian energy market including the key market bodies, applicable energy legislation and objectives, as well as a comparison on the aforementioned areas with other jurisdictions
- Chapter 3: introduces each jurisdiction and sets out how the jurisdiction and its energy regulatory decision-maker manage and account for decarbonisation
- Chapter 4: presents more detailed information on each jurisdiction's energy market and governance structure.

1.4 Enquiries

All enquiries related to the project can be directed to Lucia Zuniga-Mendoza and Yolana Keogh at lucia.zuniga-mendoza@aemc.gov.au and yolana.keogh@aemc.gov.au.

2 AUSTRALIAN ENERGY MARKET OVERVIEW AND COMPARISON WITH OTHER JURISDICTIONS

2.1 Introduction

In this chapter:

- Section 2.2: provides a brief overview of the Australian electricity market
- Section 2.3: summarises the current governance arrangements and relevant energy market bodies
- Section 2.4: explains the applicable energy legislation and objectives under the national framework
- Section 2.5: discusses the similarities and differences between Australia and other jurisdictions, including comparisons on decarbonisation objectives, market structure and governance structure.

2.2 The Australian electricity market

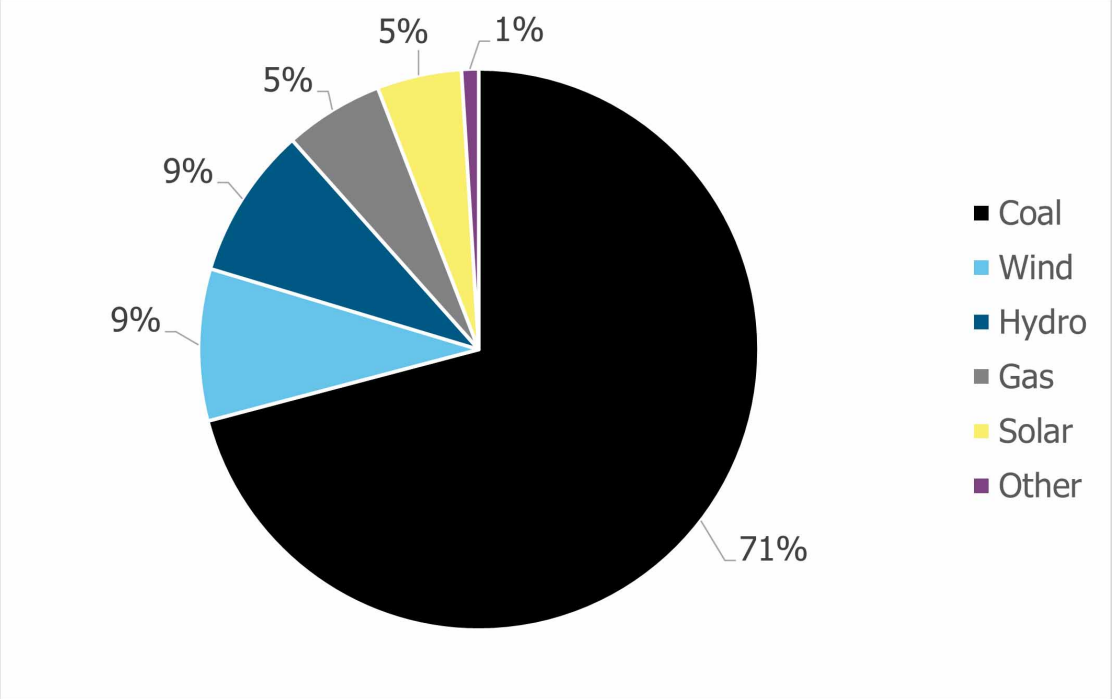
The National Electricity Market (NEM) is a wholesale electricity market that covers the six electrically connected states and territories in eastern and southern Australia. It commenced operation in December 1998. The NEM covers around 40,000 km of transmission lines and cables, supplying around nine million customers and delivers around 80% of all electricity consumption in Australia.[3]

In a spot market, power supply and demand are matched instantaneously and electricity is sold at the spot price. Systems within the NEM balance supply with demand in real-time, select which generators are dispatched, determine the spot price and facilitate the financial settlement of the market.

The NEM annual generation mix by fuel type for the 2021 calendar year is: Coal (71%), Wind (9%), Hydro (9%), Gas (5%) and Solar (5%).

3 Western Australia and the Northern Territory are not connected to the NEM and have their own electricity systems and separate regulatory arrangements.

Figure 2.1: NEM electricity generation by fuel type (2021)



Source: AEMC analysis using mms data
Note: 'Other' includes electricity generation from batteries. Rooftop solar generation is not included in this diagram.

The NEM is undergoing a transformation from a centralised system of large fossil fuel generation towards smaller scale, widely dispersed wind and solar generators, including grid-scale batteries. The increasing uptake of renewables is expected to continue as thermal power stations are retired.

The federal government and NEM state and territory governments in Australia have developed short-term and long-term emissions reduction targets.

The short term targets as of May 2022 are as follows:

- Australia - 43% reduction in emissions compared to 2005 levels by 2030[4]
- New South Wales - 50% reduction in emissions compared to 2005 levels by 2030[5]
- Victoria[6] - 45-50% reduction in emissions compared to 2005 levels by 2030[7]
- Queensland - 30% reduction in emissions compared to 2005 levels by 2030[8]

4 Department of Industry, Science and Resources, Australia submits new emissions target to UNFCCC, available here.

5 Department of Planning, Industry and Environment, *Net Zero Plan Stage 1: 2020-2030 Implementation Update*, March 2020, p. 4, available here.

6 The Climate Change Act 2017 establishes Victoria's long-term target of net zero by 2050 and requires 5-yearly interim emissions reduction targets to be set.

7 Independent Expert Panel on Interim Emissions Reduction Targets for Victoria, *Interim Emissions Reduction Targets for Victoria (2021-2030)*, May 2021, p. 7, available here.

8 Queensland Government, Queensland Climate Action - Emissions and targets, viewed 8 November 2021, available here.

- South Australia - 50% reduction in emissions compared to 2005 levels by 2030[9]
- Australian Capital Territory - 65-75% emission reductions from 1990 levels by 2030[10]
- Tasmania - net zero emissions by 2030.[11]

The federal government and NEM state and territory governments have also independently developed the same long-term emission reduction target to reach net zero by 2050.

2.3 Governance structure

Australia has three levels of government: the Federal Parliament, state and territory parliaments and local councils. Each level has a range of exclusive powers and shared powers. The Commonwealth is responsible for national affairs such as defence, trade and commerce, taxation, immigration and telecommunications. The state and territory governments' areas of responsibility include schools, hospitals, roads, electricity and water supply, mining and agriculture.[12]

Sections 51 and 52 of the Constitution explain the law-making powers of the Federal Parliament. Generally, if an area is not listed in those provisions, it is a matter for the state and territory governments.[13] The Constitution does not explicitly vest power in the Commonwealth for energy matters. Despite this, both levels of government have sought to work cooperatively to develop a national policy framework.

As a result, the Energy Ministers[14] were granted responsibility for energy matters for the federal and state and territory jurisdictions. They are the leading decision maker with policy and governance responsibility of the NEM and work on key reforms in the energy sector.[15] The Energy Ministers are supported by three market bodies (as detailed below) that work together to legislate, operate and regulate the Australian electricity and gas systems and markets.

9 Government of South Australia, Climate Smart South Australia, viewed 8 November 2021, available here.

10 ACT Government, Emission Reduction Targets, viewed 8 November 2021, available here.

11 Part 2, Division 1 of the *Climate Change (State Action) Act 2008*.

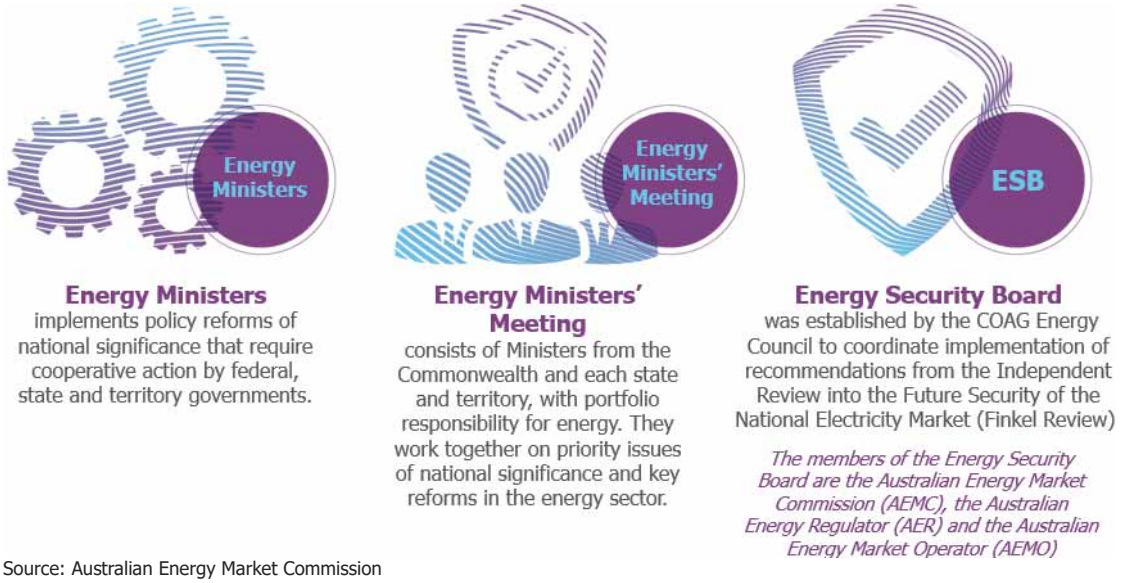
12 Parliament of New South Wales, The Roles and Responsibilities of Federal, State and Local Governments, viewed 16 March 2022, available here.

13 Parliament of Australia, The Australian Constitution, viewed 16 March 2022, available here.

14 The Council of Australian Governments (COAG) and the COAG Energy Council were replaced in May 2020 by the Energy National Cabinet Reform Committee and the Energy Ministers' Meeting. The Committee is chaired by the Commonwealth Minister for Energy and Emissions Reduction, the Honourable Angus Taylor MP.

15 Department of Industry, Science, Energy and Resources, Energy Ministers, viewed 4 February 2022, available here.

Figure 2.2: Energy Market Institutions



Source: Australian Energy Market Commission

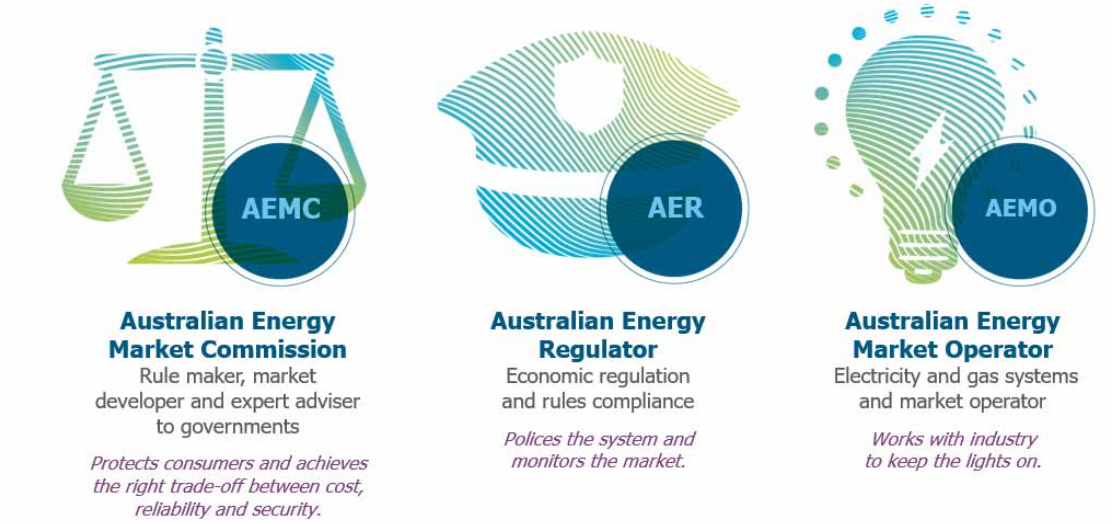
The AEMC is an independent statutory body and policy adviser to state, territory and federal governments. It has two primary functions. Firstly, to make and amend the National Electricity Rules (NER), National Gas Rules (NGR) and National Energy Retail Rules (NERR) (collectively known as the National Energy Rules) under the rule change process. Secondly, to conduct reviews and provide advice on improvements to regulatory and energy market arrangements.[16]

The Australian Energy Market Operator (AEMO) manages and operates the electricity and gas systems that allow energy to be generated, transmitted and distributed, and the financial markets that allow energy to be sold and bought. AEMO also monitors supply and demand, voltage and frequency, and manages planned and unplanned outages and emergencies.[17]

The Australian Energy Regulator (AER) is a Commonwealth entity that regulates the wholesale and retail energy markets and networks. They monitor participant bidding, market dispatch and prices, network constraints and forecasts of production and capacity. The AER also investigates and enforces compliance with national energy legislation and rules.[18]

16 AEMC, About Us, viewed 10 May 2022, available here.
17 AEMO, What we do, viewed 10 May 2022, available here.
18 Australian Energy Regulator, Our role, viewed 10 May 2022, available here.

Figure 2.3: Energy Market Bodies



Source: Australian Energy Market Commission

2.4 Legislation and energy objectives

There are three laws that govern the energy markets: the National Electricity Law (NEL)[19], National Gas Law (NGL)[20] and National Energy Retail Law (NERL)[21] (collectively known as the National Energy Laws).

The National Energy Laws were introduced, among other purposes, to:

- make provision for the operation of the NEM
- establish a framework to enable third parties to gain access to natural gas pipeline services
- establish an energy customer framework to regulate retail supply of energy to customers and make provisions for the relationship between distributors and consumers.

The AEMC's work is governed and guided by three objectives: the National Electricity Objective (NEO), National Gas Objective (NGO) and National Energy Retail Objective (NERO) (collectively known as the National Energy Objectives).

The AEMC must have regard to the National Energy Objectives in performing or exercising any function or power under the National Energy Laws, National Energy Rules and

19 The NEL is contained in a Schedule to the *National Electricity (South Australia) Act 1996*. It is applied as law in each participating jurisdiction of the NEM.

20 The NGL is contained in a Schedule to the *National Gas (South Australia) Act 2008.* An application statute for each participating jurisdiction governs the extent to which the national gas legislation applies in the relevant jurisdiction.

21 The NERL is contained in a Schedule to the *National Energy Retail Law (South Australia) Act 2011*. The extent to which this law applies in each state and territory depends on the application of legislation passed by each jurisdiction.

regulations.[22] The AEMC may only make a Rule if it is satisfied that the Rule will or is likely to contribute to the achievement of the relevant objective.[23] This is the decision-making framework that the Commission must apply.

Additionally, in certain circumstances there is an explicit obligation for AEMO and the AER to have regard to the National Energy Objectives when carrying out their statutory functions.[24]

The NEO[25] as stated in the NEL is:

> to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:
>
> price, quality, safety and reliability and security of supply of electricity
>
> *the reliability, safety and security of the national electricity system.*

The NGO[26] as stated in the NGL is:

> to *promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.*

The NERO[27] as stated in the NERL is:

> to *promote efficient investment in, and efficient operation and use of, energy services for the long term interests of consumers of energy with respect to price, quality, safety, reliability and security of supply of energy.*

The long-term interests of consumers require that market design and regulatory arrangements are both flexible and resilient enough to respond to, and evolve with, rapid changes to the energy sector. Currently, the National Energy Objectives do not explicitly include consideration of environmental or climate change impacts.

Further information on how the AEMC interprets and applies the National Energy Objectives may be found on our website at www.aemc.gov.au.[28]

2.5 Comparison to other jurisdictions

The Review has identified a number of similarities and differences between Australia and other jurisdictions with regard to their energy objectives, market structures and the role of government in energy regulation. This section draws comparisons in these key areas and aims to provide insight into how diverging frameworks can influence the national and regulatory decision-maker approach, and response to, decarbonisation.

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22 Section 32 of the NEL, section 72 of the NGL and section 224 of the NERL.
23 Section 88 of the NEL, section 291 of the NGL and section 236 of the NERL.
24 For examples, see sections 16, 18I, 28F, 28V and 49(3) of the NEL.
25 Section 7 of the NEL.
26 Section 23 of the NGL.
27 Section 13 of the NERL.
28 Australian Energy Market Commission, *Applying the energy market objectives*, 8 July 2019, available here.

2.5.1 Energy objectives

The Review has found there is a wide range of energy market objectives and an associated spectrum of obligations placed on the regulator. For some jurisdictions, their statutory objective requires explicit consideration of carbon and the environment, and for other jurisdictions their objective does not.

Jurisdictions with similar energy objectives to the NEO that explicitly account for carbon:

- The United Kingdom's Office of Gas and Electricity Markets (Ofgem) has a primary objective to 'protect the interests of existing and future consumers.'[29] In 2010, the United Kingdom updated the *Electricity Act 1989* and *Gas Act 1986* to establish that the term 'interests' must be thought of holistically to include interests 'in the reduction of electricity/gas supply emissions of targeted GHGs'.[30]
- Singapore recently included a new provision to the Energy Market Authority's (EMA's) functions and duties under the *Electricity Act 2001* that enables the EMA to consider decarbonisation in making regulatory decisions. The amendment expands its statutory objectives to include implementation of policies, strategies, measures and any other requirements on any matters for, or in connection with, the reduction of GHG emissions across the electricity supply chain.[31]

Jurisdictions with similar energy objectives to the NEO that do not explicitly consider carbon but allow for broader environmental impacts to be taken into account:

- The German Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (BNetzA) has an objective to ensure that the supply of electricity and gas is the most 'environmentally friendly which is increasingly based on renewable energies'.[32]
- A key duty of the Commission for Regulation of Utilities (CRU) in Ireland is to take account of the protection of the environment.[33]
- The South African objective requires the National Energy Regulator of South Africa's (NERSA) to ensure sustainable development and promote utilisation of diverse energy resources.[34]

These legislated objectives provide the energy regulators with discretion in their decision-making processes on whether, and how, they account for carbon.

Jurisdictions with similar energy objectives to the NEO that do not explicitly consider carbon or the environment:

- The statutory objective of the New Zealand Electricity Authority (Authority) is to 'promote competition in, reliable supply by, and the efficient operation of, the electricity industry' for consumer benefit.[35] Despite the objective's lack of an environmental limb, the

29 Section 3A of the *Electricity Act 1989*.
30 Section 3A(1A)(a) of the *Electricity Act 1989* and section 4AA(1A)(a) of the *Gas Act 1986*.
31 Section 3(g) of the *Energy (Resilience Measures and Miscellaneous Amendments) Act 2021*.
32 Part 1 Section 1 of the *Energy Industry Act 2005.*
33 Section 9 of the *Electricity Regulation Act 1999.*
34 Section 2 of the *Energy Regulation Act 2006.*
35 Section 15 of the *New Zealand Electricity Industry Act 2010*.

Authority has outlined its long-term strategic intent to assist in transitioning New Zealand to a low emissions energy sector.[36]

Jurisdictions that do not have an energy objective similar to the NEO:

- The Canada Energy Regulator (CER) is not required to perform its functions and duties according to a statutory objective equivalent to the National Energy Objectives. The decisions made by CER are influenced by laws passed by the Canadian federal government, and the provincial and territorial governments.
- The United States Federal Energy Regulatory Commission (FERC) is also not obliged to adhere to an energy objective when making regulatory decisions. Instead, it is guided by legislation passed by the United States Federal Congress (Congress) and legal precedents arising from court judgements. However, the *National Environmental Policy Act 1969* directs all agencies of the government, including FERC, to consider the impacts of its actions on the environment.[37]

2.5.2 Market structure

The Review has identified that different market structures can impact on how regulatory decision-maker responsibilities are distributed in the energy sector.

Jurisdictions where responsibility over regulatory decision-making is shared between numerous parties:

- In Canada, each province and territory is governed by multiple bodies depending on the location. For example, the Ontario Energy Board (OEB) is the independent energy regulator that regulates Ontario's energy sector as required under provincial legislation.[38]
- Similarly, in the United States many areas of energy regulation are outside of FERC's remit and are dealt with by various State Public Utility Commissions. These include regulation of retail electricity and natural gas sales to consumers, and regulation of local distribution pipelines of natural gas.[39]

Jurisdictions with similar market structure to Australia:

- New Zealand's Authority is an independent government body responsible for overseeing and regulating the New Zealand electricity market. The Authority develops and sets the market rules for New Zealand's energy market, which is akin to AEMC's functions in the NEM. However, unlike the AEMC, the Authority also enforces and administers the market rules which also makes it similar to the AER. New Zealand's system operator is Transpower, a state-owned enterprise responsible for the real-time operation of New Zealand's electricity system and wholesale market. Thus, Transpower has similar responsibilities to AEMO. One crucial difference is that Transpower is also responsible for planning, building and maintaining New Zealand's national grid infrastructure.

36 Electricity Authority, *Statement of Intent 1 July 2021 - 30 June 2025*, July 2021, p. 12, available here.
37 Section 102 of the *National Environmental Policy Act 1969*.
38 Ontario Energy Board, What we do, viewed 16 March 2022, available here.
39 Federal Energy Regulatory Commission, What FERC Does, viewed 11 March 2022, available here.

- In the United Kingdom responsibility for the energy market shared between three bodies. The Department of Business, Energy and Industrial Strategy (BEIS) is responsible for setting energy policy and their role is very similar to the AEMC. However, the AEMC is an independent statutory body rather than a government department. Ofgem's primary responsibility is the implementation of government policy and regulating the electricity and gas markets to ensure they work in the interests of consumers. Its role is similar to the AER. National Grid is the market operator and performs a similar role to AEMO. Both organisations manage the day-to-day operation of the power system including monitoring of performance and security, and overseeing settlements. A distinguishing feature of National Grid is that the company owns the electricity transmission network in England and Wales, and has established a legally separate business called the Electricity System Operator to operate the network and balance supply and demand.[40] In contrast, the electricity transmission assets in each Australian state and territory are owned and maintained by multiple different businesses.

2.5.3 Government role in regulation

The Review has also found that governance arrangements vary across jurisdictions in relation to the degree of autonomy that state governments have to derogate from national governments' energy policies and set their own approach to decarbonisation.

Jurisdictions with similar separation of powers to Australia:

- At the federal level both Canada and Australia are able to establish broad national climate change, environmental and energy policies, and related laws and regulations. Both jurisdictions at the state level have a degree of autonomy and can set and implement their own arrangements that may differ from the federal government. For example, under the carbon tax system Canadian provinces and territories can select the methodology they prefer to account for carbon instead of adopting the federal backstop system.
- South Africa also has a three tiered system of government like Australia. The national, provincial and local levels of government all have legislative and executive authority as set out in the Constitution and their powers may be distinctive or interrelated.[41] The national government is the primary driver of decarbonisation policies in the energy sector and is the main rule maker. It also owns the market operator, Eskom Holdings SOC Limited (Eskom), which holds the majority of South Africa's generation and transmission assets. In contrast, Australia's energy market bodies and transmission and generation businesses operate independently of the federal government.

Jurisdictions affected by current and former membership to the European Union (EU):

- Germany and Ireland state governments and county legislatures have limited power in the energy sector and apply a national approach to decarbonisation across their regions. These jurisdictions are uniquely distinct from Australia because they are members of the EU and as such their national policy objectives and decisions are influenced by EU energy and climate change directives and targets.

40 National Grid, What we do, viewed 20 April 2022, available here.

41 South African Government, Structure and functions of the South African Government, viewed 6 April 2022, available here.

- The United Kingdom was also a member of the EU *Internal Energy Market* until 31 December 2020 (Brexit) and now manages its power system independently of the EU. Since the cessation, there have been negotiations to establish a new energy agreement with discussions focusing on interconnection and the outcomes for Northern Ireland. The negotiations are expected to be completed by 30 June 2026, when the interim agreement expires. Brexit does not affect the United Kingdom's climate change commitments as these were established at a national level under the *Climate Change Act 2008*.[42]

42 Norton Rose Fulbright, *The impact of Brexit on the energy sector,* February 2021, available here.

3 DECARBONISATION IN ENERGY REGULATORY DECISION-MAKING

This section of the report:

- introduces each of the jurisdictions and regulators, and summarises their respective energy markets and governance structures
- sets out the relevant applicable legislation, guiding energy objectives and emissions reduction targets
- examines whether and how the jurisdictions and regulators account for decarbonisation in their decision-making frameworks
- outlines the instruments and mechanisms used to implement the decarbonisation policies and strategies.

3.1 Canada

BOX 1: KEY POINTS

- Canada has one of the most diverse supplies of energy in the world. Regulation of Canada's electricity sector is shared between federal government, provinces and territories. The Canada Energy Regulator (CER) is a government agency responsible for regulating oil and gas pipelines, as well as electrical power lines that cross a national, provincial, or territorial border.
- The functions and powers of CER are set out in the C*anadian Energy Regulator Act 2019.* CER considers the safety and security of persons and facilities, protection of property and the environment, and efficient energy infrastructure and markets when providing advice and making orders.
- Canada does not have a statutory energy objective that is equivalent to the NEO. Instead, laws passed by the federal government and provinces and territories are the basis for decisions made by regulators and utility boards.
- Canada has a legislated commitment to achieving 40-45% emissions reduction below 2005 levels by 2030 and net zero emissions by 2050 under the *Net Zero Emissions Accountability Act 2021*. It seeks to achieve decarbonisation through tools such as a carbon pricing scheme.

3.1.1 Introduction to Canada

Canada has a diverse range of energy markets and responsibility for the electricity and gas sector is shared between the federal government, provinces and territories. Laws passed by the government are the basis for decisions made by the federal regulatory body, CER, and the provincial and territorial regulators.

Canada is one of the largest energy producers in the world. It is currently ranked the sixth-largest crude oil producer, fifth-largest natural gas producer and second-largest hydroelectricity producer in the world.[43] In 2019, the Canadian electricity market recorded a total generation capacity of 148 GW, with a large proportion coming from hydro generators.[44] This is one of the reasons for the electricity sector generating only 9.4% of national emissions.[45] However, overall Canada is a large emitter of GHGs due to their oil and gas industry exporting large amounts of fossil fuels overseas.[46]

The two key components of the energy sector are:

- Energy policymakers — government departments led by elected officials who develop overarching objectives and related instruments for energy. Objectives from the federal government include health and safety, security and reliability, cost and its effects on the economy and society, and environmental performance. Instruments range from expenditure, taxation, regulation and public ownership.
- Energy regulators — the quasi-autonomous bodies that contribute to the development, implementation and interpretation of the framework of rules, standards and guidelines to pursue policy objectives. This includes CER at the federal level and utility regulators in the provinces or territories.

CER is the main regulatory body for the energy sector in Canada. It was established in 2019 and superseded the National Energy Board. It is responsible for regulating oil and gas pipelines, as well as electrical power lines that cross a national, provincial, or territorial border.[47] The primary law that establishes CER's mandate, responsibilities and powers is the *Canadian Energy Regulatory Act 2019* (CER Act).[48] CER was introduced by the federal government to consider the health, socioeconomic and environmental impacts of Canadian energy projects. These issues had previously not been considered within the decision-making framework. Additionally, all provinces and territories have individual utility boards that are responsible for the regulation of generation, transmission and distribution of electricity. For additional information on the key decision-makers, please refer to the appendix A.1.2.

3.1.2 How decarbonisation is managed and accounted for in decision-making

Canada is in the process of transitioning its remaining fossil fuel generation towards renewable energy. By 2030, Canada's energy grid is projected to be 90% emissions free.[49] By 2050, Canada's electricity sector is expected to be net zero and all industries and sectors are aiming to be carbon neutral. Canada has continued to affirm its pledge to a green future. The government has stated its primary motivation is to protect the climate, create jobs and make Canada a leader in renewable energy.[50]

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43 National Energy Board, *Canada's Energy Transition: Historical and Future Changes to Energy Systems*, August 2019, p. 18, available here.

44 Canada Energy Regulator, Canada's Energy futures 2021 Fact sheet: Electricity, viewed 10 December 2021, available here.

45 Environment and Climate Change Canada, *National Inventory Report 1900-2019: Greenhouse Gas Sources and Sinks in Canada*, 2021, p. 13, available here.

46 Canada Energy Regulator, Energy in Canada, viewed 24 March 2022, available here.

47 Canada Energy Regulator, Our Responsibilities, viewed 21 August 2021, available here.

48 Government of Canada, A New Canadian Energy regulator, viewed 7 November 2021, available here.

49 Government of Canada, Powering our future with clean electricity, viewed 1 September 2021, available here.

In June 2021, the *Net Zero Emissions Accountability Act* 2021 (NZEAA) introduced an obligation on the whole of Canada to reach net zero emissions by 2050. This helped unify each province and territories' decision-making when accounting for GHG emissions.

Provinces that had already made specific identified commitments include:

- Newfoundland, Labrador and Quebec have committed to net zero by 2050
- Prince Edward Island has pledged to reach net zero GHG emissions by 2040
- Nova Scotia and British Columbia, have put into place or intend to implement provincial net zero by 2050 legislation.[51]

Some individual cities that had also made a commitment to net zero by 2050 include Guelph, Vancouver, Hamilton, Toronto and Halifax.

3.1.3 National Approach

Canada uses a variety of tools and policies to account for decarbonisation which are outlined in more detail below.

The Net Zero Emissions Accountability Act

The NZEAA sets the national targets for reducing greenhouse gas emissions based on the best scientific information available.[52] It requires Canada to reduce its emissions by 40% below 2005 levels by 2030 and achieve net zero emissions by 2050.[53] The NZEAA also stipulates that Canada can achieve net zero before 2050. The NZEAA establishes a legally binding process to set five-year national emissions-reduction targets as well as develop credible, science-based emissions-reduction plans to achieve each target. It also supports Canada's international commitments for mitigating climate change such as the Paris agreement.[54]

The NZEAA holds the federal government accountable by requiring the Minister of Environment and Climate Change to report to parliament with respect to each target outlined in the legislation. For each target, the NZEAA requires:

- an emissions reduction plan outlining the measures and strategies the government of Canada will take to achieve the target
- a progress report to update on the ongoing implementation of the emissions reduction plan
- an assessment report to indicate whether a target has been met and to assess the effectiveness of the measures and strategies described in the associated emissions reduction plan.

Carbon Pricing

50 Government of Canada, Net-Zero Emissions by 2050, viewed 31 January 2022, available here.
51 Ibid.
52 Section 8 of the *Canada Net Zero Accountability Act 2021*.
53 The NZEAA also stipulates that Canada can achieve net zero before 2050.
54 Government of Canada, Net-Zero Emissions by 2050, viewed 31 January 2022, available here.

A carbon pricing system is widely used within Canada for oil, gas and industrial producers. Carbon pricing recognises the cost of pollution and accounts for those costs in daily decisions. Since 2019, every province and territory in Canada has had a price on carbon. Any province or territory can design its own pricing system tailored to local needs or choose the federal pricing system.

Several provinces have independent carbon pricing systems such as carbon taxes, cap-and-trade systems and carbon levies.[55] A cap-and-trade system refers to the tax applied on the allowances generated from emissions every year and is inherently different to a carbon tax where a tax is placed in the form of emissions produced.[56] A carbon levy is a set supply-side tax placed only on oil and gas.

The federal government sets minimum national stringency standards ('benchmark') that all systems must meet to ensure they are comparable and effective in reducing GHG emissions.[57] If a province or territory proposes a pricing system that does not meet these standards, the benchmark is implemented to ensure consistency.

The federal carbon pollution pricing backstop ('backstop') also supplements systems that do not fully meet the benchmark of a robust carbon pricing system.[58] For example, the backstop could increase the stringency of the provincial carbon price, through adding more cost burdens upon carbon emitters. The backstop is composed of two key elements:

- a carbon levy applied to fossil fuels
- an output-based pricing system for industrial facilities that emit above a certain threshold, with an opt-in capability for smaller facilities with emissions below the threshold.

The Pan Canadian Framework on Clean Growth and Climate Change

The Pan-Canadian Framework is Canada's overarching framework to reduce emissions across all sectors of the economy. The plan was developed in 2016 by the government to help meet Canada's emissions reduction targets, grow the economy, and build resilience to a changing climate.[59] It aims to drive innovation and growth by increasing technology development and adoption to ensure Canadian businesses are competitive in the global low-carbon economy. The framework also includes actions to advance climate change adaptation and build resilience to climate impacts across the country.[60]

3.1.4 Regulatory decision-maker approach

CER states that before they make a decision or recommendation 'we factor in economic, environmental, and social considerations'[61] and that environmental concerns are weighted

55 For example, British Columbia implemented a carbon tax in 2008, Quebec and Nova Scotia introduced a cap and trade system in 2013 and Alberta extended the scope of its existing carbon levy in 2017.

56 Environmental Defence Fund, How cap and trade works, viewed 30 November 2021, available here.

57 Government of Canada, Carbon pollution pricing systems across Canada, viewed 22 March 2022, available here.

58 Ibid.

59 Government of Canada, Pan-Canadian Framework on Clean Growth and Climate Change, viewed 16 December 2021, available here.

60 Ibid.

61 Canada Energy Regulator, Our Responsibilities, viewed 21 August 2021, available here.

equally with economic impact on consumers when making decisions. These environmental decisions range from impacts on the natural environment such as national parks and wildlife to decarbonisation. CER engages consultants to undertake independent reports on what environmental effects the project may have.[62]

The CER Act sets out the requirements and processes CER must adhere to when regulating electricity, gas and oil activities such as construction and certification of pipelines and power lines.[63] However, CER does not have specific a mandate to account for decarbonisation and cannot unilaterally make energy policy decisions, which are created and implemented by the federal government and provincial and territorial governments.

3.2 Germany

BOX 2: KEY POINTS

- Germany's energy sector has the largest energy-only wholesale electricity market in Europe. The key-decision makers are the Ministry for Economic Affairs and Climate Action (Ministry of Economic Affairs) and the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (BNetzA).
- The Ministry of Economic Affairs has a legislative, administrative and coordinating role in the energy and industrial sector. It has six agencies, including BNetzA which is an independent federal authority responsible for the regulation of the transmission and distribution networks. BNetzA has a variety of development, compliance and legislative functions.
- Similar to the NEO, the objective of the *Energy Industry Act 2005* is to provide the most secure, inexpensive, consumer-friendly and efficient supply of electricity and gas. However, the objective includes an additional limb through the term 'environmentally friendly' which allows BNetzA to consider environmental impacts in its regulatory decision-making.
- Germany has committed to reduce GHG emissions by at least 65% compared to 1990 levels by 2030 and achieve net zero by 2045. Decarbonisation of the energy sector is driven by a national approach and influenced by European Union (EU) directives. For example, the government has implemented a carbon budget and participates in the EU emissions trading scheme.

62 Ibid.

63 See Parts 3 and 4 of the *Canadian Energy Regulator Act 2019*.

3.2.1 Introduction to Germany

Germany has an energy-only wholesale electricity market[64] and is the largest electricity market in Europe. The German energy grid is part of the synchronous grid of continental Europe and is the biggest exporter of electricity.[65]

While Germany has made considerable progress in reducing its carbon emissions, the energy sector remains a major contributor to the nation's emissions.[66] Contributing factors include the retention of coal generation to assist in stabilising the grid due to volatility brought on by intermittent renewables, a large coal-fired electricity export market and the retirement of nuclear generators. In 2020, 35% of Germany's electricity generation came from renewable sources. [67]

BNetzA has similar functions to all three Australian market bodies. It has regulatory powers similar to the AER in enforcing and ensuring participants comply with the *Energy Industry Act 2005* (EnWG), grid planning and development functions similar to AEMO, and legislative functions similar to the AEMC.[68] BNetzA is the only body other than the Ministry for Economic Affairs and Climate Action (Ministry of Economic Affairs)[69] that can make changes to the EnWG. For additional information on the key decision-makers, please refer to the appendix A.2.2.

3.2.2 How is decarbonisation managed and accounted for in decision-making

3.2.3 National Approach

As a member of the EU, Germany is influenced by EU climate change policies. The EU emissions reduction targets serve as a minimum commitment to decarbonisation for EU members. The EU is seeking to reduce GHG emissions by 55% compared to 1990 levels by 2050.[70] However, Germany has increased its commitment to reduce GHG emissions beyond the EU targets by aiming to cut emissions by at least 65% by 2030 compared to 1990 levels and 88% by 2040. In addition, Germany has committed to achieving net zero by 2045.[71] Germany also participates in the EU Emissions Trading Scheme (ETS) which forms part of its national emissions reduction strategy. This sets a cap on carbon emissions through a limited supply of tradeable carbon credits which firms must purchase or be allocated in order to emit carbon.

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64 A capacity market was proposed in Germany similar to other EU countries, however, in 2016 The Federal Ministry for Economic Affairs and Climate Action rejected a capacity market on the basis that capacity markets are significantly costly and 'susceptible to regulatory failure and make it more difficult to transform the energy system'. See Federal Ministry for Economic Affairs and Climate Action, *An electricity market for Germany's energy transition*, July 2015, p. 4, available here.

65 Clean Energy Wire, Set-up and challenges of Germany's power grid, viewed 30 September 2021, available here.

66 Clean Energy Wire, Germany's greenhouse gas emissions and energy transition, viewed 29 September 2021, available here.

67 BDEW Bundesverband der Energie, Die Energieversorgung 2021, January 2022, p. 13, available here.

68 Bundesnetzagentur, The Bundesnetzagentur's duties, viewed 5 October 2021, available here.

69 The Ministry of Economic Affairs and Climate Action was formerly called the Ministry of Economic Affairs and Energy until the end of 2021.

70 European Environment Agency, EU achieves 20-20-20 climate targets, viewed 7 October 2021 here.

71 Ibid.

The Climate Action Plan 2050 has been developed by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in 2016.[72] It provides a strategic framework to decarbonise the energy sector. The Ministry of Economic Affairs is responsible for delivering climate action in the energy sector, as outlined in the plan. [73] A key feature of the plan is the introduction of a carbon budget. If the sector exceeds its carbon budget for the year, the next year's carbon budget will be reduced by the amount exceeded in the previous year. Hence, the sector would be allowed to emit less next year as a result of exceeding this year's budget.[74]

In 2000, Germany introduced the *Renewable Energy Sources Act 2000* (EEG) which set up a feed-in tariff scheme to encourage the use of renewable energy technologies.[75] The EEG was amended in 2021 to increase in tender volumes for solar and wind power. Another significant development was the privileged treatment of green hydrogen producers when procuring electricity. The EEG surcharge for their electricity purchases is to be limited to 15% of the regular surcharge or even to be waived completely. This is intended to promote green electrolysis technology. These changes were made to reduce reliance on carbon intensive generation by increasing renewable penetration.[76]

Additionally, in 2010 Germany created the 'energy concept' which is designed to shape the energy market to ensure 'environmentally sound, reliable and affordable energy supply'. The energy concept outlines the need to update the grid to ensure smooth decarbonisation of the sector. It is designed to:[77]

- be a market-driven, technology neutral plan that informs how the energy supply will be transformed
- provide a guiding framework for decisions by participants and policymakers
- incentivise the uptake of renewable energy and increase the energy efficiency of the grid.

It is also consistent with *EU directive 2012/27* to increase energy efficiency by 30%.[78]

3.2.4 Regulatory decision-maker approach

BNetzA adheres to the objectives of the EnWG which is to ensure:[79]

> the most secure, inexpensive, consumer-friendly, efficient and environmentally friendly line-based supply of electricity, gas and hydrogen to the public, which is increasingly based on renewable energies.

72 Ministry for the Environment, Nature Conservation and Nuclear Safety, Climate Action Plan 2050 – Germany's long-term low greenhouse gas emission development strategy, viewed 4 May 2022, available here.

73 Ministry for the Environment, Nature Conservation and Nuclear Safety, *Climate Action Plan 2050*, 2016, pp. 29-38, available here.

74 Helmholtz Climate Initiative, Defining the German Carbon Budget, viewed 11 October 2021, available here.

75 *Renewable Energy Sources Act 2000*.

76 London School of Economics, Renewable Energy Sources Act, viewed 15 October 2021, available here.

77 Grantham Research Institute on Climate Change and the Environment 2021, Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply, viewed 14 April 2022, available here.

78 European Union, Directive 2012/27/EU of the European Parliament and of the Council, 2012, viewed 19 October 2021, available here.

79 Section 1.1 of the *Energy Industry Act 2005*.

EnWG allows BNetzA to consider the impact on the environment when making decisions by ensuring that the outcome of their decisions are environmentally friendly. However, the EnWG does not obligate BNetzA to take actions to decarbonise the energy sector or explicitly consider carbon emissions in its decision-making.

Despite this, BNetzA is proactive in supporting the government's energy policies and carbon objectives. For example, by:

- publishing a list of coal-fired power plants in chronological order, beginning with the oldest plant based on the date they started operation to help project power station closures. This information supports the efforts to coordinate decarbonisation of the energy grid.[80]
- endorsing and publishing the Network Development Plan for 2021-2035, which aims to expand transmission and distribution infrastructure to support the uptake of renewable energy sources.[81]

3.3 Ireland

BOX 3: KEY POINTS

- Ireland's wholesale market is called the integrated single electricity market (SEM) and was established in 2018, merging the Northern Ireland and Republic of Ireland energy markets. The key decision-makers in the SEM are the Minister of Environment, Climate and Communications (Minister) and the Commission for Regulation of Utilities (CRU).
- The Minister is responsible for ensuring the energy supply is reliable, secure and efficient. The CRU has a range of duties including the issuance and enforcement of licences in relation to the generation and supply of electricity.
- The roles and responsibilities of the CRU are set out in the *Electricity Regulation Act 1999,* such as its function to advise the Minister on the development of the electricity industry and impact of electricity generation in relation to sustainability. The statutory objective confers on the CRU a duty to take account of the protection of the environment.
- Ireland has committed to reducing GHG emissions to 51% by 2030 and achieving net zero by 2050. Its approach to decarbonisation in the energy sector is driven by government initiatives such as the Climate Action Plan and shaped by European Union laws and directives.

3.3.1 Introduction to Ireland

In 2018, an integrated single electricity market (SEM) was established for the island of Ireland to develop a new set of electricity trading arrangements that met the requirements of

80 Bundesnetzagentur, Bundesnetzagentur publishes phase-out ranking for coal, viewed 13 April 2022, available here.
81 Bundesnetzagentur, Bundesnetzagentur launches consultation on grid expansion, viewed 9 October 2021, available here.

the EU Target Model.[82] The grid runs as a synchronous electrical grid and is characterised by three different markets. There are two 'ex ante' markets, called the Day Ahead and Intraday, where electricity is bought and sold before market close.[83] The third market, called the Balancing Market, is where any discrepancies between what generators promised and what is actually delivered is rectified following market close.[84]

The establishment of the SEM merged the energy markets of Northern Ireland and the Republic of Ireland (Ireland). However, they still retain separate regulatory authorities which collaborate through the SEM Committee.[85] The SEM Committee is not a decision-making body, but rather ensures consistency in both jurisdictions to complement the central goal of the mutually beneficial integrated system. The key policy makers in Ireland's energy sector are the Minister of Environment, Climate and Communications (the Minister) and the Commission for Regulation of Utilities (CRU). The Minister is responsible for enacting national climate obligations which impact the energy industry whilst the CRU directly enforces energy law and regulates the energy sector. For additional information on the key decision-makers, please refer to the appendix A.3.2.

Ireland's emissions reduction targets are relatively ambitious and currently they are not on track to meet these. This is because the main source of emissions is the agriculture industry which is not part of the EU ETS scheme and therefore difficult to decarbonise.[86] Although Ireland has undergone a significant uptake in renewables it is still facing energy security challenges, compounded by greater energy demand due to economic and population growth.[87]

3.3.2 How is decarbonisation managed and accounted for in decision-making

3.3.3 National approach

Ireland is a member of the EU and as such must abide by EU rules and regulations. The Constitution of Ireland recognises that EU law is superior to national law, meaning that Ireland cannot pass laws that contradict EU laws and an EU law may over-rule an Irish law.[88] A directive is a law that sets goals that all member states must achieve and normally has a deadline for countries to adopt them into national law.[89] Consequently, Ireland has progressively enacted legislation that reflects a number of EU energy and climate change policies and directives.[90]

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82 EirGrid Group, *Quick Guide to the Integrated Single Electricity Market*, 2016, p. 3, available here.

83 Ibid, p. 7.

84 Ibid.

85 See appendix A.3 for further detail on governance structure.

86 Gas Networks Ireland, Ireland's decarbonisation trilemma, viewed 8 April 2022, available here.

87 Ibid.

88 Citizens Information, EU Law, viewed 8 April 2022, available here.

89 Ibid.

90 Examples include: *Regulation (EU) 2018/1999* of the European Parliament and on the Governance of the Energy Union and Climate Action, amending *Regulations (EC) No 663/2009 and (EC) No 715/2009* of the European Parliament and of the Council, *Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU* of the European Parliament and of the Council, Council Directives *2009/119/EC and (EU) 2015/652* and repealing *Regulation (EU) No 525/2013* of the European Parliament and of the Council.

On 14 July 2021, the European Commission adopted a series of legislative proposals setting out how it intends to achieve climate neutrality in the EU by 2050, including the intermediate target of at least 55% net reduction in GHG emissions by 2030. The package proposes to revise several EU climate laws.[91]

The EU's revised targets have been incorporated into the *Climate Action and Low Carbon Development (Amendment) Act 2021* (Climate Action Act) which was recently passed by Ireland's government. The Climate Action Act adopts the EU net zero target but adjusts the 2030 target to 51% by 2030.[92]

Ireland has also implemented legislation and policies which compliment the SEM rules and inform decision-making and development of the energy sector. These are outlined below.

Climate Action Act

The Climate Action Act makes Ireland's energy targets and carbon budgets legally binding. Ministers will be responsible for achieving targets for their own sectoral area and must account for their performance towards sectoral targets and actions before a parliamentary committee. It also requires the Climate Action Plan to be updated and for relevant bodies to perform its functions in a manner that is consistent with the most recent Climate Action Plan.[93]

Climate Action Plan

Published in 2019, this plan sets out the national development path towards meeting emissions reductions targets and builds on the framework, measures and actions set out in the National Mitigation Plan, Project Ireland 2040 and Ireland's Draft National Energy and Climate Plan.[94] It allocates carbon budgets to each sector of the economy and any development must consider this budget. Hence, grid developers such as Eirgrid have aligned their strategic development strategy with the Climate Action Plan.[95]

Renewable Electricity Support Scheme (RESS)

The RESS is a government initiative that provides support to renewable electricity projects in Ireland.[96] It uses a competitive auction process to determine which generators receive support. Project developers must submit offer prices to participate in the auction. The first auction held in 2020 resulted in 82 successful projects receiving government support.[97]

Offshore wind development guideline

91 European Union, European Green Deal, viewed 22 January 2022, available here.

92 I Gerretsen, 'Ireland's government agrees on climate bill to set 2050 net zero goal in law', *Climate Home News*, 25 March 2021, available here.

93 Section 15 of the *Climate Action and Low Carbon Development (Amendment) Act 2021.*

94 Department of the Environment, Climate and Communications, National Mitigation Plan, 18 July 2017, available here; Government of Ireland, Project Ireland, 2040, viewed 10 April 2022, available here; Department of the Environment, Climate and Communications, Ireland's Draft National Energy and Climate Plan 2021-2030, December 2018, available here.

95 EirGrid Group, *Decision-making process for major policy proposals,* 2021, p. 1, available here.

96 EirGrid Group, R*enewable Energy Support Scheme 1: RESS 1 final auction results*, 10 September 2020, p. 1, available here.

97 Ibid, p. 2.

Offshore wind is a major component of the Climate Action Plan. However, it is excluded from planning frameworks used for the rest of the grid. Instead, processes to develop of offshore wind is detailed in a separate guideline which offers advice to planning authorities on planning processes for wind energy and in assessing project applications. The guidelines will be updated considering the recent Climate Action Act. A draft revision is currently in consultation.

National Energy Efficiency Action Plan (NEEAP)

In 2009, Ireland set a national target to improve its energy efficiency by 20% by 2020 which it has achieved.[98] The NEEAP outlines Ireland's energy savings targets and how it plans to achieve them. Notably, Ireland has not published a new plan which sets targets beyond 2020.

3.3.4 Regulatory decision-maker approach

The SEM rules confer on the CRU several functions including to advise the Minister on the development of the electricity industry and the impact of electricity generation in relation to sustainability. It also requires the CRU to have regard to the need to promote the use of renewable, sustainable or alternative forms of energy and take account of the protection of the environment in their decision-making.[99] The CRU's mission statement reflects these obligations and illustrates the presence of environmental considerations in the CRU's decision-making. Their mission is to:[100]

> protect the public interest in Water, Energy and Energy Safety by ensuring safe, secure and sustainable energy supplies at a reasonable cost.

For example, when making the decision to adopt measures to curb data centres energy usage, the CRU considered the risk that new data centres pose to achieving government climate targets because of their high energy usage which may require a delayed foreclosure of coal and gas plants.[101]

The development of tools to account for carbon emissions is both a collaborative and iterative exercise. Though the Minister is ultimately responsible for developing the Climate Action Plan and long-term strategy, these are informed by the CRU through a joint planning process and is regularly revised. The CRU also performs an advisory role by monitoring the carbon intensity of the energy sector. The Climate Action Plan and long-term strategy are subject to change and are often updated due to observed increases in emissions, changes in EU directives or domestic emissions reduction targets.

3.4 New Zealand

98 A O'Brien, 'Public sector charging towards 2020 energy efficiency targets, Sustainable Energy Authority of Ireland finds', *The Times*, 12 February 2021, available here.

99 Section 9 of the *Electricity Regulation Act 1999*.

100 Commission for Regulation of Utilities, About CRU, viewed 9 September 2021, available here.

101 GridBeyond, CRU unveils limits on data centre usage amid supply worries, viewed 1 November 2021, available here.

BOX 4: KEY POINTS

- New Zealand's wholesale electricity market has been operating as an energy only market since 1996. The key decision-makers are the Minister of Energy and Resources (the Minister) and the New Zealand Electricity Authority (the Authority).
- The Authority is the regulator of the electricity market with responsibility for developing the market rules, its enforcement and administration, as well as monitoring of market performance. As set out in the *Electricity Industry Act 2010*, the objective of the Authority is to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers.
- The Authority does not have a statutory obligation to consider the environment in their decision-making. However, in its 2021-2025 Statement of Intent it acknowledged the need to decarbonise the energy sector and has created a forward-looking workplan to support the transition to a low carbon economy.
- New Zealand has made a legally binding commitment to achieve net zero by 2050 under the *Climate Change Response Act 2002*. The government has implemented several decarbonisation programs such as the emissions trading scheme and emissions budget.

3.4.1 Introduction to New Zealand

New Zealand is progressing relatively quickly towards achieving its goal of net zero emissions by 2050. In 1996 an energy only wholesale electricity market was established, and in 2020 over 80% of New Zealand's total electricity generation was produced from renewable sources. New Zealand contributes approximately 0.17% of the world's gross emissions, highlighting that despite their small total contribution to global GHG emissions, the country is taking action to decarbonise their economy and electricity sector.[102]

The New Zealand electricity market contains three core markets: the spot market, hedge market and ancillary services market. The New Zealand Electricity Authority (Authority) was established in 2010 to oversee and regulate the electricity market. It is an independent Crown entity responsible for the development, enforcement, and administration of the market rules and monitoring market performance.[103] Additionally, the Ministry of Business, Innovation and Employment (MBIE) is responsible for monitoring the Authority on the behalf of the Minister of Energy and Resources (the Minister), and provides strategy and policy advice in relation to the regulation of energy competition. For additional information on the key decision-makers, please refer to the appendix A.4.2.

102 NZ Ministry for the environment, How New Zealand compares to other countries, viewed 25 March 2022, available here.
103 A Crown entity is a public body that works closely with Ministers. For more information see here.

3.4.2 How is decarbonisation managed and accounted for in decision-making

3.4.3 National approach

New Zealand first took carbon and climate risk into consideration in its regulatory framework in 1992 by signing the United Nations Framework Convention on Climate Change and thereby committing to reduce atmospheric concentrations of GHGs.[104] New Zealand's international Nationally Determined Contribution under the Paris Agreement for the 2021 to 2030 period is to reduce net GHG emissions to 50% below gross 2005 levels by 2030.[105]

To act on their international emissions reduction targets New Zealand has made changes to its regulatory framework through the *Climate Change Response (Zero Carbon) Amendment Act 2019* (Zero Carbon Act). This policy provides a framework by which New Zealand can develop and implement clear and stable climate change policies that align with its commitment under the Paris Agreement.[106] The Zero Carbon Act amended the *Climate Change Response Act 2002* (Climate Act) to legislate New Zealand's domestic target to reach net zero GHG emissions (other than biogenic methane) by 2050[107] and involved four key changes:

1. setting of new domestic GHG emissions reduction targets
2. establishment of emissions budgets to be used as a tool to reach New Zealand's long-term target
3. accountability for the government to develop and implement climate change policies
4. establishment of a new, independent Climate Change Commission that gives evidence-based advice to the New Zealand government with the objective of mitigating climate change.[108]

New Zealand's climate change program includes a range of tools to help achieve its emissions reduction commitments. The tools are outlined below.

Emissions budgets

The Climate Act requires the Climate Change Commission to provide recommendations to the New Zealand government on emissions budgets.[109] This keeps the government accountable to meet its long-term emissions reductions targets because the budgets act as 'stepping stones' and provide information on the total quantity of emissions that can be emitted during an emissions budget period.[110] The draft emissions budget for 2022-2025 proposed by the

104 In 1992, it committed to reduce GHG emissions to 1990 levels by 2000. It made multiple amendments to update its emissions reduction targets through the 1997 Kyoto Protocol, 2010 Cancun voluntary pledge, a further pledge in the 2011 Durban conference and a secondary Kyoto Protocol commitment in 2013.

105 New Zealand Ministry for the Environment, Greenhouse gas emissions targets and reporting, viewed 27 October 2021, available here. This target was announced at the November 2021 Glasgow Conference of the Parties 26.

106 Ministry for the Environment, Climate Change Response (Zero Carbon) Amendment Act 2019, viewed 27 October 2021, available here.

107 Ministry for the Environment, Greenhouse gas emissions targets and reporting, viewed 27 October 2021, available here.

108 New Zealand Government, Climate Change Commission, viewed 27 October 2021, available here.

109 New Zealand Ministry for the Environment, About New Zealand's climate change programme, viewed 21 January 2022, available here.

110 Ibid.

Climate Change Commission was a 290 $MtCO_2e$ reduction which equates to a 15% reduction below 2019 levels.[111]

New Zealand Emissions Trading Scheme

The Emissions Trading Scheme (ETS) is a crucial instrument to reduce emissions and meet legislated emission reduction targets.[112] Reforms in mid-2020 added the auctioning of carbon credit units, the phase-out of industrial allocation, an ETS wide cap on emissions, and averaging accounting for forestry starting in 2023 to the scheme.[113] The current work program is focused on market governance, industrial allocation reform[114] and technical regulation updates.[115]

Emissions Reduction Plan (ERP)

The ERP will be published in May 2022 and will describe how New Zealand will meet its emissions budgets and progress towards its 2050 target. It will include policies and strategies for specific sectors as well as a multi-sector approach to meet emissions budgets and improve the ability of those sectors to adapt to the effects of climate change.[116]

Additionally, in June 2021 the Climate Change Commission published a key document, *Ināia tonu nei: a low emissions future for Aotearoa*, which outlines the path Aotearoa can take to meet its climate target.[117] The Authority has referred to this document as a 'watershed' moment for New Zealand because of the level of detail in which it outlines the path to net zero emissions by 2050 and highlights the economic opportunities.[118] This document outlines:[119]

- the evidence and models used to form New Zealand's carbon budgets
- the recommended emissions budgets for 2022-2025
- how these recommended budgets fit within New Zealand's net zero by 2050 target
- how emissions budgets can be achievable, fair, inclusive and equitable.

3.4.4 Regulatory decision maker approach

The statutory objective of the Authority is to[120]:

> promote competition in, reliable supply by, and the efficient operation of, the electricity

111 New Zealand Climate Change Commission, *Ināia tonu nei: a low emissions future for Aotearoa*, May 2021, pp. 74-77, available here.

112 The New Zealand ETS covers all sectors of New Zealand's economy, except for agriculture.

113 New Zealand Ministry for the Environment, About New Zealand's climate change programme, viewed 21 January 2022, available here.

114 Industrial allocation is focused on ensuring allocation levels to industry align with New Zealand's emissions budgets.

115 Technical regulation updates refer to ensuring improved functioning of the ETS.

116 New Zealand Ministry for the Environment, About New Zealand's climate change programme, viewed 21 January 2022, available here.

117 New Zealand Climate Change Commission, *Ināia tonu nei: a low emissions future for Aotearoa*, May 2021, pp. 26-34, available here.

118 New Zealand Electricity Authority, *Statement of Intent 2021-2025*, June 2021, p. 6, available here.

119 New Zealand Climate Change Commission, *Ināia tonu nei: a low emissions future for Aotearoa*, May 2021, pp. 26-34,available here.

120 Section 15 of the *Electricity Industry Act 2010.*

industry for the long-term benefit of consumers

The objective does not explicitly include consideration of environmental impacts, however, the Authority has recently drawn links between the reliability and efficiency limb with the need to decarbonise the energy sector. Further, in carrying out this objective, the Authority is influenced by input from the Minister who declared that a government priority is the reduction of carbon emissions.

The Minister may issue a non-statutory Letter of Expectations to the Authority which sets out their expectations of the Authority's governance and planning. In the 2020/2021 letter, the Minister stated that 'the energy sector has a key role in meeting the government's priorities to shift to a carbon neutral economy'.[121] Crucially, the Minister outlined that a priority for the Authority is to ensure the electricity industry plays its part in the economic transformation needed for New Zealand to meet its emission reduction targets.[122]

As required under the *Crown Entities Act 2004*[123], the Authority must submit to the Minister two core documents: a Statement of Intent (SOI) and a Statement of Performance Expectations (SPE).[124] The SOI outlines the strategic intent and objectives of the Authority over a four-year period. The SPE highlights the planned work and financial information of the Authority over a one-year period. The Minister may participate in determining the content of the documents by providing the Authority with comments or directions to amend information. These must be considered by the Authority before it provides a final version of the documents to the Minister and publishes the SOI and SPE on its website. [125]

There is a similar process under the NEL, where the Ministerial Council on Energy (MCE)[126] may issue a statement of policy principles in relation to any matters relevant to AEMC's exercise and performance of its powers. Before issuing the statement, the MCE must be satisfied it is consistent with the NEO.[127] The AEMC must have regard to any relevant MCE statement of policy principles in making a Rule or conducting a review.[128] To date, this process has not been used but could be a way for the MCE to establish a link between price, reliability, security and the interests of consumers with environmental impacts and, enable the AEMC to factor decarbonisation into its decision-making.

The 2021-2025 SOI outlines in more detail how the Authority will measure its impact on enabling an efficient transition to reliable low-emissions energy in New Zealand. The three core measures are:[129]

1. improved participant confidence in settings to facilitate efficient transition

121 New Zealand Electricity Authority, *Letter of Expectation from the Minister of Energy and Resources*, December 2019, p. 1, available here.

122 Ibid.

123 Sections 138-149M of the *Crown Entities Act 2004.*

124 New Zealand Electricity Authority, Strategic Planning and Reporting, viewed 18 February 2022, available here.

125 Sections 145-146 and 149H-149I of the *Crown Entities Act 2004.*

126 MCE means the group of Ministers responsible for energy matters at a national level.

127 Section 8 of the NEL.

128 Section 33 of the NEL.

129 New Zealand Electricity Authority, *Statement of Intent 2021-2025*, June 2021, p. 14, available here.

2. improved participant confidence in reliability as New Zealand transitions to low-emissions energy
3. assessment of the ability of market settings to facilitate an efficient transition to low emissions energy.

The 2021-2025 SOI highlights electrification of the economy as a core driver of opportunity for the Authority to help reduce New Zealand's emissions. The Authority's focus on the importance of electrification is a result of the Climate Change Commission's advice to the New Zealand government, as mentioned earlier in the draft report, which sets the emissions budgets and direction for its emissions reduction plan for 2022 to 2025.[130]

Additionally, the Authority has taken an approach to create a forward-looking workplan to address the demands of decarbonisation. This is clear in the Authority's 2020 Strategic Reset which states that their purpose is to enhance New Zealanders' lives, prosperity and environment through electricity.[131] Within their Strategy Reset, the Authority state their desire for low-emissions energy to electrify the economy and, their goal to 'promote a stable investment environment with robust rules and clear price signals to unlock the potential for more renewable generation and ensure the transition is as efficient as possible'.[132] The Authority also reports on the progress of their strategic ambitions and statutory objective each year in their Annual Report. The 2022 Annual Report will be an important source of information to understand how the Authority is progressing in decarbonising the electricity system.[133]

3.5 Singapore

BOX 5: KEY POINTS

- In Singapore the electricity wholesale and retail markets are referred to as the National Electricity Market of Singapore (NEMS). The key market bodies in the NEMS are the Energy Market Authority (EMA), the Energy Market Company and the Power System Operator.
- The EMA is responsible for regulating the electricity market, including licensing and the establishment of standards of performance and codes of practice within the NEMS. It also adheres to, and facilitates implementation of, the policy directives set by the Ministry of Trade and Industry such as the *Four Switches.*
- The EMA's statutory objective was amended in 2021 to enable them to explicitly consider decarbonisation when making decisions. Commencing in 2022, it now has an additional

130 New Zealand Climate Change Commission*, Ināia tonu nei: a low emissions future for Aotearoa*, May 2021, pp. 26-34, available here.

131 New Zealand Electricity Authority, *New Zealand Electricity Authority Strategy Reset*, July 2020, available here.

132 Ibid.

133 New Zealand Electricity Authority, *2020/2021 Annual Report*, December 2021, available here.

duty under the *Electricity Act 2001* to implement policies and standards on matters for the reduction of greenhouse gas emissions.

- Singapore is committed to reducing its carbon emissions intensity by 36% by 2030 relative to 2005 level and aims to achieve net zero emissions as soon as practicable in the second half of the century. The government is addressing decarbonisation under a national agenda called the Singapore Green Plan 2030 and through a carbon tax regime.

3.5.1 Introduction to Singapore

In Singapore, the electricity market consists of a wholesale market and retail market known as the NEMS. It is an energy only market and became fully competitive in 2003. The wholesale market comprises of two main markets: the spot market and the procurement market for other ancillary services. The retail market is regulated under the *Electricity Act 2001* and by the EMA via electricity licenses and codes of practice. Market support services licensees act as an intermediary between retailers and the wholesale market within the retail market, allowing retailers to directly buy from the wholesale market and sell to consumers.[134]

Singapore is an island city-state and due to its geographic composition,[135] the NEMS is constrained in its capacity to adopt renewable energy sources such as nuclear, hydro-electric, wind and geothermal power. This has led the country to be dependent on imported fuels for energy.[136] As such, Singapore's energy mix largely comprises of gas (95%) and the power sector contributes 38.9% to national carbon emissions, which have been on an upward trend for the past three decades. Notwithstanding this, the government has deployed various national plans, strategies and initiatives towards decarbonisation.

There are three main regulatory decision-makers in the NEMS: the EMA, the Energy Market Company (EMC) and the Power System Operator (PSO).[137] For additional information on each of the market bodies, please refer to the appendix A.5

The EMA is responsible for regulating the electricity market under the Energy Market Authority of Singapore Act 2001.[138] Its primary functions are:

- PSO (a division of the EMA) – responsible for the reliable supply of electricity to consumers as well as the operation of the power system, similar to AEMO
- Industry developer – this relates to catalysing innovations and establishing thought leadership within the energy sector, similar to the ESB

134 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, pp. 6-10, 53-55, available here.

135 Singapore has a small and flat landscape, high urban density, limited land resources and typically low wind speeds.

136 National Climate Change Secretariat Strategy Group Prime Minister's Office, *Climate Action Plan: Take Action Today, for a Sustainable Future,* January 2016, pp. 4-25, available here.

137 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, pp. 16-18, available here.

138 Singapore Statues Online, Energy Market Authority of Singapore Act 2021, viewed 22 February 2022, available here.

- Industry regulator – responsible for regulating the electricity industry through enforcing regulations, codes of practices and licenses, similar to the AER.[139]

3.5.2 How decarbonisation is managed and accounted for in decision-making

3.5.3 National approach

The Singapore government has signed several international treaties to reduce global carbon emissions, including becoming a signatory of the United Nations Framework Convention on Climate Change (UNFCCC) in 1997, the Kyoto Protocol in 2006 and the Paris Agreement in 2016.[140] In March 2020 under the UNFCCC, the Singapore government pledged to peak its absolute emissions at 65 million tonnes of carbon dioxide equivalent by 2030 and to achieve net zero emissions as soon as practicable in the second half of the century.[141]

In 2021, the Singapore Government released a national agenda called the *Singapore Green Plan 2030* (Green Plan) to strengthen its commitment to the United Nations 2030 Sustainable Development Agenda and the Paris Agreement that outlines key programs and targets. The Green Plan sets out programs and actions Singapore will undertake over the next decade to meet its target of reducing carbon emissions to net zero as soon as practicable. The Green Plan's four programs include:

- increasing green space in areas with high urban density to increase absorption of CO2
- improving energy efficiency by increasing deployment of solar energy and reducing energy consumption
- promoting green finance and provide support for small and medium-sized enterprises through programs like the Enterprise Sustainability Program which provides training to develop the knowledge and skills for promoting sustainable practices
- reducing Singapore's carbon footprint at a community level through programs like the *Eco Stewardship Program*, where students are educated on sustainability and climate change to empower them to make day-to-day decisions that reduce their carbon footprint.[142]

Singapore has also legalised efforts to decarbonise such as imposing a carbon tax regime to incentivise businesses to reduce their GHG emissions. Under the *Carbon Pricing Act 2019*, businesses that emit more than a certain threshold of GHG emissions annually (equal to or more than 25,000 tonnes of CO_2 equivalent) are required to register and submit a Monitoring Plan and an Emissions Report on an annual basis to the National Environment Agency (NEA). Businesses with emissions above the threshold are subject to a carbon tax.[143] NEA[144] is responsible for administering and regulating the carbon tax regime, including the

139 Energy Market Authority, Our Roles, viewed 2 November 2021, available here.

140 Singapore Ministry of Foreign Affairs, Climate Change, viewed 16 September 2021, available here.

141 National Climate Change Secretariat Strategy Group Prime Minister's Office, Singapore and international efforts, viewed 17 September 2021, available here.

142 SG Green Plan, Singapore Green Plan 2030, viewed 11 April 2022, available here.

143 National Environment Agency, Carbon Tax, viewed 17 September 2021, available here.

144 A statutory board under the Ministry of Sustainability and the Environment responsible for ensuring a clean and sustainable environment in Singapore.

measurement, reporting and verification of GHG emission levels emitted by any industrial facility for determining the respective carbon tax.[145]

3.5.4 Regulatory decision-maker approach

The EMA states that its objective is to:[146]

> *ensure a reliable and secure energy supply, promote effective competition in the energy market and develop a dynamic energy sector in Singapore.*

In November 2021, the *Energy (Resilience Measures and Miscellaneous Amendments) Act 2021* amended the *Electricity Act 2001*[147] and expanded the EMA's functions and duties to include implementation of policies, strategies, measures and other requirements on matters for or connected with the reduction of GHG emissions.[148] The amendment, which commenced operation in January 2022, allows the EMA to explicitly take into account decarbonisation in its regulatory decisions. For example, requiring power generators to reduce its carbon emissions as part of its licence conditions to promote the use of energy and carbon efficiency technologies.[149]

The Minister for the Ministry of Trade and Industry largely determines the EMA's work program around decarbonisation. In October 2019, the Minister announced its plan to reform the energy sector via the *Four Switches* as a commitment to transition the energy market towards renewable energy whilst maintaining reliability and affordability. The *Four Switches* consists of four pillars:

1. Natural Gas — to assist generation companies to improve the efficiency of their power plants
2. Solar — to work towards achieving a solar target of at least two gigawatt-peak by 2030 by working with the energy industry and agencies
3. Regional Power Grids — to expand use of regional power grids so the cost of energy use can be competitively reduced
4. Emerging Low-Carbon Alternatives — to utilise carbon capture, storage technologies and hydrogen.[150]

The EMA takes decarbonisation into account in its decisions by working with the Singapore government and implementing its energy policies and programs like the *Four Switches*, as well as using tools such as incentive schemes to support industry participants and stakeholders in increasing their energy production and consumption efficiency.[151] It considers

145 National Environment Agency, Legislation, viewed 17 September 2021, available here.
146 Energy Market Authority, Our Roles, 19 August 2021, viewed 17 November 2021, available here.
147 Section 3(g) of the *Energy (Resilience Measures and Miscellaneous Amendments) Act 2021.*
148 In relation to the generation, transmission, import, export or supply of electricity. See section 3(3)(ca) of the *Electricity Act 2001.*
149 Ministry of Trade and Industry Singapore, Public consultation on energy (resilience measures and miscellaneous amendments) bill, viewed 10 November 2021, available here.
150 Energy Market Authority, *The Future of Singapore's Energy Story*, 29 October 2019, p. 2, available here.
151 Ibid p. 1-2.

that changes are required to both the production and consumption side of the energy market to promote decarbonisation in the energy sector.[152] For example, the EMA has:

- launched the 'Energy Efficiency Grant Call for Power Generation Companies' incentive scheme. It encourages power generators to improve energy efficiency and reduce carbon emissions. The EMA provides financial grants based on the amount of carbon abated through energy efficiency projects.[153] This aligns with the first pillar of the *Four Switches*.
- begun working with the Public Utilities Board[154] and SP Group[155] to accelerate the roll-out of smart meters across the electricity, gas and water networks.[156] The EMA announced the national roll out of electricity smart meters in 2019.[157] This aligns with the second pillar of the *Four Switches* as achieving the solar target would require smart meters.
- administered the Low-Carbon Energy Funding Initiatives alongside the Economics Development Board.[158] EMA confirms that the government funding provided to projects, that invest and implement low-carbon energy solutions through research and development, are relevant to the power sector. In October 2021, $55 million was provided to twelve projects.[159] This aligns with the fourth pillar of the *Four Switches.*

3.6 South Africa

BOX 6: KEY POINTS

- South Africa has a coal-intensive energy market and is the 13th largest carbon emitter in the world. The key market bodies are the Department of Mineral Resources and Energy (Department of Energy), Eskom Holdings SOC Limited (Eskom) and the National Energy Regulator of South Africa (NERSA).
- The Department of Energy is the main planning and policy-maker and Eskom is the grid owner and operator, and owns the majority of generation capacity. NERSA is the regulatory authority responsible for issuing licences, approving tariffs and prices, and setting guidelines and codes.
- South Africa's statutory objectives do not explicitly mandate the consideration of decarbonisation in regulatory decision-making. However, the *National Energy Act 2008* gives power to the Minister of Mineral Resources and Energy to adopt measures to minimise the environmental impact of energy producers and distributors. NERSA also has

152 Energy Market Authority, Singapore's Energy Story, viewed 20 August 2021, available here.
153 Energy Market Authority, Energy Efficiency Grant Call for Power Generation Companies, viewed 22 October 2021, available here.
154 A statutory board under the Ministry of Sustainability and the Environment that manages Singapore's use, supply and catchment of water.
155 A government owned electricity and gas distribution company.
156 Smart Energy International, Why Singapore Needs to Get Smart about Metering, viewed 10 September 2021, available here.
157 Energy Market Authority, Energy Timeline, viewed 10 September 2021, available here.
158 A government agency under the Ministry of Trade and Industry that is responsible for Singapore's economic development.
159 Energy Market Authority, 12 Projects Awarded $55 Million to Accelerate Decarbonisation in Singapore, viewed 8 October 2021, available here.

scope to account for environmental impacts as part of its objective under the *Energy Regulation Act 2006* is to ensure sustainable development and promote utilisation of diverse energy resources.

- South Africa plans to reduce coal generation to 45% down from approximately 83% by 2030 and has committed to achieving net zero by 2050. The government has implemented several decarbonisation initiatives like the integrated resource plan and carbon tax.

3.6.1 Introduction to South Africa

Historically, the provision of electricity in South Africa was dominated by local governments and private companies until the establishment of Eskom in 1922. Eskom was given government funding to purchase the country's electricity infrastructure and assets. South Africa's energy market is now characterised by regulated fixed prices set by Eskom (as the market operator). However, prices must first be approved by the market regulator before they can be passed on to consumers.[160]

Coal continues to feature significantly in South Africa's generation profile because the country has plentiful coal deposits, therefore it is a relatively cheap source of energy. This allows South Africa to have one of the lowest energy costs in the world.[161] Consequently, it is the 13th largest carbon emitter in the world, accounting for 1.29% of global emissions.[162]

Decarbonisation of the energy sector is mainly driven by the Department of Mineral Resources and Energy (Department of Energy) which is the main policy-maker. The energy market is regulated by NERSA through the issuing of licenses and enforcing compliance with license conditions. All market participants must have a valid license to participate in the market. License conditions are designed to ensure efficient market outcomes and establish appropriate consumer safeguards. For additional information on the key decision-makers, please refer to the appendix A.6.2.

3.6.2 How decarbonisation is managed and accounted for in decision-making

3.6.3 National approach

Commitments to emissions reduction

The South African government acceded to the Kyoto Protocol in 2002 and is a signatory to the Paris Agreement, having committed to net zero by 2050. The country intends to limit GHG emissions to 398-510 $MtCO_2e$ by 2025, and to 350-420 $MtCO_2e$ by 2030.[163] This represents a 32% decrease from the upper bound 2030 target made in 2015.[164] The

160 Enerdata 2022, South Africa allows Eskom to raise electricity prices by 9.6% in 2022-23, viewed 20 April 2022, available here.
161 K Ratshomo and R Nembahe, *the South African energy sector report*, 2019, p. 2, available here.
162 International Trade Administration, South Africa - country commercial guide, viewed November 2021, available here.
163 Republic of South Africa, *First Nationally Determined Contribution under the Paris Agreement*, September 2021, p. 15, available here.

government plans to reduce emissions in absolute terms from 2026 and plans to reduce coal generation from 83.5% to 45% by 2030, however, it acknowledges that coal power has an ongoing role in the future.[165]

Decarbonisation of the energy sector is pursued primarily through national government action and legislated by the *National Energy Act 2008 (Energy Act)*. The Energy Act seeks to establish a planning framework and obligations on the sector which ensures that diverse resources are available, in sustainable quantities and at affordable prices. This is intended to support South Africa's economic growth and wider poverty alleviation, as well as considering environmental management requirements. The Energy Act gives power to the Minister of Mineral Resources and Energy to adopt measures to minimise the environmental impact of energy producers and distributors.[166]

The Integrated Energy Plan (IEP) and Integrated Resource Plan (IRP)

The Department of Energy has developed an IEP and IRP which drive the decarbonisation of energy supply. The IEP projects the country's future energy requirements under different scenarios and the IRP acts as an infrastructure development plan to meet future energy demand.[167] The IRP provides a mechanism for the government to diversify the electricity generation mix and promote the use of renewable energy and other low-carbon technologies.

The draft 2018 update of the IRP anticipates that in the period up to 2030, approximately 24 GW of renewable capacity will be developed.[168] The IRP update envisages, in line with the South African Government's policy to reduce GHG emissions, that a carbon budget is the preferred instrument to help achieve targets.[169] Unlike the integrated systems plan in the NEM, the IRP is explicitly designed to pursue the decarbonisation of the energy sector.

The IRP and IEP were meant to be 'living plans' that would be periodically revised by the Department of Energy. However, they have not been updated since 2018 and stakeholders have raised concern over their suitability to meet the current needs of the market.[170] For example, the IRP's plan to procure more coal-fired generation has been found by the Energy Systems Research Group to be unnecessary costly and sub-optimal. Furthermore, committed projects in the IRP have been cited as unlikely to materialise because of a lack of infrastructure investment.[171]

Carbon budgets and Carbon Tax

The government has also implemented a carbon tax and carbon budgets across industries to facilitate low carbon development in the country. The implementation of carbon budgets is

164 Ibid.
165 Ibid.
166 E le Grange, 2019, Electricity regulation in South Africa: overview, viewed 20 September 2021, available here.
167 Republic of South Africa, *South Africa's low emission development strategy 2050*, February 2020, pp. 21-23, available here.
168 E le Grange, 2019, Electricity regulation in South Africa: overview, viewed 20 September 2021, available here.
169 Ibid.
170 C Yelland, 'Big holes emerge in SA's Integrated Resource Plan for Electricity', *ESI Africa*, viewed 15 November 2021, available here.
171 Ibid.

divided into phases, with South Africa currently undergoing a two-year trial period for voluntary carbon budgets as part of the carbon budget pilot.[172] Any company with facilities registered in the South African Greenhouse Gas Emissions Reporting System may submit their own voluntary threshold that they will meet within the trial period. This is an example of carbon policy that is collaborative with participants rather than strictly prescriptive.

South Africa's carbon tax framework is legislated in the *Carbon Tax Act 2019*. This Act gives effect to the polluter-pays-principle for large emitters and helps to ensure that businesses and consumers take the negative adverse costs (externalities) into account in their future production, consumption and investment decisions. Firms are incentivised towards adopting cleaner technologies. The design of the carbon tax also provides significant tax-free emission allowances ranging from 60% to 95% in this first phase from 2019-2022.[173]

The introduction of the carbon tax will also not have any impact on the price of electricity for the first phase. This will result in a relatively modest carbon tax rate ranging from R6 to R48 per tCO_2eand provide current significant emitters time to transition their operations to cleaner technologies through investments in energy efficiency, renewables and other low carbon technology.[174]

The Renewable Energy Independent Power Producer Procurement Program (REIPPP)

The government has also launched the REIPPP to competitively tender private sector investment in renewable energy sources. The program seeks to incentivise and support increased renewable penetration in South Africa, contributing to decreasing emissions. [175]

3.6.4 Regulatory decision-maker approach

South Africa's legislative instruments enable low carbon development of the energy sector by the market bodies. Under the *Energy Regulation Act 2006* (Regulation Act), NERSA is able to take a more active role in facilitating decarbonisation of the market. NERSA must consider the objectives of the Regulation Act in its decision-making such as when issuing rules or approving stakeholder licences, and other requests. Terms like 'long-term sustainability' and 'diverse energy sources' allow stakeholders to raise issues around decarbonisation in their submissions to NERSA.

The objectives are as follows:[176]

> (a) achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;
>
> (b) ensure that the interests and needs of present and future electricity customers and

172 Department of the Environment, Forestry and Fisheries, Meeting Summary: Implementing Paris Agreement; Carbon Tax and Carbon Budgets: DEFF briefing; with Minister, viewed 02 March 2021, available here.

173 Ibid.

174 Ibid.

175 A Eberhard and R Naude, 'The South African Renewable Energy Independent Power Producer Procurement Programme: A review and lessons learned', *Journal of Energy in Southern Africa*, vol. 27, no. 4, 21 December 2016, pp. 1-14, available here.

176 Section 2 of the *Energy Regulation Act 2006*.

> end users are safeguarded and met, having regard to the governance, efficiency, effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic;
>
> (e) promote the use of diverse energy sources and energy efficiency.

For example, in 2010 when NERSA was considering whether to approve proposed tariff hikes by Eskom, it considered submissions from Greenpeace and consumer groups who questioned the extent to which the tariff hikes increased South Africa's dependency on coal. Greenpeace suggested that the tariff increase should not go towards funding more coal power and that Eskom should ring-fence at least 50% of the proposed tariff increase for investments into renewables and energy efficiency.[177] NERSA decided not to approve the tariff hike on the basis that it relied on an expired methodology and instead began consultation on developing a new methodology which accounts for the rapid transformation of the electricity sector.[178]

Further, the Regulation Act requires NERSA to issue rules designed to implement the government's national policy framework including the IRP.[179] However, NERSA has not issued any such rules since the IRP 2010 was first published. Instead, the Department of Energy implemented the IRP 2010 by issuing Ministerial Determinations in line with section 34 of the Regulation Act to give effect to the procurement of new generation capacity.[180]

3.7 United Kingdom

BOX 7: KEY POINTS

- The United Kingdom's energy market operates across England, Wales and Scotland. Industry reforms and the introduction of a regulatory framework in 1990 led to the privatisation of the sector. The key market bodies are the: Department for Business, Energy and Industrial Strategy (BEIS), Gas and Electricity Markets Authority and Office of Gas and Electricity Markets (Ofgem).
- BEIS is responsible for setting the United Kingdom's energy policy and Ofgem's role is to implement the policies and monitor the market for all energy users.
- A principle duty of Ofgem's is to protect the interests of existing and future energy consumers. Section 3A of the *Electricity Act 1989* and section 4AA of the *Gas Act 1986* specify that 'interests' is taken to include their interests in the reduction of greenhouse gases.

177 N Maphiri, Greenpeace presentation to NERSA: public hearing into ESKOM tariff increase, 21 January 2010, available here.

178 NERSA, NERSA embarks on MYPD% pricing methodology review and rejects Eskom's MYPD% revenue application for the financial years 2022/23, 2023/24 and 2024/25, media release, 30 September 2021, available here.

179 Section 4 of the *Energy Regulation Act 2006.*

180 Cliff Dekker Hofmeyr, The draft Integrated Resource Plan 2018: The roadmap for future generation capacity, viewed 1 September 2021, available here.

- The United Kingdom has made a legally binding pledge under the *Climate Change Act 2008* to achieve net zero by 2050. The national government account for decarbonisation by implementing carbon budgets. Ofgem analyse the impact of proposals on consumers and industry participants through Impact Assessments, and determine a monetary value for the carbon emissions associated with that particular proposal.

3.7.1 Introduction to United Kingdom

The United Kingdom energy market operates across England, Wales and Scotland (collectively Great Britain). The region uses both a real time market and a balancing services market that operate alongside a capacity market, which commenced in 2018.[181] The United Kingdom is a relatively small producer of electricity on a world scale, accounting for 313 TWh or less than 1% of global generation in 2020. Furthermore, 38% of its electricity was generated from coal and gas, compared to 43% generated from renewables.[182]

BEIS is the United Kingdom's government body responsible for setting energy policy.[183] Ofgem is the regulator for electricity and gas markets and is overseen by the Gas and Electricity Markets Authority (GEMA). Ofgem's role is to implement the policies set by BEIS and regulate transmission and distribution networks, wholesale markets and retail markets. For additional information on each of the market bodies, please refer to the appendix A.7.2.

Northern Ireland's power system is linked to Great Britain's through transmission infrastructure and a Contracts for Difference scheme.[184] Policy decisions are made by the Northern Ireland Department for the Economy rather than BEIS, and Ofgem do not act as the regulator for Northern Ireland.[185] Northern Ireland work closely with BEIS to align energy policy through the United Kingdom.

3.7.2 How decarbonisation is managed and accounted for in decision- making

3.7.3 National approach

The United Kingdom ratified the Kyoto Protocol in 2002 and pledged in 2015 to join the Paris Climate Agreement and cut emissions by 68% by 2030.[186] In June 2019, all countries in the United Kingdom amended the *Climate Change Act 2008* (the Act) to support its commitment to a 100% reduction in GHG emissions by 2050 against a 1990 baseline. The Act establishes the framework to deliver on the requirement to meet the net zero target, and to help achieve their commitment, BEIS has introduced a system of carbon budgets.[187]

181 Department for Business, Energy & Industrial Strategy, *Market Information Report: Great Britain*, November 2018, p. 10, available here.

182 Department of Business, Energy & Industrial Strategy, *UK energy in brief 2021,* Department of Business, Energy & Industrial Strategy, July 2021, p. 28, available here.

183 K Massie and J England, 'Electricity regulation in the UK (England and Wales): Overview', *Thomson Reuters Practical Law*, viewed November 2021, available here.

184 Department of Business, Energy & Industrial Strategy, Policy paper: Contracts for Difference, 2022, available here.

185 Parliament.uk, Electricity policy in Northern Ireland, viewed November 2021, available here.

186 M Chadwick, 'What is the Paris climate agreement and why does it matter?' *Greenpeace*, viewed November 2021, available here.

The five-yearly carbon budgets set the total amount of carbon equivalent emissions that can be released over the five year budget period. The Act also established the Committee on Climate Change (CCC) to ensure that emissions targets are evidence-based and independently assessed.[188] The CCC advises on the appropriate level of each carbon budget. Once a carbon budget has been set, the Act places an obligation on BEIS to prepare policies to ensure the budget is met. This can be handed to Ofgem for implementation.[189]

To date, the CCC has established five carbon budgets spanning 2008 to 2032, which BEIS has accepted. The CCC have reported that the first and second carbon budgets were met and that the United Kingdom is on track to meet the third budget.[190] A sixth carbon budget covering the period of 2033-2037 was published in December 2020. This recommended a 78% reduction in emissions from 1990 levels. Budgets are set at least 12 years in advance to allow policymakers, businesses and individuals enough time to prepare.[191]

Decarbonising energy intensive industries has been a lasting priority for the United Kingdom. On 1 January 2021, the United Kingdom formally began operating its emission trading scheme for the energy and aviation industries. The cap-and-trade scheme places a limit on the amount of carbon these industries can release and this total is reduced over time to align with net zero legislation.[192]

3.7.4 Regulatory decision-maker approach

One of Ofgem's primary objectives is to 'protect the interests of existing and future consumers.'[193] In 2010, the *Electricity Act 1989* and *Gas Act 1986* were updated to establish that interests must be thought of holistically to include interests in 'the reduction of electricity/gas supply emissions of targeted greenhouse gases.'[194]

In February 2020, Ofgem published their Decarbonisation Action Plan which outlines the actions they will take over the next 18 months to help BEIS achieve its net zero ambition at the lowest cost to consumers. Ofgem acknowledges it is vital for the regulator to take steps to enable and encourage decarbonisation of the energy sector.[195] In setting their regulatory frameworks and making decisions, they recognise there will be inevitable trade-offs, and the need to balance the benefits of GHG reductions for future consumers alongside the potential costs to current consumers.[196] Some key actions include:

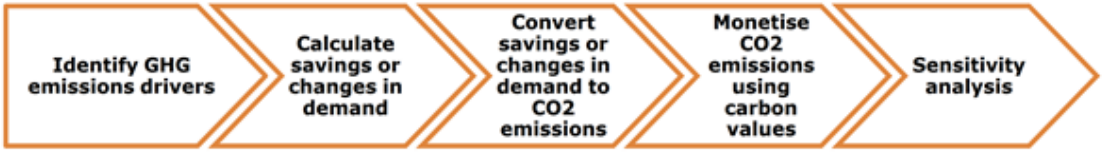
- regulation to ensure network companies invest efficiently to deliver affordable clean energy

187 Climate Change Committee, A legal duty to act, viewed November 2021, available here.
188 Ibid.
189 Ibid.
190 S Fankhauser, 'What are Britain's carbon budgets?' *London School of Economics and Grantham Research Institute*, 30 April 2020, available here.
191 Ibid.
192 Gov.uk, Participating in the UK ETS, viewed November 2021, available here.
193 Section 3A(1) of the *Electricity Act 1989* and section 4AA(1) of the *Gas Act 1986*.
194 Section 3A(1A)(a) of the *Electricity Act 1989* and section 4AA(1A)(a) of the *Gas Act 1986*.
195 Ofgem, *Ofgem's Decarbonisation Action Plan*, February 2020, p. 8, available here.
196 Ibid, p. 14.

- creating a fund to unlock investment in innovative solutions to tackle climate change
- explore options to support development of an offshore grid to enable wind generation by 2030
- build a network that can power 10 million electric vehicles by 2030
- assist government and industry in developing low carbon heating options.[197]

Currently, Ofgem accounts for carbon using an Impact Assessment (IA) when making regulatory decisions. IAs are a tool to assess the impact of policy proposals on consumers, industry participants and the environment. They provide a clear and structured process to assess the carbon impacts of policy proposals. Ofgem's 2021 Impact Assessment Guidance lays out the typical approach for valuing GHGs.[198] A high-level summary of the process is provided in the figure below.

Figure 3.1: Ofgem impact assessment approach



Ofgem, *Impact Assessment Guidance,* Ofgem, 2020, p. 23. available here.

IAs identify the change in emissions resulting from the policy under consideration and then determines a monetary value of the emissions impact. The amount of carbon is converted to a dollar value using the carbon values set by the government.[199] However, IAs are not necessarily determinative of the final policy outcome. While decarbonisation is accounted for, the process also considers a range of other factors that may be more influential, for example, security of supply or level of market competition.[200]

3.8 United States

BOX 8: KEY POINTS

- In the United States, the structure, operation and regulation of the different energy markets vary significantly between states. Responsibility for regulation is shared between federal and state governments and their respective market bodies.

197 Ibid, p. 16.
198 Ofgem, *Impact Assessment Guidance*, 4 May 2020, p. 23, available here.
199 Ibid.
200 Ibid.

- The Federal Energy Regulatory Commission (FERC) is the primary regulator of the United States' energy markets and regulates interstate transmission of electricity, natural gas and oil.
- FERC does not have an equivalent statutory objective to the NEO. Instead, laws passed by Congress are the basis upon which it makes regulatory decisions. Its powers and duties stem from the *Department of Energy Organisation Act 1977*, *Energy Policy Act 2005* and Federal Code of Regulations.
- The United States aims to reduce GHG emissions 50-52% by 2030 and achieve net zero by 2050. The Biden Administration is addressing decarbonisation through issuing several climate change focused Executive Orders. FERC is required to consider the environmental impacts of its decisions under the *National Environmental Policy Act 1969* and has recently undertaken stakeholder consultation on how it conducts environmental assessments, particularly around the treatment of GHG emissions.

3.8.1 Introduction to United States

Energy markets in the United States are complex because across the different markets there can be significant variances in governance structures, carbon emissions and intensities, fuel mixes and geographical features.

For example, CAISO, in the state of California, generated the majority of its energy in 2020 from natural gas (37.1%), with 13.2% derived from solar, 9.3% from nuclear and 2.7% from coal. Overall 33.09% of its generation mix was sourced from renewable sources.[201] In comparison, PJM Interconnection, which covers the north-east states, generated the majority of its energy in 2020 from natural gas (39.8%), with 34.2% from nuclear, 19.6% from coal and 0.5% from solar. Only 6.31% of its fuel mix was derived from renewable sources.[202]

Regulation of the United States energy markets is shared between federal and state regulators. However, the primary regulator is FERC. FERC is a federal level organisation with power over the regulation of interstate transmission of electricity, natural gas and oil. FERC's powers are derived from laws passed by Congress and it is answerable to Congress. The primary legislation that gives FERC its functions and duties are the *Federal Power Act 1920*, *Energy Policy Act 2005* and the Code of Federal Regulations.[203] For additional information on the other key decision-makers, please refer to the appendix A.8.2.

201 California Energy Commission, 2020 Total System Electric Generation, viewed 3 March 2022, available here.
202 Monitoring Analytics, 2020 State of the Market Report for PJMMarch 2021, p. 13, available here.
203 Federal Energy Regulatory Commission, What FERC Does, viewed 3 November 2021, available here.

3.8.2 How is decarbonisation managed and accounted for in decision-making

3.8.3 National Approach

Under the Biden Administration, the United States has re-joined the Paris Agreement and set carbon emissions reduction targets of 50-52% by 2030. It also aims to achieve net zero by 2050.[204] The Biden Administration has also issued several Executive Orders[205] aimed at addressing climate change in the United States. Executive Order 14008 (Tackling the Climate Crisis at Home and Abroad) seeks to place the climate crisis at the centre of government processes. Key aspects of the order include:

- creating a White House Office of Domestic Climate Policy which will co-ordinate the domestic policy making process
- developing a comprehensive plan to stimulate clean energy industries by revitalising the Federal Government's sustainability efforts
- establishing a carbon pollution-free electricity sector no later than 2035.[206]

President Biden also issued Executive Order 139990 (Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis) which directs all Federal departments and agencies to immediately review, and take action, to address the promulgation of regulations during the last four years which are inconsistent with the priorities of the new Administration. This includes the reduction of GHGs.[207]

Recent attempts to legislate significant climate action has had difficulty passing through Congress. The Build Back Better Bill proposed a program called the Clean Electricity Performance Program (CEPP). CEPP was designed to incentivise rapid uptake of clean energy by utilities in the United States. Under this scheme, the Department of Energy would issue grants to electricity companies that achieve designated clean electricity targets and penalise for those who fail to meet the target.[208] The total cost of this program was estimated at $150 billion USD. However, facing opposition from Senators, the CEPP was removed from the final version of the Build Back Better Bill. The final version of the Bill passed the House but is currently expected to not pass in the Senate as the democrats lack a majority vote on this issue in the Senate.

3.8.4 Regulatory decision-maker approach

FERC has obligations under the *National Environmental Policy Act 1969* (NEPA) to consider the environmental impacts of its decisions in its decision-making processes:[209]

> The agencies shall include in every recommendation or report on proposals for

204 White House, Fact Sheet: President Biden sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, viewed 3 May 2022, available here.

205 An Executive Order is a signed directive from the President that manages operations of the federal government. It is not a legislative instrument.

206 White House, Executive Order on Tackling the Climate Crisis at Home and Abroad, viewed 3 November 2021, available here.

207 White House, Executive Order on Tackling the Climate Crisis at Home and Abroad, viewed 3 November 2021, available here.

208 117th Congress, H. R. 5376, Build Back Better Bill, 27 September 2021, available here.

209 Section 102 of the *National Environmental Policy Act 1969.*

> legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement on the environmental impact of the proposed action and any adverse environmental effects which cannot be avoided should the proposal be implemented.

NEPA requires government departments and agencies to perform environmental impact statements,[210] however, it is the guidelines issued by the relevant administration that outlines the extent to which, and the way in which, these statements are taken into account.[211] The way this obligation has been carried out has varied depending on the broader authorising environment. For example, following President Biden's election and in line with Executive Order 139990, the Council on Environmental Quality (CEQ) rescinded the guideline on how to interpret NEPA obligations that was issued under the previous Administration.[212] FERC is commencing a process to update the guideline so that it is consistent with the stated goals of the new Administration. Any changes to this guideline which bring it more in line with the policy intent of both Executive Order 139990 and 14008 would potentially expand the environmental assessment to more explicitly address decarbonisation.

FERC has recently moved to consider decarbonisation more explicitly in its decisions. For example, in relation to the Northern Gas Company's request to build and operate 87.3 miles of replacement natural gas pipelines facilities across South Dakota and Nebraska. This is the first time that FERC has assessed the significance of a proposed natural gas pipeline's emissions, and their contribution towards climate change. In making this decision FERC approved the pipeline, finding that the project's reasonably foreseeable GHG emissions to the total GHG emissions of the United States could potentially increase carbon emissions based on 2018 levels by 0.003%.[213] Additionally, FERC considered the significance of these emissions on the reduction targets of both South Dakota and Nebraska. However, neither state has any target. Based on this information FERC found that the project's contribution to climate change was not significant.[214]

Furthermore, FERC is undertaking a process of consultation with stakeholders on the way in which it considers environmental assessments in its regulatory functions. This consultation is specific to the Certification of New Interstate Natural Gas Facilities. This process was started in 2018 and recommenced in early 2021. In its 2021 Notice of Intention [215] FERC requested stakeholder feedback on the alternatives that the Commission evaluates in its environmental review and how the Commission addresses climate change, including the impact of GHG emissions.[216]

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210 Council on Environmental Quality, National Environmental Policy Act Implementing Regulations, May 2022, p. 12, available here.

211 U.S. Department of Energy, FERC - NEPA Review (9-FD-i), viewed 28 March 2022, available here.

212 Ibid.

213 Federal Energy Regulatory Commission, FERC Reaches Compromise on Greenhouse Gas Significance, viewed 3 March 2022, available here.

214 Ibid.

215 A notice of intention is a type of consultation paper for a change in FERCs processes.

216 Federal Energy Regulatory Commission, Certification of New Interstate Natural Gas Facilities, February 2021, p. 1, available here.

ABBREVIATIONS

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
Authority	New Zealand Electricity Authority
BEIS	The Department of Business, Energy and Industrial Strategy
BnetzA	The Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway
CCC	The Committee on Climate Change
CEQ	Council on Environmental Quality
CEPP	Clean Electricity Performance Program
CER	Canada Energy Regulator
CRU	Commission for Regulation of Utilities
DMF	Decision Making Framework
EEG	The Renewable Energy Sources Act 2000
EMA	Energy Market Authority
EMC	Energy Market Company
EnWG	Energy Industry Act 2005
ERP	Emissions Reduction Plan
Eskom	Eskom Holdings SOC Limited
ETS	Emissions trading scheme
EU	European Union
FERC	Federal Energy Regulatory Commission
GEMA	Gas and Electricity Markets Authority
GHG	Greenhouse gases
IA	Impact Assessment
IEP	Integrated energy plan
IESO	Independent Electricity System Operator
IRP	Integrated resource plan
ISO	Independent System Operator
MBIE	Ministry of Business, Innovation and Employment
MCE	Ministerial Council on Energy
NEA	National Environment Agency
NEEAP	National Energy Efficiency Action Plan
NEL	National Electricity Law
NEM	National Electricity Market
NEMS	National Electricity Market of Singapore

NEO	National Electricity Objective
NER	National Electricity Rules
NERL	National Energy Retail Law
NERR	National Energy Retail Rules
NERO	National Energy Retail Objective
NERSA	National Energy Regulator of South Africa
NGL	National Gas Law
NGO	National Gas Objective
NGR	National Gas Rules
OEB	Ontario Energy Board
Ofgem	Office of Gas and Electricity Markets
OME	Ontario Minister of Energy
PSO	Power System Operator
REIPPP	Renewable Energy Independent Power Producer Procurement Program
RESS	Renewable Electricity Support Scheme
RTO	Regional Transmission operator
SEM	Single Electricity Market
SEMC	Single Electricity Market Committee
SOI	Statement of Intent
SPE	Statement of Performance Expectations
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
UR	Northern Ireland's Utility Regulator

A APPENDIX

A.1 Canada

A.1.1 Energy Market Overview

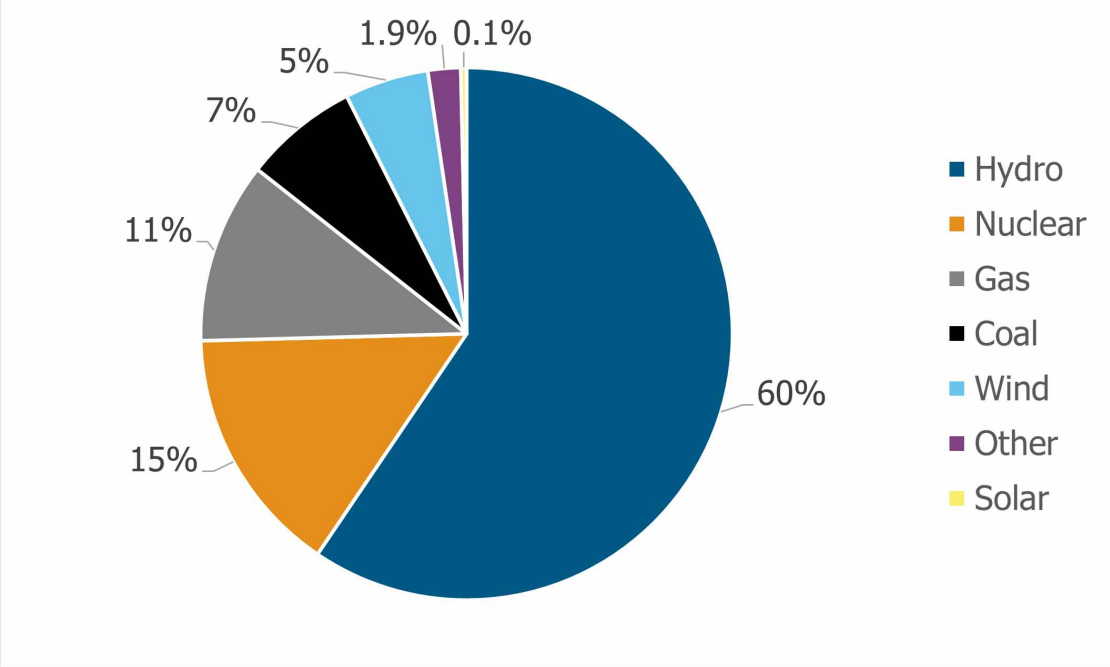
Canada's energy sector underwent a period of liberalisation in the 1990s. In some cases, this led to the unbundling of the generation, transmission, and distribution functions of incumbent utilities. This created a competitive wholesale market. In the cases of large jurisdictional exporters such as Quebec and British Columbia, liberalisation of the electricity markets was favourable, as it allowed these jurisdictions to comply with the United States Federal Energy Regulatory Commissions' rules so that they could export to the United States markets. However, most provincial and territorial governments still maintain strong financial stakes as operators in the electricity markets.[217]

Approximately 10-15% of Canada's emissions are generated from burning gas for heating.[218] Generating electricity contributes to 8.8% of emissions.[219] Canada is reducing its emissions by:

- phasing out pollution from coal-fired electricity by 2030
- setting new standards for natural-gas electricity
- increasing investment in renewable energy, transmission lines and smart grids
- supporting rural and remote communities to reduce reliance on diesel
- putting a price on carbon pollution from fossil-fuel-based electricity, and
- electrifying gas heating processes in households and commercial properties[220].

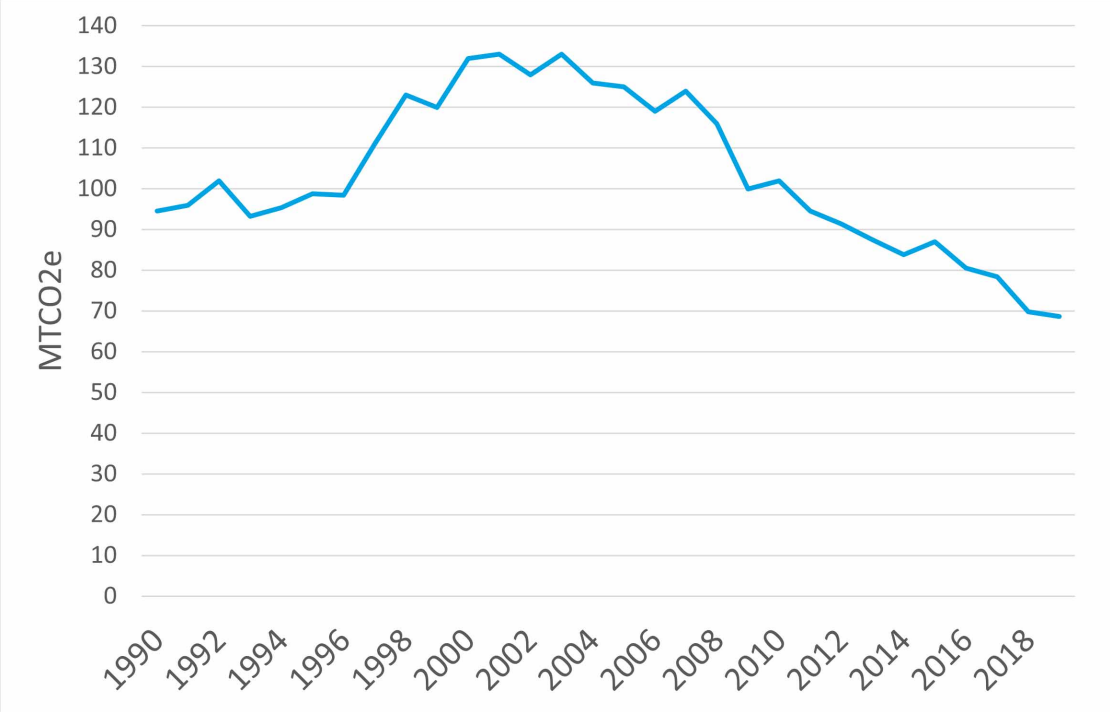
217 J Christian and L Shipley, 'Electricity Regulation in Canada', *Thomson Reuters Practical Law*, August 2020, p. 3, available here.
218 Prairie Climate Centre, Where Do Canada's Greenhouse Gas Emissions Come From, viewed 7 March 2021, available here.
219 Government of Canada, Canada's actions to reduce emissions, viewed 1 September 2021, available here.
220 Ibid.

Figure A.1: Canada's electricity generation by fuel type (2018)



Source: Canada Energy Regulator, Canada's Energy futures 2021 Fact sheet: Electricity, viewed 10 December 2021, available here.

Figure A.2: Canada's greenhouse gas emissions sources by sector (1990 - 2019)



Source: Environment and Climate Change Canada, *National Inventory Report 1900-2019: Greenhouse Gas Sources and Sinks in Canada*, 2021, p. 13, available here.

A.1.2 Governance Structure

In this section, the province of Ontario is used as an example to demonstrate how the Canadian energy market bodies interact with each other. There are five key decision-makers responsible for the regulation and operation of Ontario's energy market. These are the:

- Federal government of Canada
- CER
- Ontario Minister of Energy (OME)
- OEB
- Independent Electricity System Operator (IESO).

Federal government

The Canadian federal government sets overarching policy that the OME must consider when making decisions for their province. They do not regulate or operate the energy industry within Ontario, with those roles delegated to the OEB and IESO.

CER

CER regulates Ontario regarding decisions that impact cross-province and territorial matters such as electricity transmission infrastructure and gas pipelines.[221] Areas that are addressed within Ontario are managed by the OEB, including regulation of electricity and gas retailers to ensure consumers are protected within Ontario.[222]

OME

The OME is the provincial department that manages both the OEB and IESO. The OME works to develop a safe, reliable and affordable energy supply across Ontario. They are responsible for developing all of Ontario's energy policy.[223]

OEB

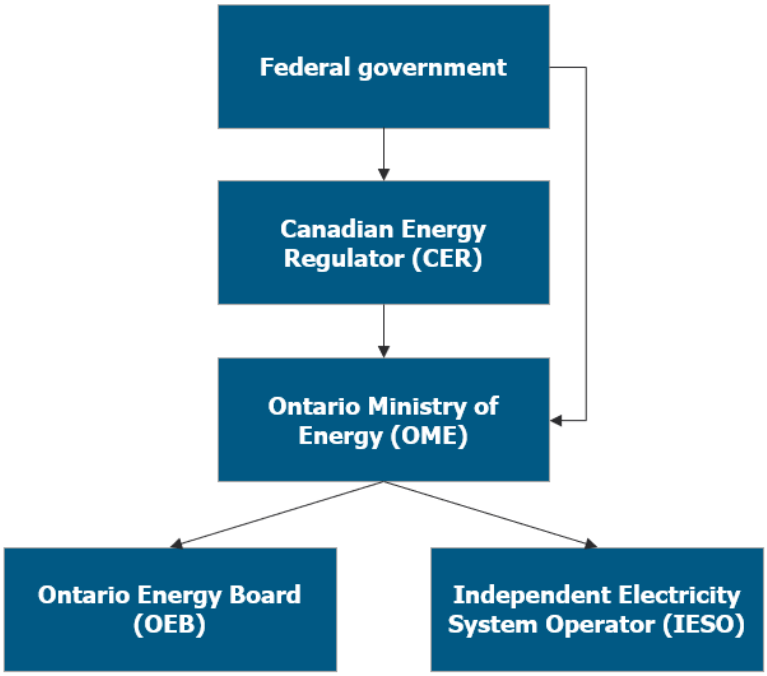
The OEB is the independent regulator of Ontario's electricity and natural gas sectors. They focus only on Ontario and are different from the CER who are responsible for cross border issues. They protect the interests of consumers and deliver public value that contributes to Ontario's economic, social and environmental development.[224]

IESO

The IESO acts as the market and system operator of the provincial grid. It deals with the transportation of electricity, planning for the future and management of the system.[225]

221 Canadian Energy Regulator, Our Responsibilities, viewed 9 March 2022, available here.
222 Ontario Energy Board, Who we are, viewed 22 March 2022, available here.
223 Ontario Ministry of Energy, Ministry of Energy, viewed 1 September 2021, available here.
224 Ontario Energy Board, Who we are, viewed 10 October 2021, available here.
225 IESO, About the IESO, viewed 6 September 2021, available here.

Figure A.3: Canadian energy sector governance structure



Source: AEMC created based on information from Canada energy Regulator, Our Responsibilities, viewed 9 March 2022, available here; and Ontario Ministry of Energy, Ministry of Energy, viewed 1 September, available here.
Note: This figure uses Ontario as an example.

A.2 Germany

A.2.1 Energy market overview

Electricity network industries in Germany were traditionally monopolies owned by the state and state influenced enterprises which led to market deficits and high prices. A process of liberalisation was then initiated by EU directives to open the market for competition while state influence was restricted to regulation to promote and safeguard competition. Hence, the electricity sector was privatised and a wholesale electricity trading market developed to facilitate competition.[226] Its transmission and distribution networks are regulated natural monopolies.

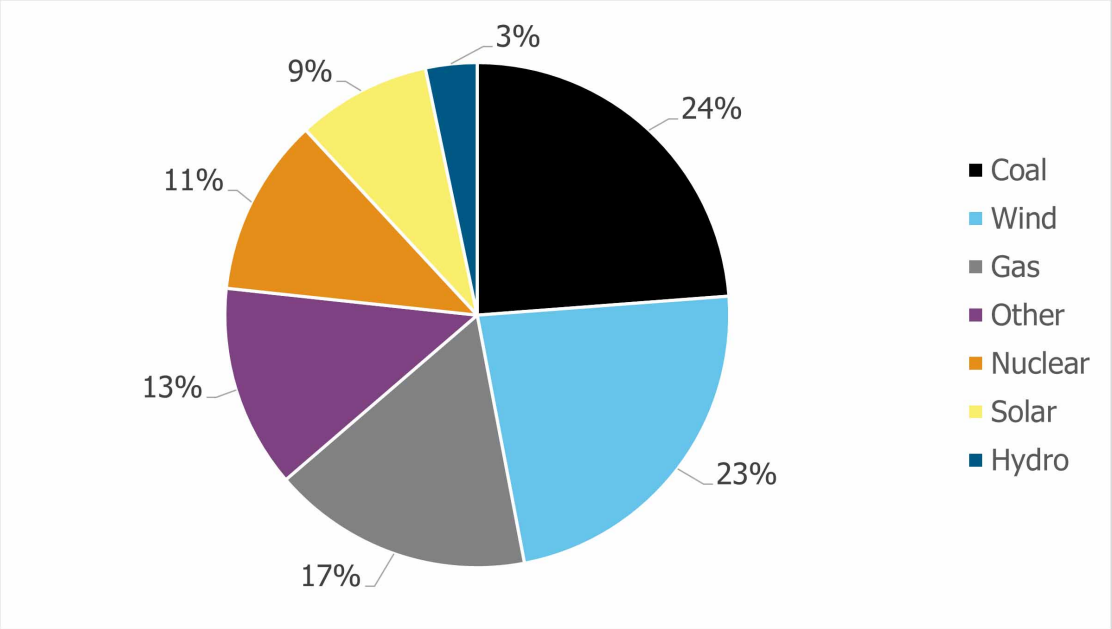
The German transmission grid is connected via cross-border interconnectors to power systems in neighbouring countries. Germany is located at the centre of an interconnected European electricity system. Due to its geographical position it is an important player in the European electricity market and a hub for Europe-wide power flows.[227] As a result, Germany

226 U Scholz and H Wessling, 'Electricity regulation in Germany: overview', *Thomson Reuters Practical Law*, viewed 28 October 2021, available here.

227 Federal Ministry for Economic Affairs and Climate Action, Electricity Market - A modern electricity market, viewed 20 October 2021, available here.

has a large electricity export market. However, CO_2 prices through the EU's ETS have made coal-fired power more expensive and led to a significant decrease in German electricity exports from fossil fuels.[228] Figure A.4 shows that 35% of Germany's electricity generation came from wind, solar and hydro sources in 2020.[229] GHG emissions by sector in Germany has steadily declined since 1990 (see Figure A.5).[230]

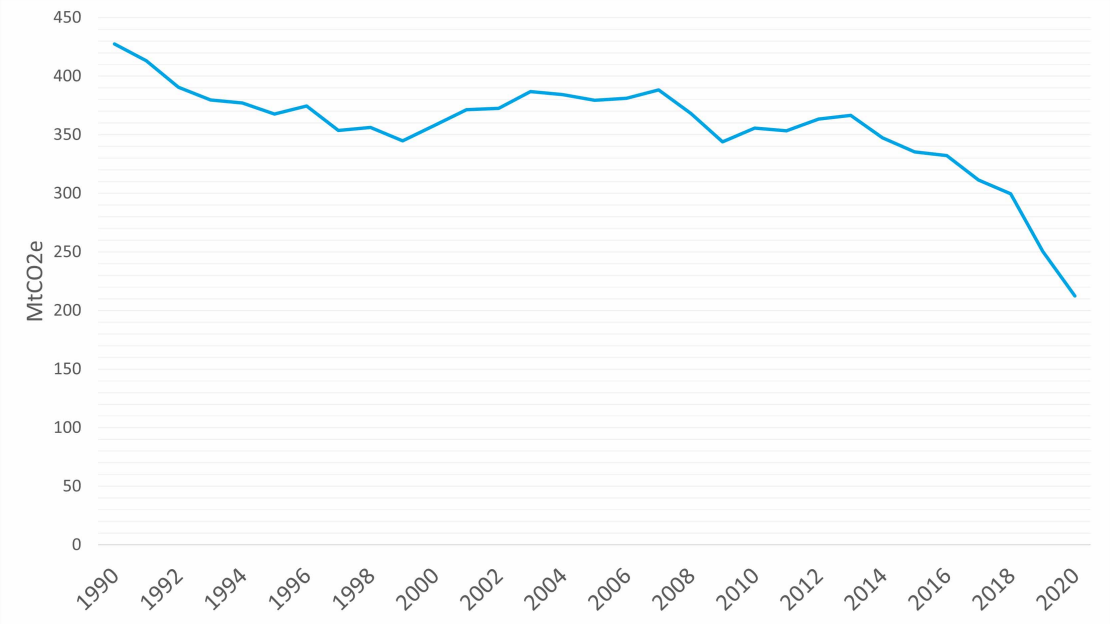
Figure A.4: Germany electricity generation by fuel type (2020)



Source: BDEW Bundesverband der Energie, Die Energieversorgung 2021, January 2021, p. 24, available here.

228 European Commission, EU Emissions Trading System, viewed 19 October 2021, available here.
229 BDEW Bundesverband der Energie, Die Energieversorgung 2021, January 2021, p. 24, available here.
230 Umwelt Bundesamt, Emission trends for Germany since 1990, viewed 24 February 2022, available here.

Figure A.5: Germany's greenhouse gas emissions sources by sector (1990-2020)



Source: Umwelt Bundesamt, *National Trend Tables for the German Atmospheric Emission Reporting 1900-2020*, January 2022, available here.

A.2.2 Governance structure

The key decision-makers in the German energy sector are the:

- Ministry of Economic Affairs
- BNetzA
- Federal Office for Economic Affairs and Export Control
- Federal Cartel Office.

Ministry of Economic Affairs

The Ministry of Economic Affairs has legislative, administrative and coordinating functions in the energy sector and is responsible for developing energy policy. A key goal in carrying out its duties is to promote competitiveness and increase employment in the industry. As part of facilitating the transition of the energy sector, the Ministry of Economic Affairs is responsible for ensuring the climate targets set out in the Climate Action Plan 2050 are achieved. [231]

BNetzA

BNetzA serves as the most important regulatory authority for overseeing the regulation of transmission and distribution networks. It is an independent federal multi-sector regulatory

231 The Federal Ministry for Economic Affairs and Climate Action, Tasks and Structure of the Federal Ministry for Economic Affairs and Climate Action, viewed 3 May 2022, available here.

authority with delegated power from the Ministry.[232] BNetzA enforces and ensures compliance with the EnWG and the ordinances under the EnWG.[233]

BNetzA also has an independent litigation office which oversees various ruling chambers, five of which concern the regulation of electricity and gas. In the ruling chambers, regulatory decisions are taken on network access and rates approval cases in the context of controlling sector-specific anti-competitive practices. The setting up of ruling chambers takes the European law requirements into account about transparency and independence of decision-making mechanisms in regulation.[234]

The German electricity market does not have a single independent market operator. The electricity market is operated by several transmission and distribution system operators. These operators are regulated via BNetzA through incentive-based mechanisms.

The Federal Office for Economic Affairs and Export Control

This office sits within the Ministry and is entrusted with conducting a variety of tasks to promote the efficient and economical use of energy, and the further expansion of renewable energy. This includes the granting of exemptions to energy-intensive companies from having to pay the EEG surcharge.[235]

The Federal Cartel Office

The Cartel Office is also a part of the Ministry and is the authority regarding merger control in the electricity sector and competition law infringements.[236]

232 A Groebel, 'BNetzA (Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway) and Its Role in Energy Infrastructure Regulation and Planning/Permitting', *Journal of Energy and Power Engineering*, vol. 12, p. 4.

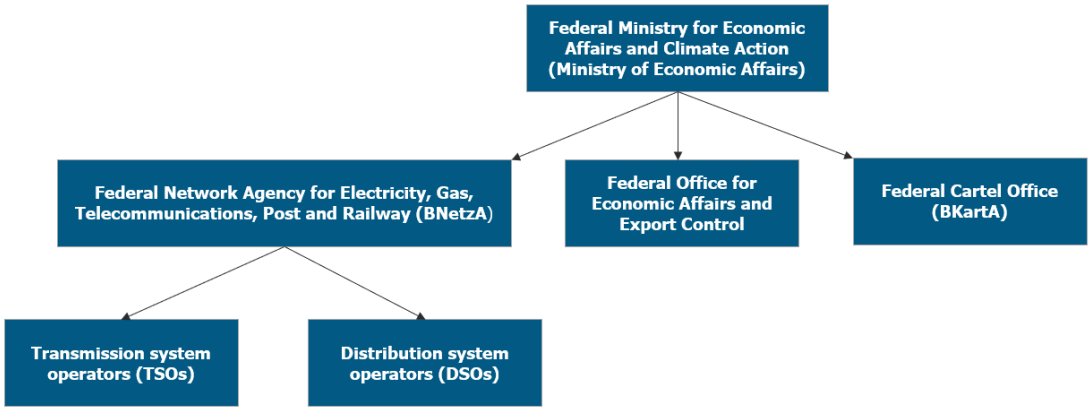
233 Any changes to the EnWG must be passed through Federal Parliament.

234 Bundesnetzagentur, Bundesnetzagentur ruling chambers, Germany, viewed 24 October 2021, available here.

235 Federal Office for Economic Affairs and Export Control, Federal Office for Economic Affairs and Export Control, viewed 22 October 2021, available here.

236 Bundeskartellamt, Bundeskartellamt, viewed 22 October 2021, available here.

Figure A.6: German energy sector governance structure



Source: AEMC created based on the Federal Ministry for Economic Affairs and Climate Action, Tasks and Structure of the Federal Ministry for Economic Affairs and Climate Action, viewed 3 May 2022, available here; and A Groeble, 'BNetzA (Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway) and Its Role in Energy Infrastructure Regulation and Planning/Permitting', *Journal of Energy and Power Engineering,* vol. 12, 2018, p. 4,

A.3 Ireland

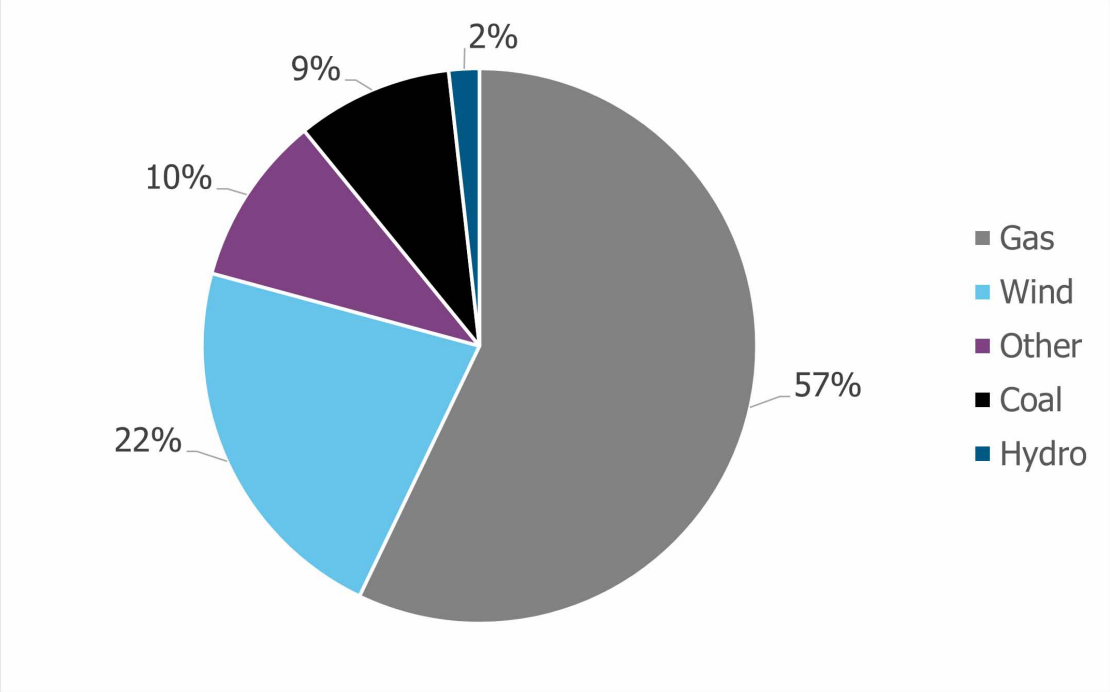
A.3.1 Energy market overview

The SEM is the wholesale electricity market for Ireland, where suppliers and generators trade electricity. The SEM comprises several markets that span short and long-term time horizons. There are two short term 'ex-ante' markets — the day ahead and intra-day markets — where energy is traded from a day-ahead of the trading day up to real-time. Real-time energy trading occurs in the Balancing Market, which runs before and into real-time to address any resulting physical imbalances. Capacity is also traded in the Capacity market up to five years ahead of real-time trading. Whilst most generators are obligated to participate in the Balancing and Capacity markets, trading in other markets is optional for participants.[237]

As shown in Figure A.7 below, fossil fuels remain the major source of electricity generation, with gas accounting for approximately 57% of the fuels used in electricity generation in 2020. This was followed by wind (22%), other sources (10%) and coal (9%).[238] The Irish market is very competitive, with 13.5% of electricity and 18% of gas consumers switching suppliers in 2019.[239]

237 Single Electricity Market Operator, Ireland markets, viewed 20 January 2022, available here.
238 Sustainable Energy Authority of Ireland, Energy in Ireland 2021 Report, p. 40, available here.
239 Enerdata, Ireland energy report, viewed 9 January 2022, available here.

Figure A.7: Ireland electricity generation by fuel type (2020)

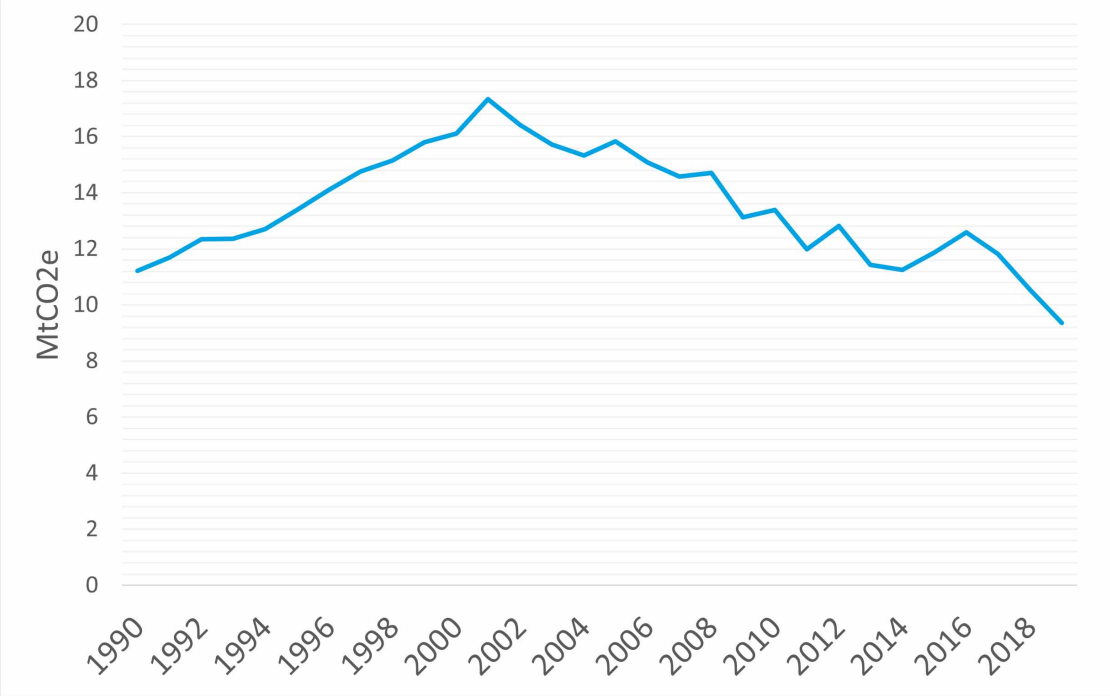


Source: Sustainable Energy Authority of Ireland, Energy in Ireland 2021 Report, p. 40, available here.

Figure A.8 illustrates that Ireland's GHG emissions in the electricity sector have steadily declined following a peak in 2001.[240]

240 Environmental Protection Agency, Ireland's National Inventory Submissions 2021 - Annex 2 Ireland NIR 2021, available here.

Figure A.8: Ireland's greenhouse gas emissions sources by sector (1990 - 2019)



Source: Environmental Protection Agency, Ireland's National Inventory Submissions 2021 - Annex 2 Ireland NIR 2021, available here.

A.3.2 Governance structure

The key decision-makers for Ireland's energy sector include:

- The Minister
- CRU
- Single Electricity Market Committee (SEMC).

Minister

The Minister is the member of the Irish government with responsibility for the exercise of executive power in relation to the electricity sector.[241] The Minister is required to develop the Climate Action Plan and must report to parliament on progress towards achieving Ireland's emission's reduction strategy.[242] The Minister is also responsible for ensuring the energy supply is reliable, secure and efficient.

CRU

241 Department of the Environment, Climate and Communications, About Us: Department of the Environment, Climate and Communications, viewed 11 January 2022, available here.

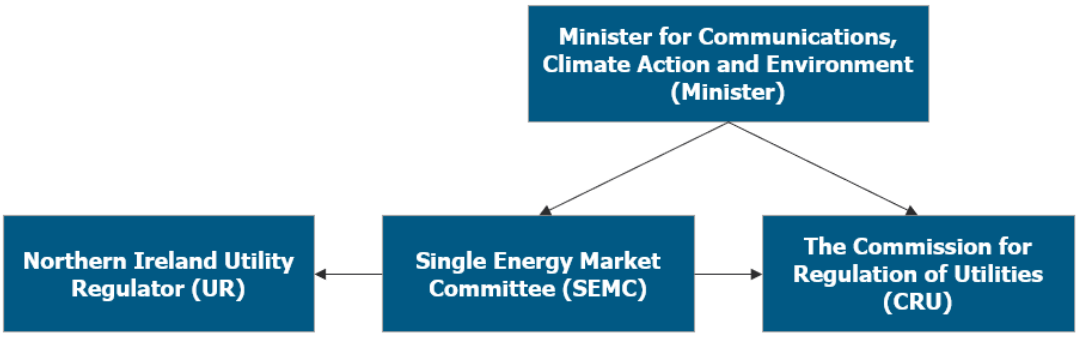
242 Ibid.

The *Electricity Regulation Act 1999* (SEM rules) established the CRU and has been amended frequently to supplement the role, powers, and duties of the CRU.[243] The CRU is an independent multi-sector regulator with a range of economic, customer, and safety functions and duties. The SEM rules also made provision for the issuance by the CRU of licenses in relation to the generation and supply of electricity. The CRU's administration of this licensing function and the supervision of licensed activities (which have been extended to include transmission and distribution ownership and operation, and the operation of electricity interconnectors) form the basis for the competition that exists in the Irish electricity sector.[244]

SEMC

Established in 2007, the SEMC is the decision-making authority for all SEM matters and governance. It consists of identical constitutions and membership from both Ireland's CRU and Northern Ireland's Utility Regulator (UR), as well as an independent and a deputy independent member.[245] Whilst the Minister can exercise executive power in relation to the electricity sector, matters are generally dealt with through the SEMC.

Figure A.9: Ireland energy sector governance structure



Source: AEMC created based on Department of the Environment, Climate and Communications, About Us: Department of Environment, Climate and Communications, viewed 11 January 2022, available here; and Single Electricity Market Committee, Single Electricity Market Committee overview, viewed 10 January 2022, available here.

A.4 New Zealand

A.4.1 Energy market overview

New Zealand's wholesale electricity system operates as an energy only market. The core markets that facilitate New Zealand's power system operating reliably and securely are the spot market, hedge market and ancillary services market.[246]

Spot market

243 Part II, Section 8 of the *Electricity Regulation Act 1999.*
244 Commission for Regulation of Utilities, CRU, viewed 10 January 2022, available here.
245 Single Electricity Market Committee, Single Electricity Market Committee overview, viewed 10 January 2022, available here.
246 New Zealand Electricity Authority, *Electricity in New Zealand*, 2018, p. 43, available here.

Electricity is auctioned every thirty minutes and market participants upload their bids and offers into the wholesale information and trading system. The system operator, Transpower, through its dispatch system, determines which offers to accept with a goal of minimising cost.

Hedge market

A marketplace to buy and sell financial contracts to manage the risk of price movements in the spot market. There are three types of hedge markets in New Zealand:

- over the counter where buyers negotiate directly with sellers to agree on a price
- the ASX market where buyers and sellers trade contracts on the futures market
- financial transmission right, which allow spot market participants to cover their price risks between nodes on New Zealand's national grid.

Ancillary Services market

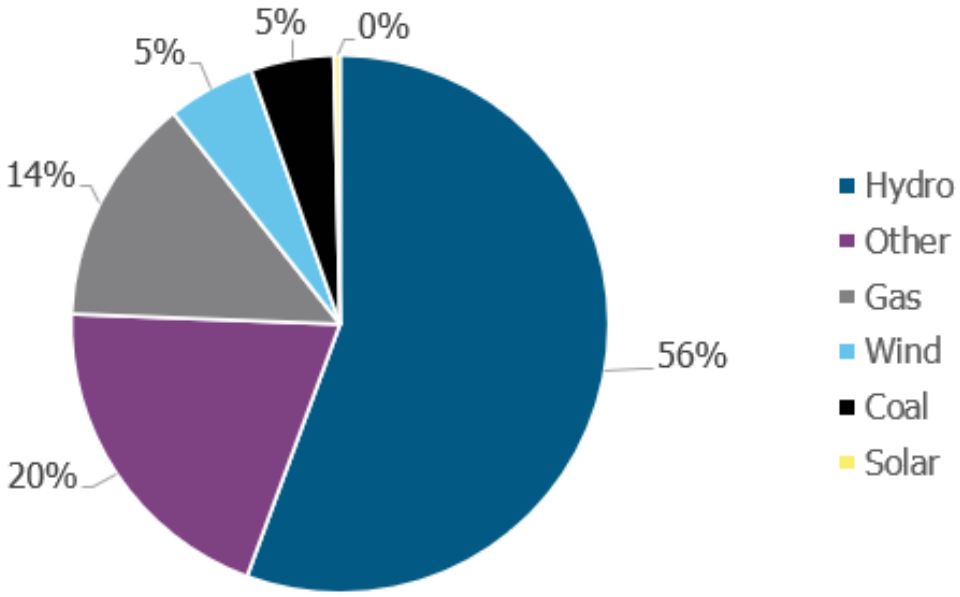
This market includes a variety of services such as an instantaneous reserve, frequency control, voltage support, black start services, over voltage services and extended reserve automatic under frequency load shedding.

New Zealand's electricity system derives 82.4% of its generation from renewables.[247] The most dominant generation type is hydropower which accounted for 56% of total generation in 2020.[248] Figure A.10 below highlights the range of resources that make up New Zealand's generation mix.

247 New Zealand Ministry of Business, Innovation and Employment, *Energy in New Zealand 20,* August 2020, p. 13 available here.

248 New Zealand Ministry of Business, Innovation and Employment, Electricity Statistics: Data tables for electricity, September 2021, available here.

Figure A.10: New Zealand electricity generation by fuel type (2020)



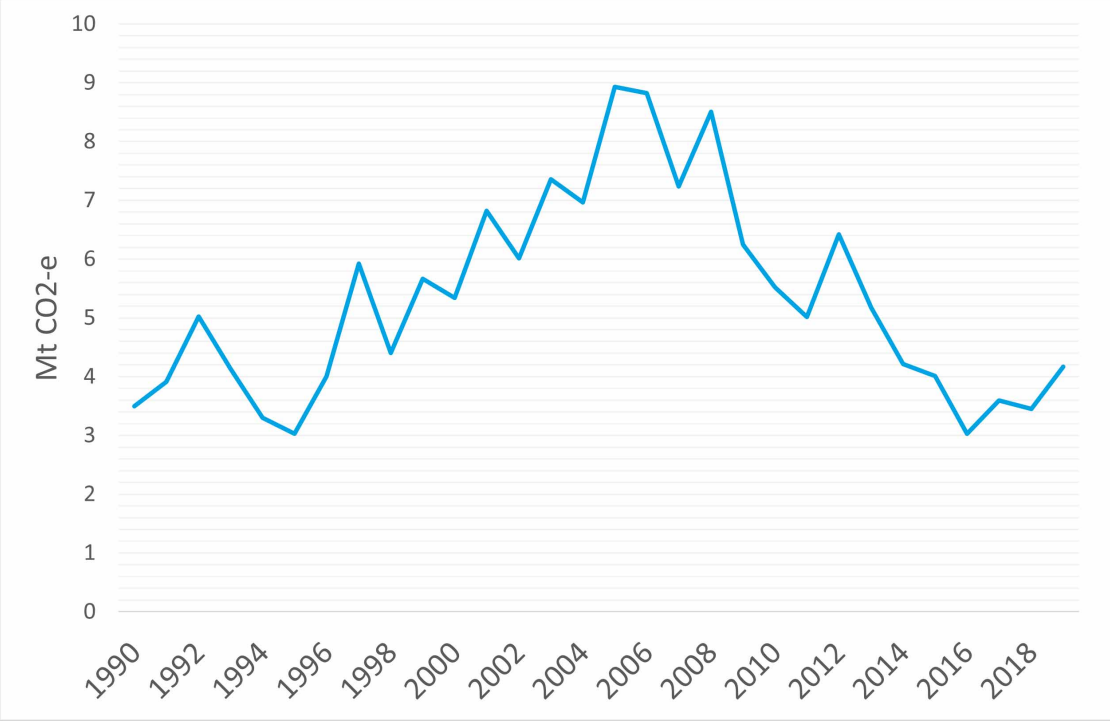
Source: New Zealand Ministry of Business, Innovation and Employment, *Electricity Statistics: Data tables for electricity*, September 2021, available here.

New Zealand's energy sector accounted for over 40% of greenhouse gas emissions in 2019. The electricity sector only accounts for 5.1% of New Zealand's total emissions.[249] However, it is the agriculture industry that remains their heaviest polluter accounting for 48.1% of total emissions. Figure A.11 indicates the total amount of greenhoue gas emissions the electricity sector is accountable for.[250]

249 New Zealand Ministry for the Environment, *New Zealand's interactive emissions* tracker, viewed 17 February 2022, available here.

250 New Zealand Ministry for the Environment, New Zealand's interactive emissions tracker, October 2021, available here.

Figure A.11: New Zealand electricity sector green house gas emissions (2019)



Source: New Zealand Ministry for the Environment, *New Zealand's interactive emissions tracker: timeseries emissions by data category,* October 2021, available here.

A.4.2 Governance structure

There are multiple bodies responsible for the regulation and operation of New Zealand's energy system. The key decision-makers are:

- The Minister
- The MBIE
- The Authority
- Transpower.

The Minister

The Minister oversees and manages the New Zealand government's relationship with the Authority, as the responsible minister for the Authority. The Minister's functions and powers include:[251]

- the appointment and removal of members of the Authority
- directing the Authority to give effect to a government policy that relates to its functions

251 Section 27 of the *Crown Entities Act 2004.*

- participating in the process of setting the Authority's strategic direction and performance expectations.

MBIE

The MBIE monitors the Authority on behalf of the Minister of Energy and Resources, including administering appropriations and legislation, and tendering advice to the Minister.[252] The MBIE also provides strategy and policy advice, working closely with the Minister, in relation to the regulation of energy competition.[253] Advice to the government relating to the Authority focuses on energy issues including supply and demand, efficiency and conservation, and renewable energy. The Consumer Protection division also provides information and advice for consumers and businesses.[254]

The Commerce Commission forms part of the MBIE and is responsible for enforcing the Fair Trading and Commerce Acts that the electricity industry is subject to.[255] Its main role is to oversee the efficiency, quality and revenue of New Zealand's electricity transmission and distribution sector.[256]

The Authority

The Authority's responsibilities include developing the market rules, its enforcement and administration as well as monitoring of market performance.[257] The Authority is responsible for governing almost all aspects of New Zealand's electricity industry including[258]:

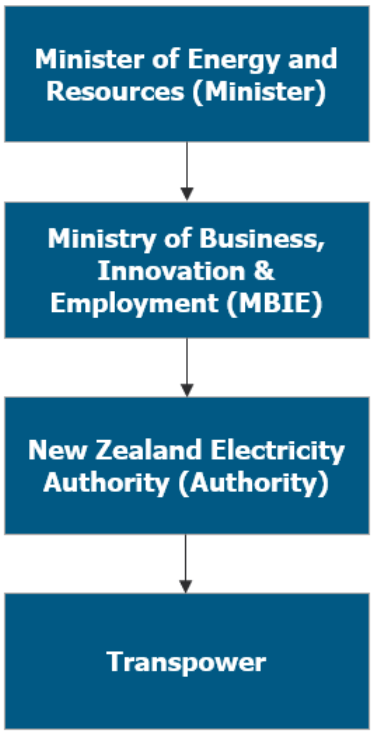
- generation and transmission
- system operation and security of supply
- market arrangements and metering
- distribution and retail.

Transpower

As New Zealand's transmission network is a natural monopoly, Transpower's investments and transmission charges are regulated by the Commerce Commission.[259] Transpower also publishes the Transmission Planning Report — a 15-year forward outlook of issues that may arise affecting demand and generation within the system.[260]

252 Section 27A of the *Crown Entities Act 2004.*
253 Ministry of Business, Innovation and Employment, Our Structure, viewed 11 February 2022, available here.
254 New Zealand Electricity Authority, *Electricity in New Zealand,* 13 November 2018, p. 47, available here.
255 New Zealand Commerce Commission, Commission's role in electricity lines, viewed 24 March 2022, available here.
256 New Zealand Electricity Authority, *Electricity in New Zealand,* 13 November 2018, p. 47, available here.
257 Ministry of Business, Innovation and Employment, Energy markets regulatory system, viewed 11 February 2022, available here.
258 New Zealand Electricity Authority, What we do, viewed 24 March 2022, available here.
259 Transpower, What we do, viewed 11 February 2022, available here.
260 Transpower, *Transmission Planning Report 2020,* July 2020, p. 2, available here.

Figure A.12: New Zealand energy sector governance structure



Source: AEMC created based on New Zealand Ministry of Business, Innovation and Employment, *Our Structure,* available here.

A.5 Singapore

A.5.1 Energy market overview

The NEMS is an energy-only market comprised of a wholesale market and a retail market. The wholesale market has a spot market and a procurement market. The spot market facilitates the trade of wholesale electricity in half-hour intervals via bilateral contracts between generators and wholesale buyers. Ancillary services are contracted in the procurement market, required for maintaining the security and operation of the power system.[261]

The EMC clears the wholesale market and provides settlement services in addition to dispute resolution services. The traders in the wholesale market are generators, retailers, the market support services licensees (MSSL) and contestable consumers registered as market participants.[262]

261 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, p. 2-2, available here.

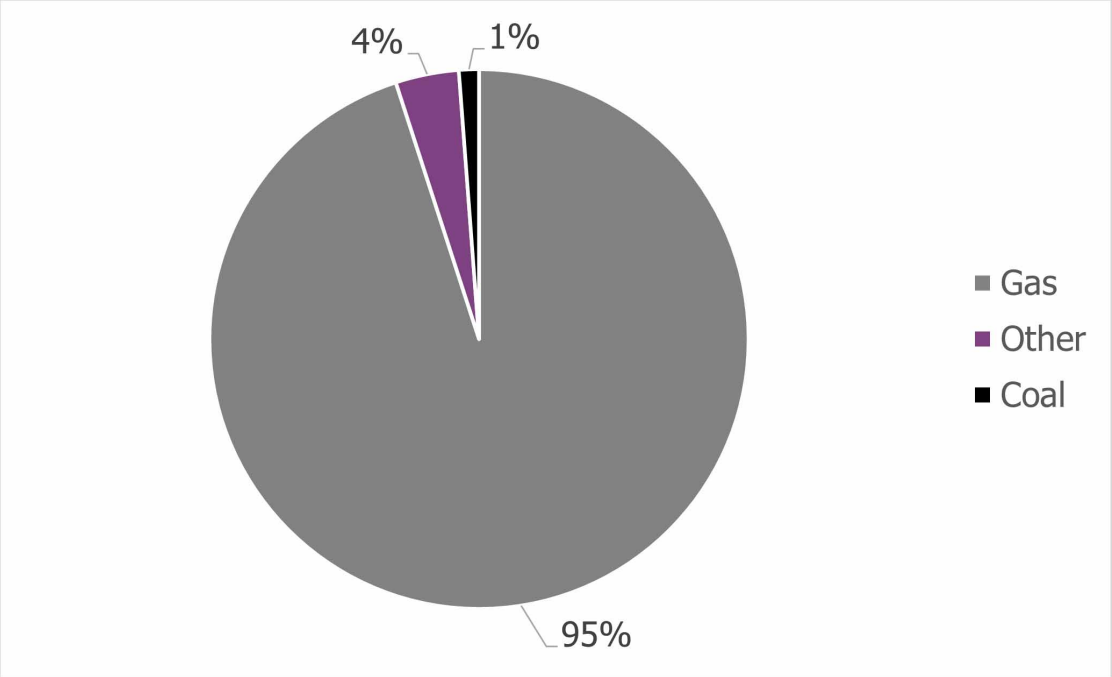
262 Consumers can also be registered as a market participant in the NEMS in Singapore. As such, consumers are categorised as contestable and non-contestable determined by their annual electricity usage.

The retail market is regulated under the *Electricity Act 2001* and by the EMA through electricity licenses and codes of practice. In the retail market MSSLs act as an intermediary between retailers and the wholesale market. Through MSSLs, retailers can directly buy from the wholesale market and sell to consumers. Fees charged to consumers by SP Services Ltd[263] are regulated by the EMA.[264]

Singapore is located along the East-West trade route, making the country a hub for oil storage and refining facilities in the Asia Pacific. As such, Figure A.13 shows that Singapore's energy mix for electricity generation in 2021 largely comprised of natural gas (95%).[265]

As of 2018, the majority of Singapore's carbon emissions derived from the refining and petrochemical sector. According to the International Energy Agency, Singapore's carbon intensity is ranked 126th and it is ranked 27th in terms of emissions per capita out of 142 countries.[266] Figure A.14 shows that carbon emissions from electricity generation have been on an upward trend overall in the past three decades.

Figure A.13: Singapore electricity generation by fuel type (2021)



Source: Energy Market Authority, Electricity Generation, viewed 7 January 2021, available here.

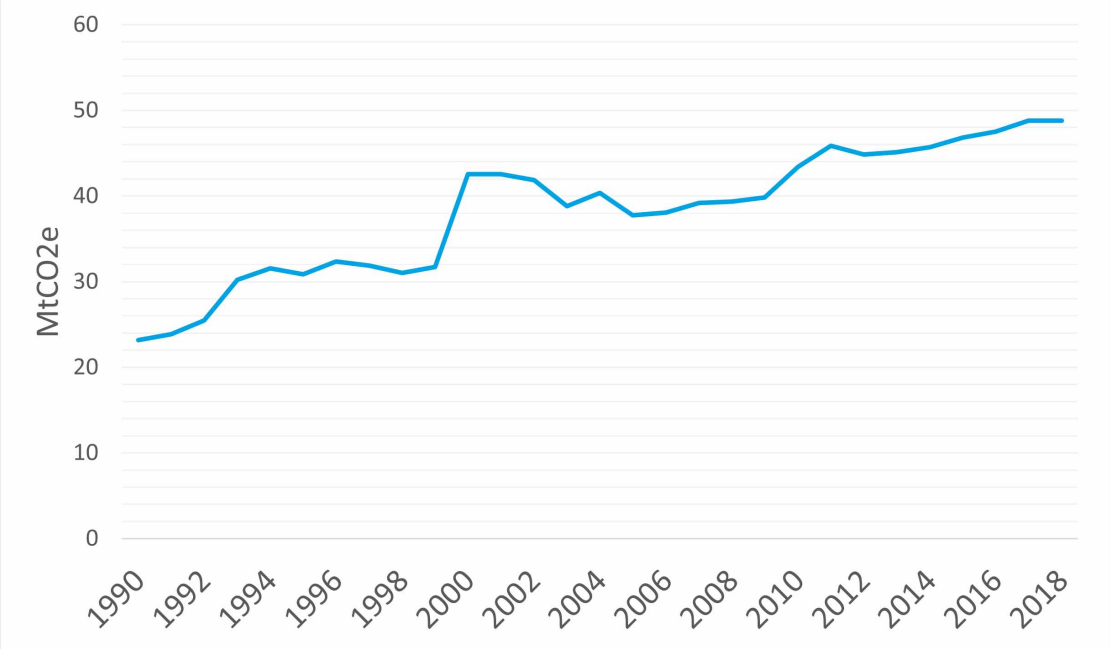
263 A subsidiary of the SP Group, an electricity and gas distribution company owned by the Singapore government.

264 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, p. 2-1, available here.

265 Government of Singapore, Annual Fuel Mix for Electricity Generation by Energy Products, viewed 8 February 2022, available here.

266 National Climate Change Secretariat Strategy Group Prime Minister's Office, Singapore's Emissions Profile, viewed 18 January 2022, available here.

Figure A.14: Singapore carbon emissions by sector (1990-2018)



Source: International Energy Agency, Greenhouse Gas Emissions from Energy Data Explorer, viewed 10 November 2021, available here.

A.5.2 Governance structure

The three key decision-makers in the Singapore energy sector are the:

- EMA
- EMC
- PSO.

EMA

The EMA is a statutory board as part of the Ministry of Trade and Industry and is conferred powers under the *Energy Market Authority of Singapore Act 2001* and the *Electricity Act 2001*.[267] It issues market rules, electricity licenses and codes of practice. It also endorses changes to the Singapore Electricity Market Rules.[268]

EMC

The EMC, which is majority-owned by the EMA,[269] is responsible for the operation and administration of the wholesale market and, administers the market rules that govern the operation of the NEMS. The Rules Change Panel, which is appointed by the EMC Board,

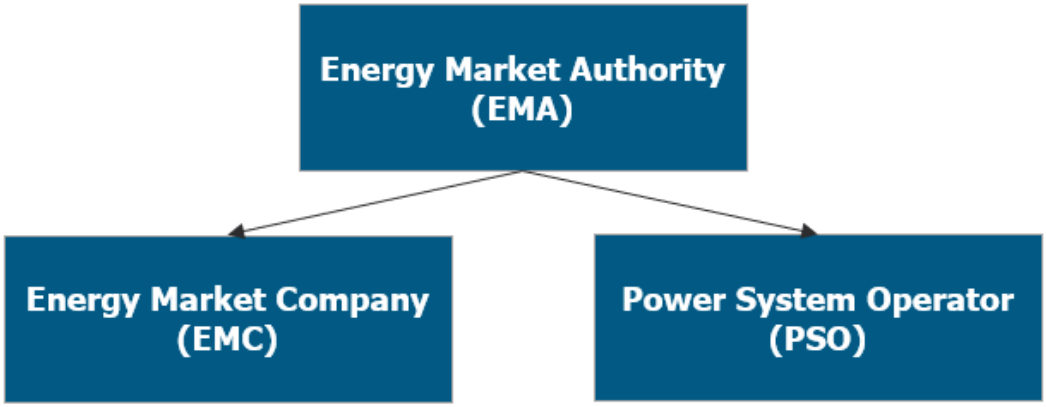
267 Singapore Statues Online, Energy Market Authority of Singapore Act 2001, viewed 22 February 2022, available here.
268 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, p. 2-1, available here.
269 EMC is jointly owned by the EMA and the operator of New Zealand's wholesale market (M-co). EMA has majority ownership.

receives submissions to amend the Market Rules and recommends changes to the EMA for endorsement.[270] The EMC Board is the ultimate decision-maker for rule changes made by the EMC and therefore has a similar function to the Commission at the AEMC.

The PSO

The PSO, a division of the EMA, is responsible for ensuring power system security and reliability.[271] Its functions are similar to that of AEMO as it controls dispatch of electricity from generators in the wholesale market and prevents power outages, among other operational functions of the power system.

Figure A.15: Singapore energy sector governance structure



Source: AEMC created based on Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, available here.

A.6 South Africa

A.6.1 Energy market overview

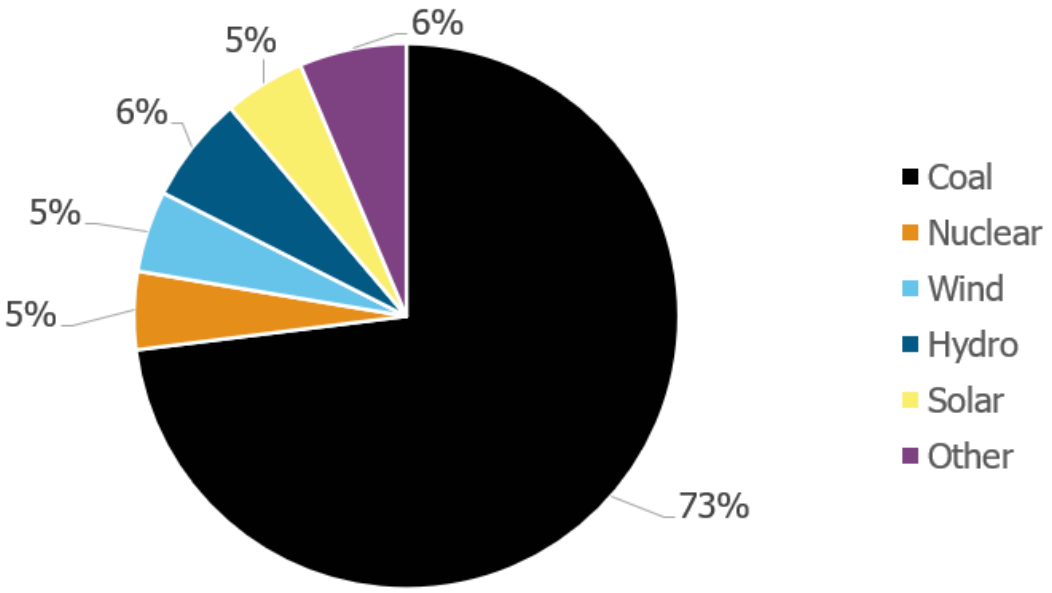
South Africa does not have an electricity spot market. South African electricity prices are determined by a multi-year price determination method, where Eskom determines the prices by taking into consideration the future capacity additions, GDP growth, Consumer Price Index, and Producer Price Index. These prices are then reviewed by NERSA.[272]

South Africa's generation profile mix remains dominated by coal-fired power generation which makes up over 70% of generation capacity (see Figure A.16).[273] However, according to the 2019 IRP, over 24000 MW of conventional thermal power sources are likely to be decommissioned within the next 10 to30 years.[274] Further, Figure A.17 shows that emissions

270 Energy Market Company, Rules Change Panel, viewed 3 September 2021, available here.
271 Energy Market Authority, *Introduction to the National Electricity Market of Singapore*, October 2010, p. 2-4, available here.
272 Beroe 2021, Utilities Electricity South Africa Market Intelligence, viewed 23 September 2021, available here.
273 Enerdata 2021, Renewables accounted for 16.1% of South Africa's power mix in 2020, viewed 20 January 2022, available here.
274 Department of Mineral Resources and Energy, *Integrated Resource Plan*, October 2019, p. 53, viewed 20 January 2022, available here.

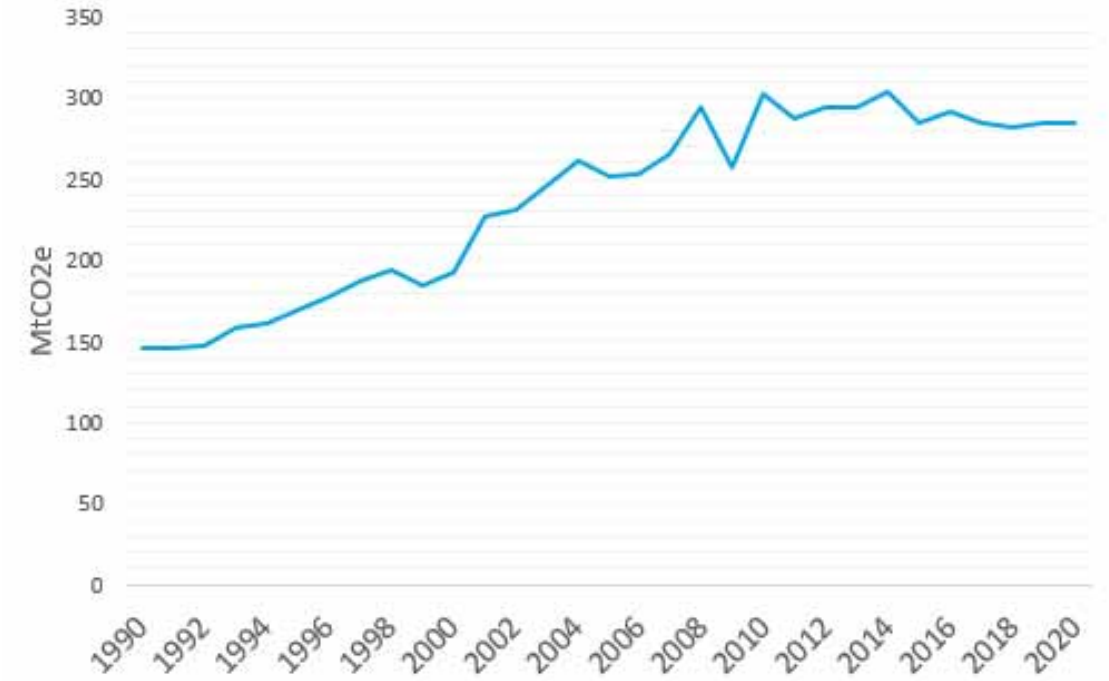
for electricity generation is starting to plateau and is expected to relatively decrease as a result of stronger 2030 climate targets.

Figure A.16: South Africa's electricity generation by fuel type (2020)



Source: Enerdata 2021, Renewables accounted for 16.1% of South Africa's power mix in 2020, viewed 20 January 2022, available here.

Figure A.17: South Africa's emissions from electricity generation (1990 - 2020)



Source: ClimateWatch, Historical GHG emissions: South Africa, viewed 20 February 2020, available here.

A.6.2 Governance structure

South Africa has a regulated energy market with three key decision makers:[275]

- Department of Energy
- NERSA
- Eskom.

The Department of Energy

The Department of Energy is a government entity which acts as the main planning and policy making body for the energy market. It is responsible for ensuring development, utilisation and management of South Africa's energy resources. The Department of Energy is also responsible for creating and amending energy legislation and, under the *Electricity Regulation Act 2006*, is responsible for developing the IRP.[276]

NERSA

275 E le Grange, 2019, Electricity regulation in South Africa: overview, viewed 20 September 2021, available here.
276 Ibid.

NERSA is the regulatory authority for the South African energy market. It is a non-governmental entity and is established as a juristic person under the *National Energy Regulator Act 2004*.[277] The key functions of NERSA are:[278]

- issuing of licences and setting pertinent conditions
- setting and/or approving tariffs and prices
- monitoring and enforcing compliance with licence conditions
- setting of rules, guidelines, and codes for the regulation of the three industries which includes rules designed to implement the IRP.

Eskom

Eskom is listed as a public company, however, the South African government is the sole shareholder of Eskom. The shareholder representative is the Minister of Public Enterprises. It is the national transmission company responsible for the expansion, ownership and maintenance of the national grid. Eskom is a vertically integrated generator and systems operator and supplies 94% of South Africa's electricity.[279] Eskom has a distribution license, but municipalities (local government councils) are mostly responsible for electricity distribution.

NERSA and the Department of Energy work closely together to govern the energy market. The Department of Energy must consult with NERSA in making several determinations such as:[280]

- whether new generation capacity is needed to ensure the continued uninterrupted supply of electricity
- the types of energy sources from which electricity must be generated, and the percentages of electricity that must be generated from these sources
- other generation capacity requirements.

The Department of Energy may amend the Electricity Regulation Act to broaden or reduce NERSA's regulatory oversight. For example, the Department of Energy changed the law to exempt embedded power generation projects with a capacity of up to 100MW from needing to obtain a generation licence.[281]

277 Section 3 of the *National Energy Regulator Act 2004.*

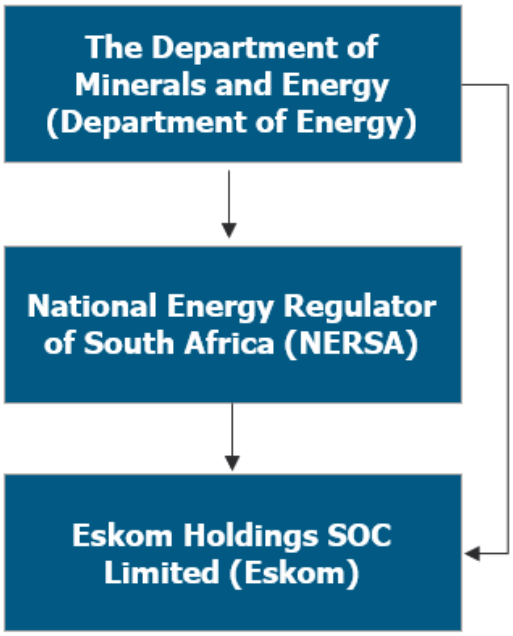
278 NERSA, About us, viewed 1 September 2021, available here.

279 The remaining 6% of electricity is supplied by municipal power stations and independent power producers in the private sector.

280 Section 47 of the *Energy Regulation Act 2006*.

281 Pinsent Masons, South Africa embedded generation changes to boost energy security, viewed 16 September 2021, available here.

Figure A.18: South Africa energy sector governance structure



Source: AEMC created based on Thomson Reuters Practical Law, Electricity Regulation in South Africa: overview, viewed 20 September 2021, available here; and Pinsent Masons, South Africa embedded generation changes to boost energy security, viewed 16 September 2021, available here.

A.7 United Kingdom

A.7.1 Energy market overview

The United Kingdom's energy sector was privatised in 1990. Following privatisation, competition emerged in the retail and wholesale markets. There are around 60 energy suppliers in the United Kingdom and of these, the market is dominated by the six largest companies.[282]

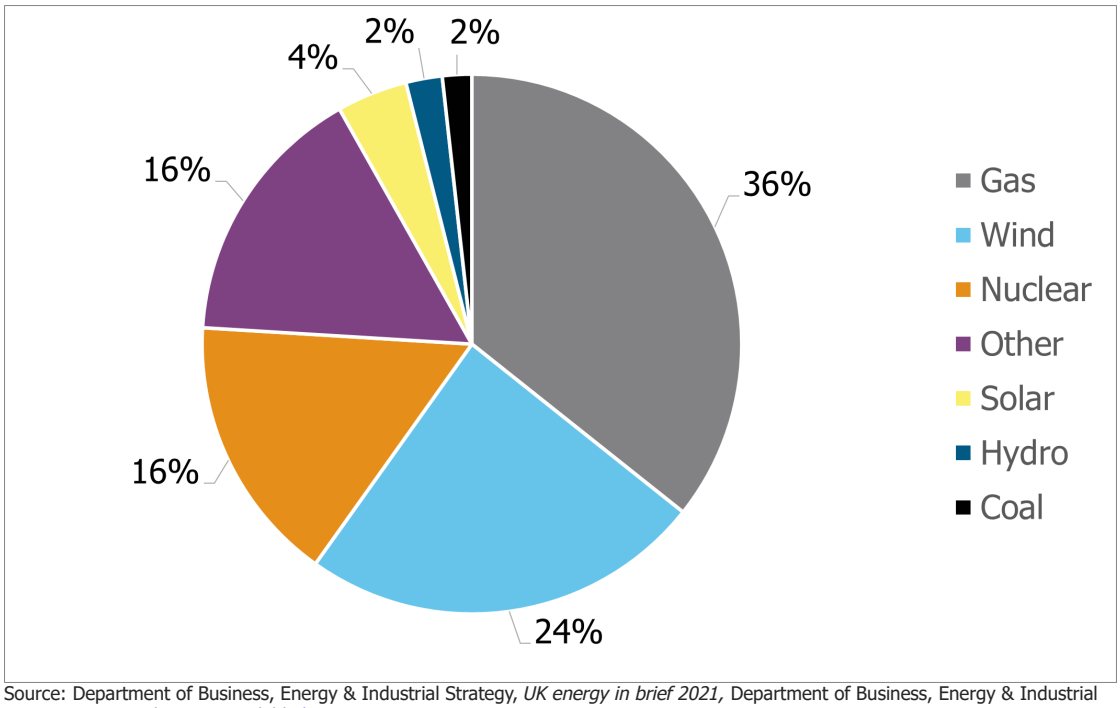
The transmission network includes four Interconnectors: France to Great Britain, Northern Ireland to Great Britain, the Republic of Ireland to Great Britain and the Netherlands to Great Britain. The distribution network is split into 14 areas within Great Britain, which are run by private companies as a regulated monopoly.[283]

In the energy market, generators and suppliers buy and sell electricity either under contract or through the spot market pool, which is a collective organisation of electricity generators and suppliers. Electricity is traded in 30-minute Settlement Periods and the Balancing Mechanism allows for real time management to ensure that supply matches demand and to address any issues with transportation and delivery.[284]

282 S Barrett, All You Need To Know About How The UK Energy Market Works, Forbes, 2021, viewed November 2021, available here.
283 Elexon, *The Electicity Trading Arrangement - A Beginner's Guide,* 2019, p. 4, available here.
284 Ibid.

The generation mix throughout the United Kingdom has changed dramatically as suppliers transition to increased uptake in renewables. In 1970, 91% of energy came from oil and coal sources. In 2020, this fell to 5%, however, the use of gas has increased.[285] In 2019, territorial GHG emissions were estimated to be 44% lower than in 1990. The transport sector was the largest single source of GHG emissions in 2019, accounting for 27% of total emissions. In 2019, GHG emissions from the energy supply sector accounted for 21% and have decreased by 66% since 1990 due to changes in the electricity mix.[286]

Figure A.19: United Kingdom electricity generation by fuel type (2020)

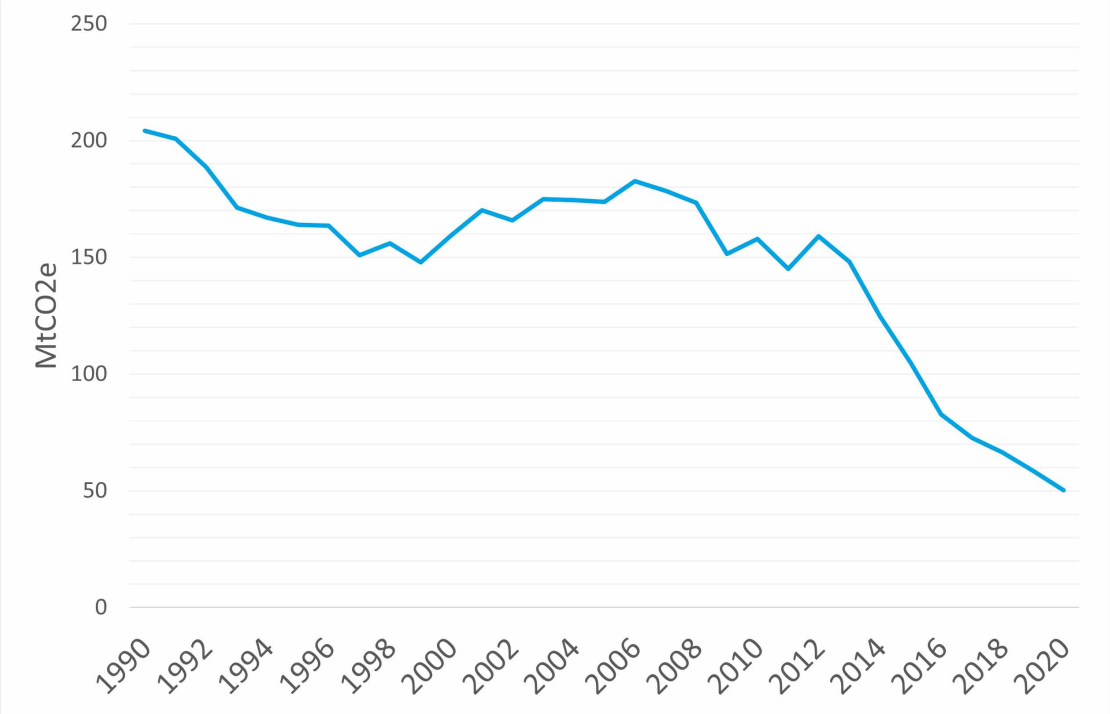


Source: Department of Business, Energy & Industrial Strategy, *UK energy in brief 2021,* Department of Business, Energy & Industrial Strategy, July 2021, available here.

285 Ibid.

286 Department of Business, Energy & Industrial Strategy, *UK Energy in Brief,* Department of Business, Energy & Industrial Strategy, 2021, p. 18, available here.

Figure A.20: United Kingdom greenhouse gas emissions by sector (1990-2019)



Source: Gov.uk, Final UK greenhouse gas emissions national statistics: 1990 to 2020, March 2022, available here.

A.7.2 Governance structure

The key decision-makers in the United Kingdom's energy sector are:

- BEIS
- GEMA
- Ofgem
- National Grid.

BEIS

BEIS is the energy policy maker in the United Kingdom. BEIS is led by the Secretary of State for Business, Energy and Industrial Strategy (Secretary of State) and is responsible for ensuring the United Kingdom meets statutory targets for reducing GHG emissions. Its energy related strategic objectives are to:

- ensure the United Kingdom's energy system is reliable and secure
- deliver affordable energy for households and businesses
- support clean growth and promote global action to tackle climate change.[287]

GEMA

287 Gov.uk, About us, viewed November 2021, available here.

GEMA are a governing body that oversee Ofgem and are accountable to the Secretary of State. GEMA determines Ofgem's strategy, sets policy priorities and makes decisions on a wide range of regulatory matters, including price controls and enforcement.[288]

GEMA delegates their work to Ofgem who support GEMA in its day to day operations.[289] The two organisations are closely linked to such an extent that the terms 'Ofgem' and 'GEMA' are used interchangeably in many contexts.[290]

Ofgem

Ofgem is the United Kingdom energy market regulator. Ofgem's role is to monitor the retail and wholesale electricity markets and downstream natural gas markets,[291] and regulate the construction and operation of network infrastructure.[292] Ofgem is also responsible for making regulatory decisions that ensure the electricity market works in the interests of consumers.[293]

Ofgem is directly accountable to BEIS as set out in Part 1 of the *Utilities Act 2000*. They deliver many of the government's environmental and social support schemes which are key in enabling low carbon energy.[294] Ofgem is required under section 132 of the *Energy Act 2013* to have regard to any strategic priorities set out by the Secretary of State and must publish a document explaining how it intends to meet the policy objectives outlined by BEIS.[295] Further, Ofgem is required to inform BEIS of its progress in helping to achieve BEIS' policy objectives and demonstrate how resources are being used to achieve those objectives.[296]

National Grid

National Grid is the market operator for the United Kingdom's energy system. They balance supply and demand by managing the settlement system and funds administration platform in the spot market pool so that customers have reliable access to electricity. National Grid also own the high-voltage electricity transmission network in England and Wales.[297]

National Grid ESO is part of National Grid and is responsible for moving high-voltage electricity around the country.[298] National Grid ESO is regulated by Ofgem through regulatory price controls that set out the services they must provide and the amount they can recover from consumers to deliver these services.[299]

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288 Ofgem, Our powers and duties, viewed November 2021, available here.

289 K Massie, J England, *Electricity regulation in the UK (England and Wales): Overview,* Thomson Reuters Practical Law, viewed November 2021, available here.

290 Ofgem, *Consultation: GEMA gaining enforcement powers under The Business Protectionfrom Misleading Marketing Regulations 2008,* February 2013, p. 1, available here.

291 Ofgem, *Framework Document,* Ofgem, 2019, p. 2, available here.

292 Ofgem, *Ofgem's Decarbonisation Action Plan,* Ofgem, February 2020, p. 12, available here.

293 K Massie, J England, *Electricity regulation in the UK (England and Wales): Overview,* Thomson Reuters Practical Law, viewed November 2021, available here.

294 Ofgem, *Ofgem's Decarbonisation Action Plan,* Ofgem, February 2020, p. 12, available here.

295 Ofgem, *Framework Document,* Ofgem, 2019, p. 2, available here.

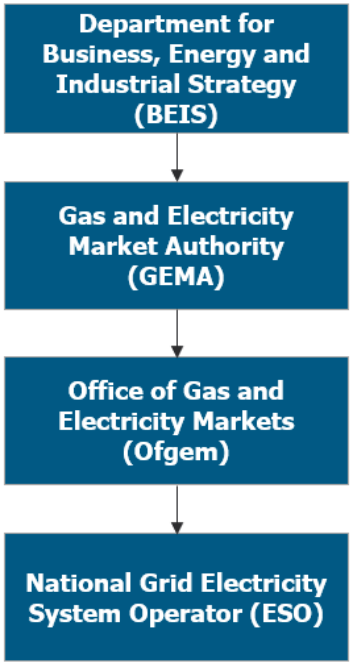
296 Ibid.

297 National Grid, What we do, viewed April 2022, available here.

298 NationalgridESO, What we do, viewed 12 May 2022, available here.

299 nationalgridESO, How we're regulated, viewed May 2022, available here.

Figure A.21: United Kingdom energy governnace structure



Source: AEMC created based on Gov.uk, About us, viewed November 2021, available here; and Ofgem, Our powers and duties, viewed November 2021, available here.

A.8 United States

A.8.1 Energy market overview

In the United States, the electricity markets operate differently depending on their location. Some areas of the country are served by municipally owned utilities, and other areas are served by customer owned rural co-operatives. However, the majority of utilities are privately owned. These are generally either vertically integrated monopolies[300], or a de-regulated market, with some federal oversight over wholesale market operations.[301]

Prices in the vertically integrated markets are based on recovering a 'fair' rate of return. This instrument, which is determined by a state utility board, will recover the operating and investment costs along with the rate of return for that investment.[302] In the 1990s, some markets began to move away from this model which involved selling generation assets and creating independent energy suppliers within a competitive wholesale market. The transmission and distribution assets now form regulated monopolies. Utilities and retailers in de-regulated markets do not generate their own electricity and as such need to purchase power for their customers in the centralised wholesale market. In these centralised wholesale

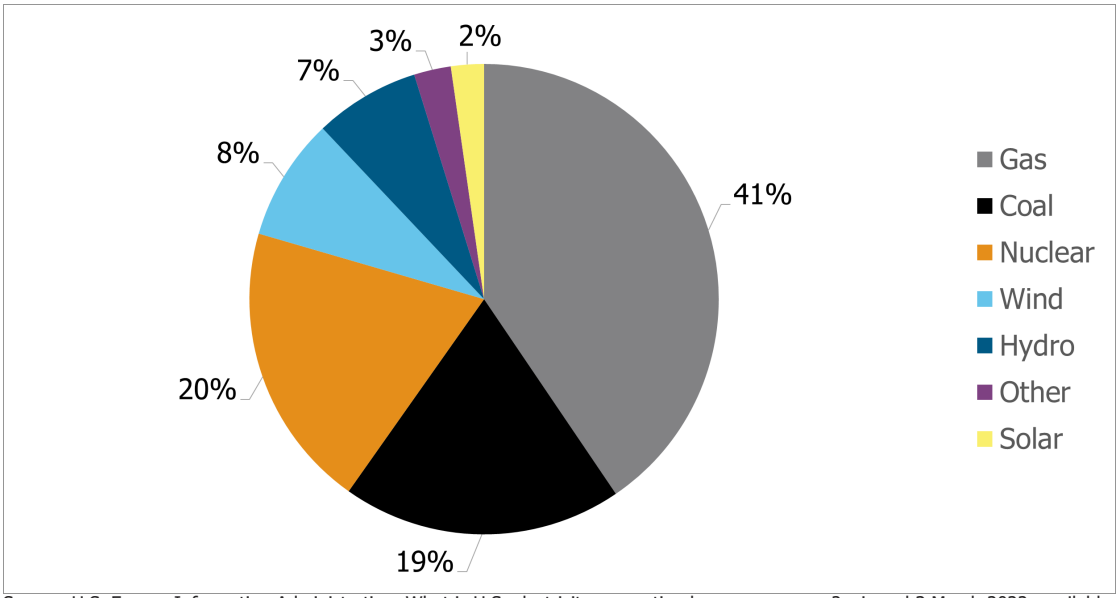
300 Traditional vertically integrated markets account for approximately one third of electricity demand in the United States.
301 Resources for the Future, US Electricity Markets 101, viewed 28 March 2022, available here.
302 Ibid.

markets generators sell wholesale power to load serving entities, such as a utility or retailer. The centralised wholesale markets are usually operated by either a Regional Transmission operator (RTO), or an Independent System Operator (ISO) in a deregulated market. [303]

Wholesale energy markets in the United States are typically auctions where suppliers offer their load at a particular price, while load serving entities bid to meet their customer's demand. Markets clear when supply matches demand. Generators receive the market price per megawatt hour generated. RTOs typically run two markets, a day ahead market[304] and a real time market. Some RTOs also run capacity markets which ensure there is a certain amount of energy that can be dispatched if required to meet unexpected demand.[305]

In 2020, the United States generated approximately 4.01 trillion kW/h of electricity at utility scale. Approximately 60% was derived from fossil fuels, 20% from nuclear and 20% from renewable sources. Additionally, around 42 Billion kW/h of generation was derived from small scale solar photovoltaic systems.[306] Figure A.23 shows that greenhouse gas emissions associated with electricity production in the United States have declined since the mid 2000s.

Figure A.22: Electricity generation by fuel source (2021)



Source: U.S. Energy Information Administration, What is U.S. electricity generation by energy source?, viewed 3 March 2022, available here.

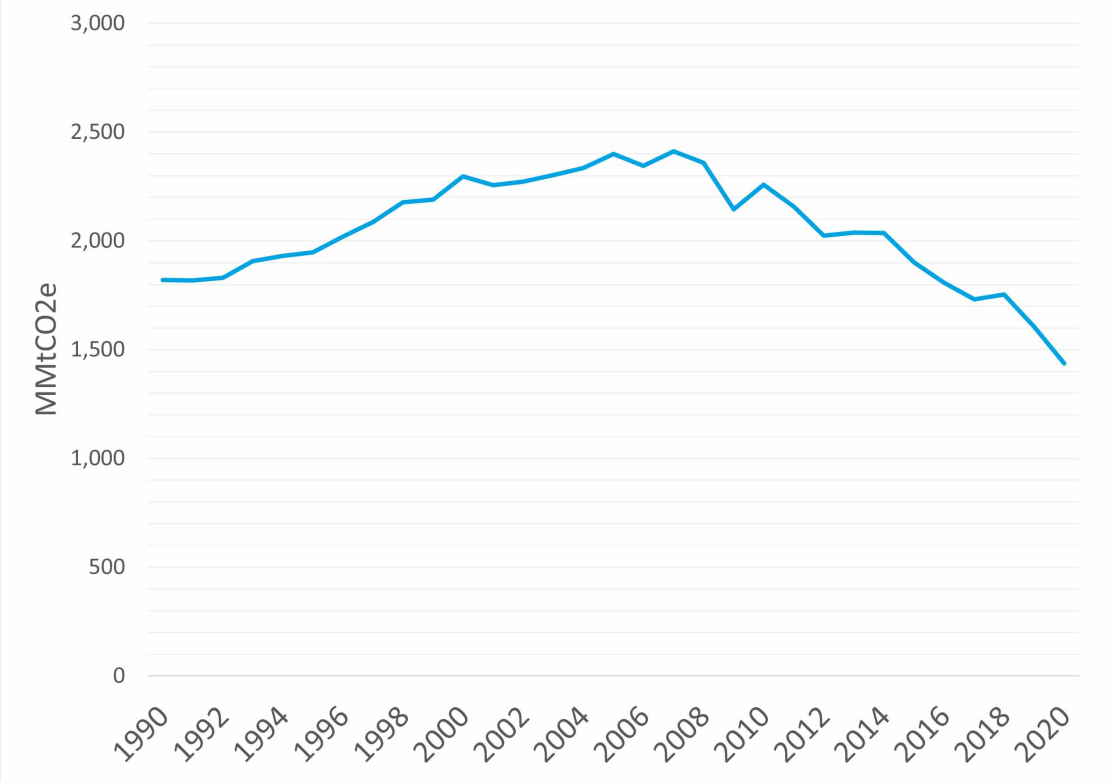
303 Ibid.

304 Around 95% of the transactions occur in this market.

305 Ibid.

306 US Energy Information Administration, What is U.S. electricity generation by energy course, viewed 28 March 2022, available here.

Figure A.23: United States greenhouse gas emissions by sector (1990-2019)



Source: United States Environmental Protection Agency, Greenhouse Gas Inventory Data Explorer, viewed 3 March 2022, available here.

A.8.2 Governance structure

The key-decision makers in the United States are:

- The Federal Government
- FERC
- State governments and regulators
- System operators.

FERC

FERC consists of up to five Commissioners who are appointed by the President for five-year terms, subject to approval by the Senate. Laws passed by Congress affect the powers and functions of FERC and regulatory decisions made by FERC can be appealed to Federal Courts.[307]

FERC regulates the interstate sale of natural gas, electricity and oil. It also has powers to review proposals and licences for instance in relation to the construction of LNG terminals

307 Federal Energy Regulatory Commission, What FERC Does, viewed 28 March 2022, available here.

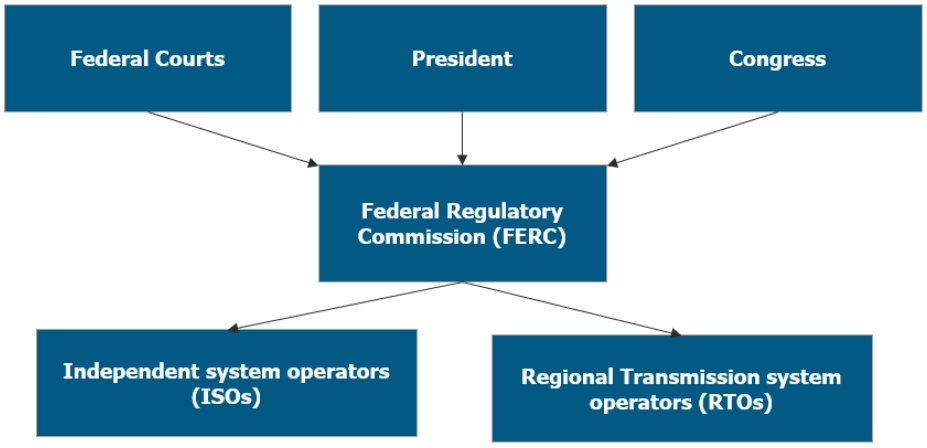
and gas pipelines, and the operation of hydropower facilities. As part of its duty to regulate the sale of electricity, FERC is responsible for the regulation of entities that are either RTOs or ISOs. [308]

There are a number of areas of regulation outside of FERC's remit that are dealt with by State Public Utility Commissions. For example, the regulation of retail electricity and natural gas sales to consumers, and of local distribution pipelines of natural gas.[309]

System operators

System operators, such as PJM RTO and California ISO, are entities that run different energy markets, and are regulated by FERC. The intention of these regional groupings, and subsequent markets is to facilitate competition in wholesale markets and provide open access transmission.[310]

Figure A.24: United States energy governance structure



Source: AEMC created based on Federal Energy Regulatory Commission, What FERC Does, viewed 28 March 2022, available here.

308 Ibid.
309 Ibid.
310 Federal Energy Regulatory Commission, Electric Power Markets, viewed 3 March 2022, available here.