Ireland 2024

Energy Policy Review

International Energy Agency

INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 32 Member countries, 13 Association countries and beyond.

IEA Member countries:

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Korea
Latvia
Lithuania
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Spain
Sweden
Switzerland
Republic of Türkiye
United Kingdom
United States

The European Commission also participates in the work of the IEA

IEA Association countries:

Argentina
Brazil
China
Egypt
India
Indonesia
Kenya
Morocco
Senegal
Singapore
South Africa
Thailand
Ukraine

Source: IEA.
International Energy Agency
Website: www.iea.org

Table of contents

Executive summary

The IEA energy policy review of Ireland took place from 18 to 22 April 2023. It came at an opportune time for Ireland, which published a comprehensive package of energy security measures to 2030 in November 2023. The package sets out permanent measures to guarantee long-term security of supply to ensure net zero emissions in 2050 and short-term, transitional measures to 2030. Given Ireland's location and its current reliance on electricity and natural gas imports from a single supply source, the commitment to supply 80% of electricity from renewable sources by 2030 has important climate and energy security benefits. The 2021 Climate Act requires the implementation of a carbon budget to reach an emissions reduction target of 51% by 2030 compared to 2018. Ireland is currently not on track to meet this target.

Implementation must accelerate to reach 2030 targets

The IEA commends the Irish government for its comprehensive list of targets, policies and strategies to support the achievement of its energy and climate ambitions. The annual climate action plans are a useful means of tracking progress and proposing remedial actions. They should, however, be short and succinct, and focus on accelerating implementation. Furthermore, there is evidence that some of the infrastructure needed to deliver Ireland's ambitious targets is being delayed or not built. Ireland now needs to firmly move from the policy-setting phase towards the implementation phase and ensure that necessary investments are unlocked.

Long permitting processes threaten the transition

The lack of a speedy and predictable planning and consenting regime is a major bottleneck for Ireland's energy transition. This impacts the entire energy sector value chain, including much-needed electricity interconnections. The IEA welcomes ongoing work to revise the National Planning Framework and encourages the government to bring this to an early conclusion and speedy implementation. Streamlining processes may require comprehensive changes to the legal and regulatory framework as evidence from other IEA countries suggests. In this regard, the publication in November 2023 of a new Planning and Development Bill is welcome. Proposed reforms such as improved consistency and alignment along the planning chain, the reform of An Bord Pleanála, and the introduction of statutory timelines for decision making have the potential to make a positive contribution to energy developments.

Planning authorities need more resources to ensure they have sufficient and appropriately trained staff to process applications promptly. Skills and workforce shortages are another impediment to the energy transition. The regional retrofit centres of excellence and the mobile training initiative to inform students about green careers are helpful initiatives. Ireland may wish to explore initiatives in other IEA countries that work closely with industry in this sector and consider integrating topics relevant to the transition into all curricula.

Offshore renewables will drive the transition beyond 2030 but natural gas will be needed until then

Ireland's relatively untapped renewable energy potential, notably offshore wind, can not only support the decarbonisation of the power sector but also other parts of the economy through sector coupling and the production of renewable hydrogen. For this to happen, an enabling hydrogen development framework must be put in place.

In 2023, variable renewable power generation accounted for 36% of total electricity output, one of the highest shares globally. Ireland plans to have 22 gigawatts (GW) of installed renewable capacity by 2030, including 8 GW of solar and at least 5 GW of offshore wind. Spatial planning must take a holistic approach and the IEA welcomes Ireland's policy of complementing the national Renewable Electricity Spatial Planning Framework with regional spatial, economic and renewable electricity strategies.

Ireland is putting in place a new framework to ensure a plan-led approach for the exploration of its maritime resources, including the creation of a new and independent maritime area regulatory authority. This new authority needs to be resourced with the staff and skills commensurate to its growing responsibilities. Ireland's first offshore wind auction in 2023 was successful owing to its design, which allowed for inflation and compensation in case of curtailment.

Ireland will continue to rely on natural gas, which in 2022 accounted for one-third of total energy supply and almost half of electricity production. The government plans to install at least 2 GW of flexible gas-fired capacity to 2030 replacing oil, peat and coal generation to ensure being able to meet peak electricity demand in a generation mix increasingly dominated by variable renewables. This capacity is also needed to meet growing electricity demand from heating, transport and data centres, the latter being a key economic sector. This implies temporarily increasing import dependency before renewable indigenous gas and renewable gas-compatible storage becomes available. Ireland currently does not have a gas storage facility.

The government is assessing potential sites for hydrogen and future renewable gas storage as long-term security of supply solutions, as well as the creation of a transitional state-led strategic gas emergency reserve to deliver greater resilience in the event of a disruption of the country's natural gas supplies.

Ireland's inclusive energy transition offers important lessons

A key feature of the renewable electricity support schemes is the requirement for project promoters to establish a community benefit fund into which they must pay EUR 2 per megawatt hour (MWh) to ensure that local hosting communities benefit directly. Communities are fully involved in decision making related to how the fund's proceeds are spent and will be assisted by professional fund administrators. The IEA welcomes this policy as it will realise wider societal benefits of the energy transition and improve public acceptance of new infrastructure.

Ireland is also implementing an enabling framework for active community participation targeting farms, schools, communities and small businesses under its support scheme. It created a dedicated Small-scale Renewable Electricity Support Scheme to support small and medium-sized enterprises and community projects and a micro-generation support scheme for smaller installations. These schemes target small farms, businesses, schools and communities. What makes them unique, however, is the provision of technical and financial support through a one-stop facility to enable interested communities to overcome typical barriers.

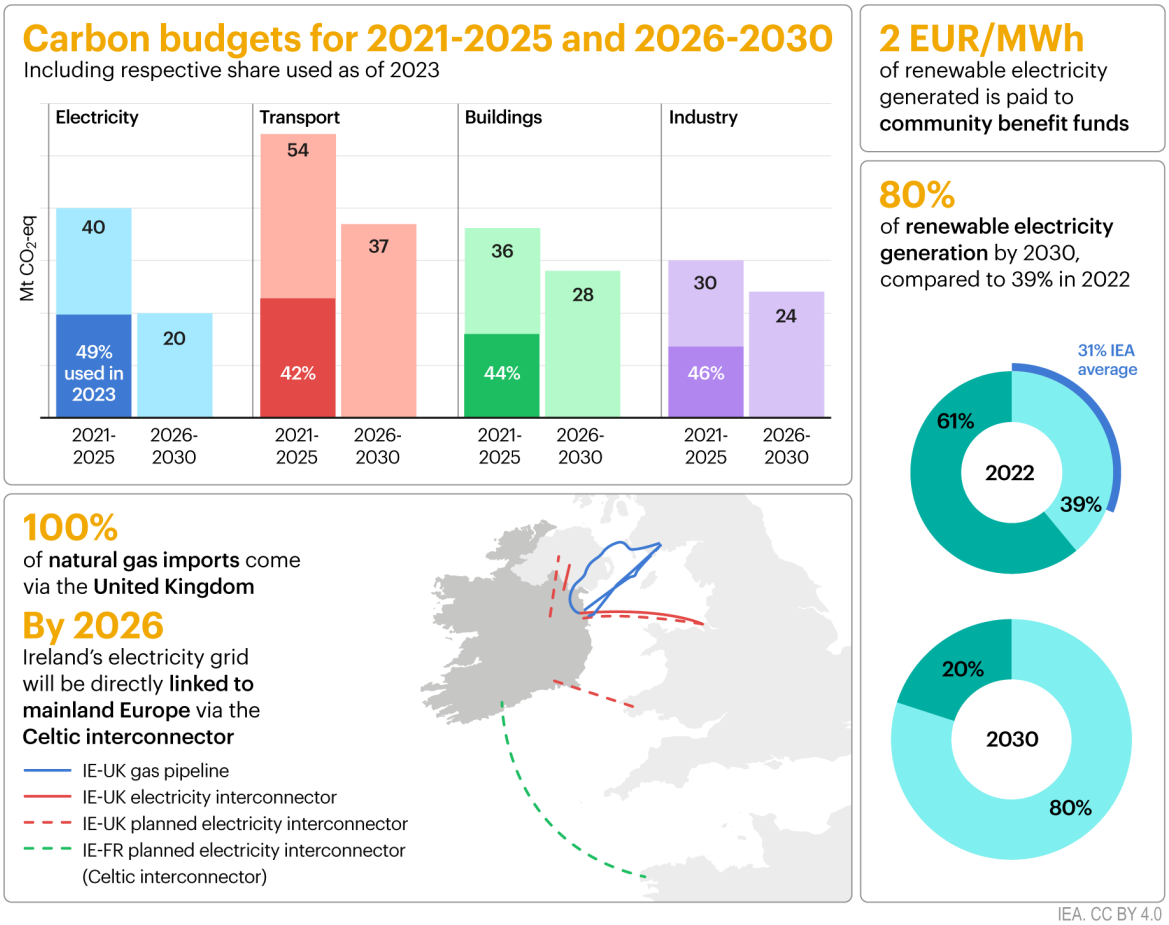
Further emissions reductions from buildings are essential

Despite having a relatively new building stock, Ireland has the highest share of oil in space heating among IEA countries owing to a dispersed population and limited gas infrastructure. Space heating accounts for 60% of energy demand in residential buildings and buildings are the single largest sector in final energy consumption. Since 2021, all new buildings need to comply with a zero energy buildings standard.

Ireland offers various support programmes targeting different types of renovation and households at the risk of energy poverty, which receive fully funded upgrades. Ireland applies the fabric-first principle, which requires first an improvement of the building envelope before supporting the installation of heat pumps. While this prevents the installation of oversized heating systems, it also slows down the shift to more efficient and clean heating systems. There is a need to strike a balance, as deep retrofits can make projects financially unattractive in some cases.

In 2022, the government introduced the one-stop shop service offering start-to-finish project management service, including access to financing, for multiple energy upgrades to achieve a set minimum final energy efficiency performance. The scheme has been successful to date, with 18 such services across Ireland and more expected in the future. Making retrofitting as easy as possible for homeowners is an important element in its success and the IEA encourages the government to continue its efforts in this area.

Smart meters are key components of a grid-interactive efficient building that facilitate more demand-side flexibility. Ireland should require the installation of smart communication-enabled equipment when providing funding for heat pumps and electric vehicle charging equipment.



Note: Mt CO_2-eq = million tonnes carbon dioxide equivalent; IE-UK = Ireland-United Kingdom; IE-FR = Ireland-France.

1. General energy and climate policy

Energy policy in Ireland is mainly driven by climate policy and climate legislation, in particular the Climate Action and Low Carbon Development (Amendment) Act 2021 (Climate Act 2021). The Climate Act 2021 commits Ireland to the legally binding targets of a 51% greenhouse gas (GHG) emissions reduction by 2030 compared to 2018 and net zero by 2050. Ireland's ambitious climate targets enjoy broad public support.

Ireland has published numerous documents defining its energy and climate policies, targets and supporting measures. Its key documents include Ireland's Energy Policy of 2020, the Climate Action Plans (CAP), the National Energy and Climate Plan (NECP) 2021-2030, Ireland's Territorial Just Transition Plan (2022), the Energy Poverty Action Plan (2022), and the National Energy Security Framework (2022). All European Union (EU) member states must establish an NECP, which defines how each country will contribute to achieving EU-wide climate and energy targets. More documents are currently under preparation, including the mandatory update of the NECP.

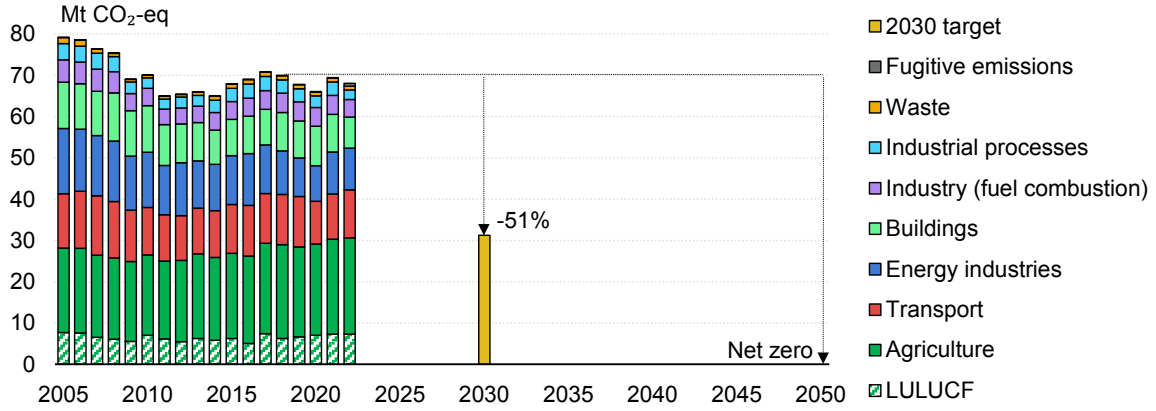
In 2022, Ireland's total GHG emissions (including from land use, land-use change and forestry [LULUCF]) stood at 68 Mt CO_2-eq, a 14% decline since 2005 and a 3% decline since 2018. The agricultural sector accounted for over 38% of the country's total GHG emissions, and is the single largest emissions sector, followed by transport (19%) energy industries (including electricity generation) (17%), buildings (12%) and industry (fuel combustion) (7%) (Figure 1.1). The LULUCF sector is a source of emissions in Ireland.

The Climate Act 2021 requires the preparation and implementation of a carbon budget programme. This programme comprises five-year budget periods that must set Ireland on a pathway to meeting the legally required emissions reduction of 51% by 2030 and the national climate objective of net zero emissions by no later than 2050. The first set of carbon budgets were approved in 2022 and comprised three five-year periods from 2021 to 2035, with increasing average annual emissions reductions:

- 295 Mt CO_2-eq from 2021 to 2025
- 200 Mt CO_2-eq from 2026 to 2030
- 151 Mt CO_2-eq from 2031 to 2035 (provisional).

The carbon budgets have sectoral emissions ceilings which provide sector-specific emissions reduction limits. The ceilings have varying allocations of emissions reductions to 2030 ranging from 35% for the industry sector to 75% for electricity against a 2018 baseline (Table 1.1). The sectoral trajectories set out through the ceilings are broadly consistent with the commerciality of currently available technologies.

Figure 1.1 Total GHG emissions by sector in Ireland, 2005-2022 and targets



Sources: IEA analysis based on UNFCCC (2023), Greenhouse Gas Inventory Data and EPA (2023), Ireland's Greenhouse Gas Projections 2022-2030.

The underlying analysis undertaken to inform the process of preparing the ceilings was based on analysis utilised to deliver CAP21. Through an iterative process, measures and actions were assessed and refined to determine their emissions abatement potential, while also considering various other factors and constraints such as cost, feasibility and socio-economic impact. Given Ireland's exceptionally large share of agricultural GHG emissions and the greater challenges to reduce these emissions, the government is seeking to deliver proportionally larger reductions in electricity and transport.

Ireland is not on track to meet its emissions reduction target for 2030. The latest data from the Irish Environment Protection Agency shows that on current trends, Ireland will exceed its first carbon budget in almost all sectors. In fact, for every sector, over 40% of the first carbon budget ceiling had already been used in the first two years (2021-22), with three years remaining. Among the energy-related emissions, the transport sector was the only sector with increasing GHG emissions year-on-year to 2022, with a 6% increase.

As not all sectors have an emissions ceiling, the sectoral emissions ceilings do not currently add to the national carbon budget for a given period. This is in part due to the deferral to set a ceiling for the LULUCF sector, given the emergence of new scientific information at the time the ceilings were being adopted, and the

inclusion of about 26 Mt CO_2-eq in unallocated emissions savings for the second carbon budget period (2026-30). This reflects that some future emissions abatement could not be allocated at this time and will be dependent on emerging and future technologies. The model to develop the carbon budgets includes contributions by technologies offsetting emissions, such as carbon capture and storage (CCS) and bio-sequestration in achieving both the 2030 and 2050 targets. CCS is needed particularly in hard-to-abate industry sectors such as cement and lime.

Table 1.1 Sectoral emissions ceilings in Ireland, 2021-2030

Mt CO_2-eq	Baseline	Emissions ceilings		Emissions in 2030	
Sector	2018	2021-2025	2026-2030	Absolute target	Reduction compared to 2018
Electricity	10	40	20	3	75%
Transport	12	54	37	6	50%
Buildings	9	36	28	5	45%
Residential	7	29	23	4	40%
Commercial	2	7	5	1	45%
Industry	7	30	24	4	35%

Note: Table reflects what was agreed by the government on 28 July 2022. Agriculture is outside the scope of this review and hence not included in the table.

Climate action plans

The government prepares annual CAPs to monitor the progress made towards the climate targets and assess the actions and budget needed. CAP23 estimates that reaching the 2030 emissions targets will require EUR 120 billion while CAP24 increased the estimate to EUR 125 billion. The Climate Change Advisory Council assessed that CAP23 is still not sufficient to deliver the targets for 2030, mainly because of the challenge of decreasing emissions from agriculture and LULUCF. The Irish government has identified sectoral measures to support the achievement of the targets. Non-energy emissions from the agricultural sector fall outside the scope of this review.

The Irish government is interested in exploring the potential for agrivoltaics. The IEA Technology Collaboration Programme (TCP) on Photovoltaic Power Systems organised a workshop in December 2022 on the legal framework for agrivoltaics in selected countries. Ireland is encouraged to reach out to the Photovoltaic Power Systems TCP (of which it is currently not a member) to learn from other countries' experiences.

The Irish government may also wish to study the findings of a 2022 study by the Fraunhofer Institute for Solar Energy Systems in Germany. The study assesses how agrivoltaics can support the German energy transition and includes two best practice examples for dialogue and engagement with citizens. Looking specifically

at Ireland, a July 2023 study by the University of Aarhus in Denmark found that 63% of Irish land would be suitable for agrivoltaics. These analytic works could possibly feed into the development of an national solar land-use policy that was mentioned as a possibility by the Irish Minister for Agriculture, Food and the Marine in July 2023. However, it is worth noting that there is no unilateral view on the benefits of agrivoltaics. In fact, the Netherlands appears to be considering a ban on agrivoltaics owing to concerns voiced by farmers.

Local authorities in Ireland are required to prepare a local authority climate action plan covering climate mitigation and adaptation measures. The Department of the Environment, Climate and Communications (DECC) funds two staff members in each local authority: a climate action officer and a climate co-ordinator. The plans will align with the national CAP and support its delivery. The local authority climate action plans are expected to support resilience and climate mitigation by reducing overall risk, especially flood risk.

The CAPs provide a useful means of tracking and evaluating the progress made in the various sectors and the remedial action to be taken if sectoral emissions ceilings are not being met. However, the annual preparation of the extensive CAPs (CAP23 is 284 pages long and CAP24 420 pages long) and the quarterly progress plans require significant resources. Ideally, the government should reduce the frequency of the CAP. If that is not possible due to statutory requirements, it should explore ways to considerably shorten its length and complexity and focus on identifying targeted action in support of reaching the energy and climate targets instead of being an end in themselves.

High-level policies must be coherent, a holistic view must be taken when sectoral plans are developed to ensure consistency and tangible action must be taken to ensure that the government's climate agenda is realised. There is evidence that some of the infrastructure needed to deliver these ambitions and targets is being delayed or not being built. This may compromise the achievement of Ireland's energy and climate commitments and undermine investor confidence. Ireland now needs to firmly move into the implementation phase and ensure that necessary investments are unlocked.

Energy sector targets to 2030 are ambitious and implementation needs to accelerate

To stay within the sectoral emissions ceiling Ireland plans to:

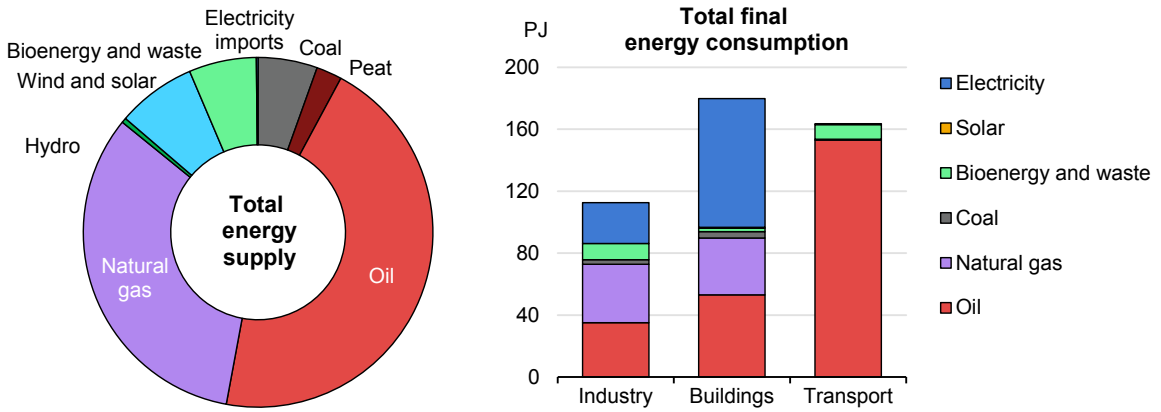
- install 22 GW of renewable capacity by 2030 (from 5.4 GW in 2023)
- achieve an almost 50-fold increase in annual deep retrofits (from 1 500 homes in 2019 to 75 000 by 2030)

- reduce vehicle kilometres travelled by 20% and increase the share of EVs in the private car fleet to a minimum of 30% (from about 4.5% in 2023)
- substantially increase energy efficiency and electrification in the industrial sector and the deployment of renewable fuels.

To achieve this, Ireland will need to make dramatic changes in its energy supply in a very short period of time, as energy demand is currently highly dependent on fossil fuels (71% of total final consumption in 2022).

In 2022, buildings was the single largest consuming sector (40%), followed by transport (35%), which has the highest demand for oil products (Figure 1.2). Almost half of electricity generation comes from natural gas, whereas wind's share is 33%. The remainder comes from coal (7%), oil (3%), bioenergy (4%), hydro (2%) and peat (1%) (see Chapter 4).

Figure 1.2 Total energy supply and demand by source in Ireland, 2022



Note: PJ = petajoule.
Source: IEA (2023), World Energy Balances (database).

Energy efficiency is central for reaching Ireland's emissions targets. The revised EU Energy Efficiency Directive came into force on 10 October 2023 and includes a higher ambition for the overall EU objective of reducing final energy consumption by 11.7% by 2030 with respect to the 2020 reference scenario. EU member states have two years to transpose the Directive into national law. Ireland is required to set new targets for primary energy consumption and final energy consumption for 2030. EU member countries are simply required to make their best efforts to achieve the primary energy target. However, the final energy target is binding, and the European Commission can use its powers to ensure the target is achieved.

Ireland met both targets for 2020. However, it is expecting population growth (7% between 2016 and 2022) to continue well into the 2030s, which implies a need to continuously strengthen energy efficiency policies, especially in the buildings and transport sectors. All sectors will need to contribute to the required national

energy-saving effort. The revised NECP will outline the policies and measures to achieve the new targets. Additionally, policies and measures contained within the CAP will need to align to the new energy-saving targets. Policies and measures to support decarbonisation and renewable energy will need to be reviewed from an energy efficiency perspective.

Table 1.2 Ireland's energy efficiency targets and status

	2020		2021	2030
	Status	Targets	Status	Targets
Primary energy consumption	564 PJ	582 PJ	580 PJ	666 PJ
Final energy consumption	468 PJ	490 PJ	477 PJ	544 PJ

Sources: Government of Ireland (2023), Draft Updated National Energy & Climate Plan; Eurostat (2023), Complete energy balances.

Onshore wind and solar are set to deliver the vast bulk of emissions savings for the first two carbon budgets to 2030. The aim is to reach 80% of renewable electricity generation by 2030. The share of offshore wind is expected to increase gradually. This requires an offshore renewable energy development plan and a national marine planning framework to set out rights, obligations and responsibilities and define go-to areas. This must be achieved while protecting the marine environment (see Chapter 4). Ireland is committed to phase out coal and peat for power generation by 2025 (see below and Chapter 3).

Energy security has recently re-emerged at the forefront of policy making and is a special topic of this review (see Chapter 3). The Russian Federation's (hereafter "Russia") invasion of Ukraine is one factor, but it is largely driven by Ireland's dependence on the United Kingdom for most of its natural gas supply and all of its electricity imports. Ireland also needs to extend and reinforce the electricity transmission and distribution systems and make them more flexible and resilient, for example by developing demand-side management and ancillary services, to accommodate the planned strong increase of variable renewable electricity, both onshore and increasingly offshore, and build new gas backup generation in the short term to balance demand as low-carbon options scale up while maintaining the legally binding climate targets.

To meet these ambitious targets, a significant amount of additional investment will be required across all energy sectors. However, a key challenge facing developers is the long and complex approval and permitting process that is leading to considerable delays in the delivery of necessary infrastructure. The current planning and permitting procedures need to be considerably streamlined and accelerated. This is particularly essential in the electricity sector, where up to 17 GW of onshore renewables and 5-7 GW of offshore wind energy are planned

by 2030. This will require streamlining the maritime consenting regime, including environmental impact assessments (see Chapters 3 and 4).

Figure 1.3 Ireland's renewable energy trajectories (2005-2022) and targets (2030)

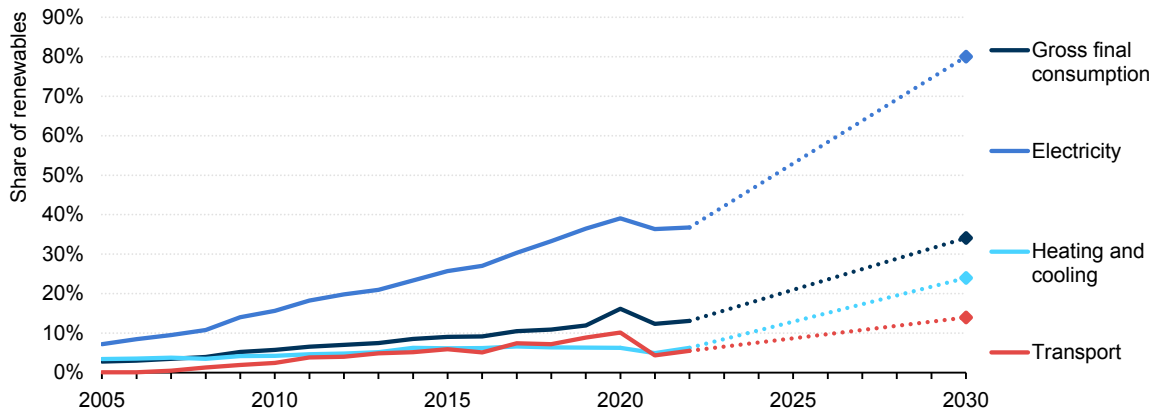


Table 1.3 Ireland's renewable energy targets and status

Renewables share in:	2020		2022	2030
	Status	Targets	Status	Targets
Gross final energy consumption	16.2%	13.6%	13.1%	34%
Electricity	39%	40%	36.8%	80%
Heating and cooling	6.3%	12%	6.3%	24%
Transport	10.2%	10.8%	5.5%	14%

Notes: The targets are computed according to Eurostat definitions for consistency with EU targets. Eurostat definitions include the normalisation of wind and hydro renewable electricity consumption, and multiplication factors for advanced biofuels and renewable electricity in transport.

Sources: IEA analysis based on Ireland (2023), Draft Updated National Energy and Climate Plan and Eurostat (2023), Share of energy from renewable sources.

Address supply chain risks and streamline permitting procedures

The Irish economy is recovering from the Covid-19 crisis and is weathering the ongoing impact from Russia's invasion of Ukraine well. Its labour market has full employment and Ireland, like many other IEA countries, is experiencing a shortage of people with the necessary skills to deliver its ambitious energy transition targets across all sectors. Meeting ongoing demand for workers will depend on increasing the labour supply. This can be done either through migration – Ireland already has one of the fastest population growths among EU countries and insufficient housing supply is becoming a major constraint – or by increasing the domestic workforce

by, for example, increasing the share of women in the labour force, though Ireland is already witnessing historically high female labour market participation rates.

It is important to reskill workers in areas that are expected to decline, such as coal and peat, and continuously enhance skills in the labour force to remain aligned with the changing skills demand and evolving technical requirements. This is particularly the case as regards the retrofitting of homes, installation of heat pumps and district heating roll-out, installing offshore wind turbines, and the development of the electricity grid. The Report on the Analysis of Skills for Residential Construction & Retrofitting, 2023 to 2030 finds that 50 831 new entrants will have to be recruited between 2023 and 2030 to deliver the government's targets in housing and retrofitting and to continue to engage in general repair and maintenance. Six of Ireland's 16 education and training boards run retrofit centres of excellence and nearly zero energy building courses to meet the requirements of the building sector; in total, more than 20 programmes for upskilling and reskilling are offered. At over 4 000, the enrolment in 2023 was almost double that in 2022. A particular innovative feature is the launch of a mobile training rig that travels to schools and construction sites to promote careers and upskilling in green construction, and even offers onsite training.

There are also dedicated skills development programmes for the offshore wind energy sector. Among them are Greentech Skillnet, sponsored by Wind Energy Ireland and co-funded by the Department of Further and Higher Education, Research, Innovation and Science, which also supports the Solas Green Skills programme. It will be important to regularly monitor the skills needed as new technologies are developed and implemented and adapt training and education accordingly.

Some best practices from IEA countries include initiatives by German industry to set up their own training facilities to ensure an adequate supply of trained workers to deliver on their orders in a timely manner. To ensure the delivery of the Greener Homes Initiative, Canada has launched the energy advisor recruitment, training and mentorship initiative. A recent study for the German labour market shows a preference of the young generation for "green" jobs, an insight that can be used to more specifically target young people in job advertisements. Also in Germany, a dedicated website advertises green job vacancies catalogued by region, field and employer. Canada runs the DiscoverEE Hub to draw workers into the energy efficiency industry.

In Switzerland, the education and environment ministries co-operate to integrate environmental topics into the curricula at all levels of education (school/universities, professional and technical vocational education, and continuing workforce education), fund training and inform about the wide array of possible careers in fields critical for the energy transition. Funding and training are

provided through a dedicated vehicle with a special focus on training in energy efficiency and renewable energy. Specifically for the building sector, the Swiss government undertook extensive stakeholder dialogue with a network of industry associations in the building sector, educational institutions and institutional partners to prepare a roadmap with 32 measures to be implemented over the next few years. One of the targets is to ensure the annual target of installations of heat pumps.

Some countries, such as Canada, have launched (paid) internship programmes and training opportunities for green jobs in co-operations with the private sector with a special focus on science, technology, engineering and mathematics. The United States Department of Energy is running a long-standing (unpaid) internship programme for students with a focus on energy efficiency and renewable energy.

The 2022 IEA report on skills development and inclusivity for clean energy transitions provides an overview of existing skills and training programmes globally to showcase programmes designed to address skills development and certification of workforces for energy transitions. The ongoing work of the IEA's Clean Energy Labour Council builds on the recommendations of the Global Commission on People-Centred Clean Energy Transition established by the IEA in 2021.

More broadly, resilient supply chains are fundamental to the roll-out of the additional infrastructure needed to achieve the sectoral targets. To achieve the offshore wind targets, immediate investments must urgently be made in ports in Ireland so that they will be ready to assemble and convey the equipment needed for offshore wind farms. However, investments in sufficiently sized ships are also required. Some IEA countries, such as Denmark, are developing domestic strategies on this issue.

A typical bottleneck for advancing the energy transition is the lack of a speedy and predictable planning and consenting process, which also greatly increases investment costs to the detriment of Ireland's population. Ireland's Strategic Infrastructure Act of 2006 (amended in 2010) has proven insufficient to accelerate the consenting regime. The government is currently working on updating the national planning framework (see Chapters 3 and 4). IEA countries offer several best practice examples; however, those cannot be transposed directly but need to be adapted by each country.

One possibility is to define infrastructure projects supporting the energy transition (e.g. renewable generation and system assets) as being of national interest and valued at least on a par with environmental interests considering the imperative to limit global temperature increase to 1.5°C. The process could assign relative weights to prioritise security of energy supply, reaching the net zero emissions target and preserving the environment; or, as in Germany and Austria, directly

assign special public interest to projects supporting the energy transition. Similarly, any spatial planning process could grant renewable projects a higher priority, support infrastructure and designate go-to areas for energy infrastructure projects (Denmark, Greece, Spain). The operation of a single-window clearance system in which one single point of contact co-ordinates all procedures needed for a given infrastructure investment could be considered, as is done in Switzerland. Requiring just one permit instead of different permits at different project implementation stages with each stage being open for legal challenge could also be considered, like the new procedure in Austria and Germany.

The United States Congress is discussing a bill to introduce fast-track permitting procedures for major energy and natural resource projects, including setting time limits for certain mandatory assessments and for court challenges. Drawn out legal processes are not compatible with the urgency to transform the energy sector. Similarly, some countries consider introducing dispute settlement arrangements for out-of-court settlements. The United Kingdom has commissioned a report from the electricity networks commissioner to make specific recommendations on how to accelerate the deployment of electricity transmission infrastructure. Among the recommendations are streamlining the consenting process and introducing a strategic approach to future spatial network planning. For the European Union has a whole, in 2022, the European Commission issued recommendations to fast-track renewable energy projects, including proposing fast-track processing and assigning overriding public interest to renewable production projects, grid and storage assets, and introducing fully digital procedures.

Many of the delays arise from challenges from local communities where new infrastructure such as wind turbines or grid infrastructure is being planned. It is therefore essential to gain the acceptance and support of the local community. Many IEA countries are exploring ways to promote more local involvement and ensure that communities benefit from hosting renewable facilities, network infrastructure and other infrastructures needed to support the energy transition. Specific suggestions are made in recent initiatives in Denmark, the United Kingdom, the United States and the European Union.

Ireland is to be commended for developing an enabling framework for community participation under its Renewable Electricity Support Scheme (RESS), which includes technical, legal and financial support. The decision to establish dedicated community benefit funds for all projects awarded under the RESS and the offshore RESS (ORESS) to benefit the host communities is also highly commendable and can serve as a best practice example (see Chapter 4).

Such efforts to gain public acceptance of new energy infrastructure need to be strengthened by the developers and public authorities engaging actively with consumers. Communication should explain why the new infrastructure is needed,

how the local community may share the benefits in energy projects in their area, and how their concerns can be addressed and mitigated.

Improvements to the planning and consenting regime should include increasing the resources allocated to the planning authorities so that they have sufficient staff to process applications promptly. Consideration should be given to prioritising investments which are in the overriding public interest and introducing statutory deadlines at each part of the planning process. It is encouraging that a new Division of the High Court has been created to deal with planning decisions, as this should help accelerate them while continuing to ensure access to justice for those challenging planning decisions.

Renewable hydrogen represents an important contribution in the long term to Ireland's high ambitions for variable renewable generation, particularly offshore wind. Australia's experience with natural gas production illustrates the need to secure domestic user access to indigenous production prior to the establishment of export capability. It is, therefore, important in Ireland to guarantee sufficient domestic access to renewable hydrogen before considering export options as part of its National Hydrogen Strategy.

Just transition – coal and peat phase-out

The role of peat and coal in Ireland's energy mix has been decreasing since 2005. All coal used in Ireland is imported. Ireland is committed to phase out coal use and commercial peat use by 2025.

The decline of peat for energy has been the most dramatic in electricity production. The public service obligation supporting the production of electricity generated from peat at three power plants ended in 2019 and the last major peat-burning power station was shut down in December 2020. The only remaining power station, co-firing peat and biomass, replaced peat with biomass in January 2024.

The share of coal in electricity generation declined from 25% in 2005 to under 2% in 2019 but rebounded in the following years to 7% in 2021 because of gas-to-coal switching due to high gas prices. The only coal power station in Ireland will stop using coal by 2025 but will be kept on stand-by and ready to run on heavy fuel oil in emergencies. Phasing out the use of peat and coal is beneficial from an emissions reduction perspective. However, the phase-out also reduces the number of available fuels that are easy and cost-effective to store before newer technologies, such as renewable hydrogen, become more profitable.

The industrial sector does not use peat while coal is used as a feedstock for the manufacturing of low-smoke coal for space heating in the residential sector. In 2021, peat and coal (mostly low smoke) accounted for approximately 6% and 5%, respectively, of the energy consumption of residential buildings. During the

2022 and 2023 energy crisis, some households increased their consumption of peat for space heating to substitute for oil and natural gas, which experienced record price spikes. Peat is usually consumed in the form of peat briquettes or sod peat. While peat briquettes are made from the existing peat stocks, sod peat is produced through turf cutting. The last peat briquette-producing factory closed earlier than planned in the summer of 2023.

Peat stocks are continuously declining and new legal restrictions on turf selling entered into force in late 2022 as part of wider solid fuel legislation introduced to reduce air pollution from solid fuel burning. As a result of this legislation, only low-smoke fuels are permitted to be sold commercially. This means more and more households will need to switch to either alternative solid fuels or entire new heating systems. The legal restrictions essentially ban public turf selling but still allow peat burning in homes, even though it produces harmful fine particles and causes local pollution. However, banning, or even limiting consumption, is a contentious issue in Ireland as private turf cutting is an inherited right connected to some properties. As for switching to other fuels, typical solid fuel appliances in residential buildings that burn peat can also burn low smoke coal or wood logs without technical modifications. Because of the limited availability of biomass in Ireland, households prefer coal to wood logs. The government provides a support scheme for renewable heat through which it grants financial support for ambient and renewable-based heating systems and has set ambitious targets for the roll-out of heat pumps throughout the country (see Chapter 2).

The most significant player in the peat sector is the semi-state company Bord na Móna, which has traditionally harvested peat and used it for electricity generation. It ceased industrial peat production in January 2021 and has announced the end to all peat harvesting on its land. Bord na Móna has made great efforts transforming itself from a conventional peat producer to a credible renewable energy company. Private commercial peat harvesting continues and not all of it in compliance with Irish law and regulations. The Environmental Protection Agency has intensified its enforcement efforts since 2022 and has brought several cases to court to compel a cessation of activities.

Globally, drained peat bogs are a major contributor to anthropogenic GHG emissions. Afforestation is a form of after-use of peat soils which has been used in the past. It is somewhat controversial to what extent the increased carbon sink of trees can offset the carbon release from a drained peat bog. Among other factors, the outcome depends on the timescale, which makes it a case-specific question.

The current focus in Ireland is on rehabilitation. Rewetting of previously afforested areas has been considered under Bord na Móna's Peatland Climate Action Scheme, which is aligned with Ireland's National Peatlands Strategy (2015-2025).

Bord na Móra is committed to rehabilitate and restore 80 bogs, covering around 33 000 hectares; work has commenced on 35 bogs. Progress of Bord na Móra's work is tracked under the National Peatlands Strategy Mid-Term Review and Implementation Plan to ensure alignment with the CAPs. The CAPs estimate that 62-78 Mt CO_2 can be sequestrated through the rehabilitation and rewetting measures, or more than Ireland's total national GHG emissions in 2022.

Peat harvesting was dominant in Ireland's Midlands region, which endures the most social and economic impacts from the ending of activities. To address these concerns, the government created a National Just Transition Fund in 2020 to support affected communities by retraining workers and creating new employment opportunities in the region. In total, 56 projects are supported for a total of EUR 22.1 million, of which over two-thirds are additional funding to complement other sources of public funding. The projects are hoped to support 178 direct and 999 indirect jobs. Funding to mitigate the socio-economic impacts from the closure of peat-related operations, including peat-burning power plants, is also available from the EU Just Transition Fund and from receipts from the Irish carbon tax (see below).

Within the government's wider Just Transition programme, Bord na Móna has created its own support scheme through which it is committed to provide peat workers with new opportunities. Some notable progress has already been made with the rehabilitation of peatlands and renewable energy projects which have provided alternative employment opportunities for its workforce.

In addition, even more direct support is offered to the most affected workers through education, retraining and creating further employment opportunities, such as engagement sessions and job fairs, both in the renewable energy and other sectors. As the peat-extracting sector has been in decline for some time, many employees have already been redeployed, retired or have voluntarily resigned; none have been fired. Overall, Bord na Móna's approach to the peat transition has been highly successful and could be a model for other sectors that need to undergo similar transitions in the future.

Carbon taxation and the need to phase out fossil fuel subsidies

In 2009, Ireland introduced a carbon tax on fossil fuels used in heating and transport. In November 2023, the tax increased from EUR 48.5 per tonne of carbon dioxide (t CO_2) emitted to 56 EUR/t CO_2 for the transport sector and deferred to May 2024 for heating fuels. This tax level is too low to make renewable alternatives cost competitive. The IEA welcomes Ireland's commitment to a trajectory with annual increases to reach 100 EUR/t CO_2 by 2030.

The total additional revenues from the carbon tax trajectory between 2021 and 2030 are estimated at EUR 9.5 billion. Since 2020, any additional revenue from the tax increase is ring-fenced for investments in building retrofit programmes, social welfare measures to address fuel poverty, a just transition and sustainable agricultural practices. This reflects a recommendation in the IEA's last review of Ireland, and the IEA congratulates the Irish government for taking this decision. About EUR 5 billion will be invested in a socially progressive programme of residential retrofits. The government should consider a public information campaign to show how the tax revenues are reinvested into the energy and just transitions and how the population is benefitting.

Yet, Ireland still has significant fossil fuel subsidies that are obstacles for the electrification of the economy. For 2021, fossil fuel subsidies are estimated to amount to EUR 2.33 billion, of which diesel for transport use accounts for the largest share. The fossil fuel subsidy estimate includes direct transfers to low-income households that are classified as being at risk of energy poverty and tax exemptions for the aviation sector.

Oil and gas are cheaper than electricity and, therefore, even if investment subsidies for heat pumps are provided, there is little incentive to switch if the house has not yet been retrofitted, as the current operating costs are significantly higher. With more efficient EVs entering the market, EVs are becoming more and competitive with combustion engines.

Among transport fuels, diesel is in effect levied with a considerably lower excise and value-added tax (VAT) than petrol, which notably negates the intended environmental impact of the carbon tax. However, freight haulage in Ireland depends on diesel-fired tracks as there is no alternative and higher diesel prices would imply a higher cost for consumers and possibly drive inflation. Since March 2022, auto diesel and petrol fuels benefit from temporary reductions of the mineral oil rate to help the population deal with the strong price increases. The restauration of the full mineral oil rates will take place in two equal instalments in April and August 2024. With the same rationale, the VAT on gas and electricity was temporarily reduced from May 2022 to the end of October 2024.

Ireland is committed to review the current fossil fuel subsidy scheme with a view to creating a roadmap to phase out fossil fuels. The 2023 Tax Strategy Group paper on climate action and tax discussed several options especially for transport fuels but fell short of making specific recommendations for implementation. Given that transport is the second-largest emitter of GHG emissions, it will be important to act quickly. The 2023 Tax Strategy Group also discussed a revision of the VAT in general, including a focus on supporting climate change measures.

Energy poverty is still a major concern in Ireland and the government plans to maintain the fuel allowance that was paid to over 400 000 households in 2022. In

addition, a targeted, lump-sum fuel allowance per household was provided to address cost-of-living concerns in 2022. Moreover, eligible households benefitted from additional cost-of-living support during 2023 funded from the revenues of the carbon tax. Ultimately, however, and as set out in the government's Energy Poverty Action Plan, improving the energy efficiency performance of buildings is the best long-term measure to permanently reduce the amount of energy, and fossil fuels in particular, needed to allow people living in efficient and comfortable homes (see Chapter 2).

Key recommendations

The government of Ireland should:

- Streamline and shorten the planning consent regime so that the investments needed for the energy transition are delivered on time.
- Decrease the frequency of climate action plans as Ireland shifts from a strategic policy and planning phase to an implementation phase. It should instead focus on delivering tangible actions set out in the plans to ensure the government's climate agenda is realised.
- Increase the resilience of supply chains across the whole energy sector to avoid delays in the roll-out of infrastructure, including ensuring that a sufficiently sized and skilled workforce is available to meet the needs of the energy transition.
- Strengthen public acceptance of the infrastructure needed for the energy transition by engaging actively with consumers, explaining the benefits of and need for the infrastructure, taking account of their concerns and developing models enabling them to share in the benefits of local energy projects.
- Take a holistic view when developing sectoral plans to ensure consistency.
- Research options of how best to increase carbon sinks or carbon retention of peatlands, especially in the long term, and establish regional guidelines. Take a holistic view when developing sectoral plans to ensure consistency.

2. End-use sectors

Buildings

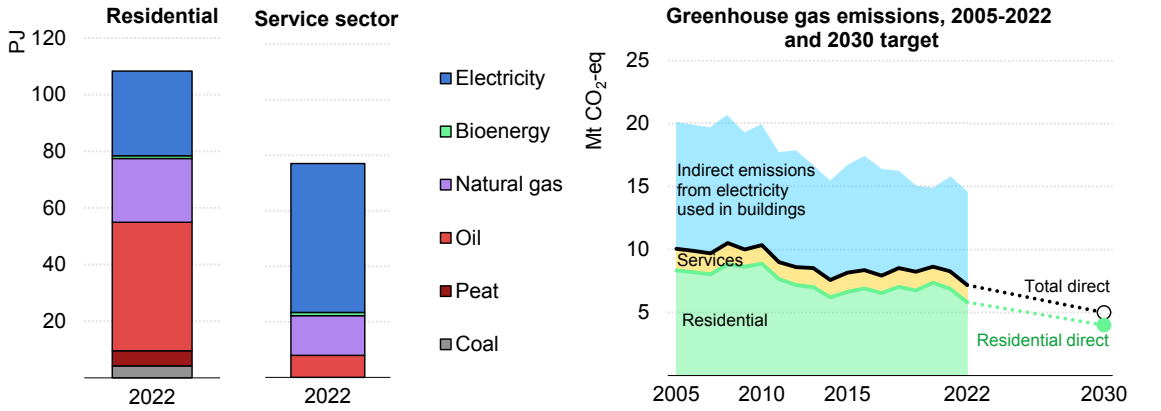
Reduce emissions from buildings to achieve targets

Ireland needs to act swiftly in the buildings sector to achieve its energy and climate goals. The buildings sector is the final end-user with the largest energy consumption (accounting for 41% of total final energy consumption [TFEC] in 2022) and despite some improvements it still heavily relies on fossil fuels (Figure 2.1). Ireland had the sixth-highest share of fossil fuels in buildings among IEA member countries in 2021 (53% versus the IEA average of 46%), driven mainly by the highest share of oil in space heating and a still significant share of coal and peat.

Direct emissions from building operations account for 21% of Ireland's total energy-related GHG emissions. When including the indirect emissions stemming from the electricity used in the sector, its share increases to 43%. Thanks to some reduction in the use of coal and oil in residential buildings, direct GHG emissions from the whole buildings sector decreased from 10 Mt CO_2-eq in 2005 to 7 Mt CO_2-eq in 2022 (Figure 2.1). Irish carbon budgets imply a further strong emissions reduction from the sector, to achieve the target of 5 Mt CO_2-eq in 2030, including sub-targets for residential buildings of 4 Mt CO_2-eq and for service sector buildings of 1 Mt CO_2-eq. In 2022, residential buildings accounted for 59% of total buildings energy demand, of which over half was for heating; service sector buildings accounted for the remaining 41%. In 2021, Ireland had the highest share of oil in space heating among IEA member countries.

The government has established a cross-sectoral, senior-level “Heat and Built Environment Taskforce” to accelerate retrofitting, renewable heat, district heat and decarbonisation of the building stock. The taskforce will identify work on the critical path to key targets under each area to ensure the alignment of policies and activities across government departments and proactively manage risks to ensure targets are achieved.

Figure 2.1 Total final energy consumption in buildings in Ireland by source, 2005-2022



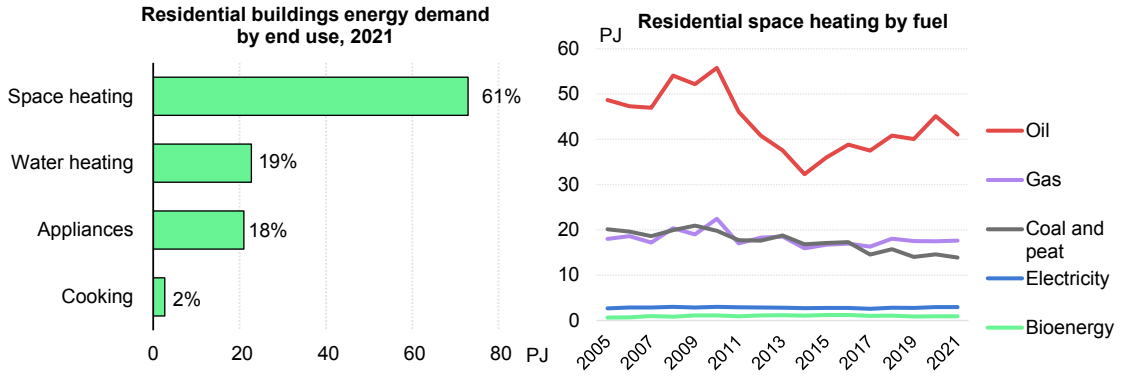
Sources: IEA (2023), World Energy Balances (database); IEA (2023) Greenhouse Gas Emissions from Energy (database).

Residential buildings

Fossil fuels dominate residential buildings' demand, with oil accounting for 41%, natural gas 20%, peat 5% and coal 4%. Electricity covers 27% of residential buildings energy demand and bioenergy 1%.

The building stock in Ireland is relatively new, as the country has the highest share of buildings built after 2000 among EU member countries (22% versus the EU average around 10%). According to the 2022 census, the Irish housing stock reached 2.1 million, an increase of more than 5% since 2016. The proportion of owner-occupied dwellings was 66% in 2022, down from 68% in 2016. Ireland also has a relatively high share of buildings in rural areas, many of which are not connected to the gas network and instead depend on oil, reducing the potential for cost-efficient district heating (DH) networks and increasing the challenges for decarbonising them.

Figure 2.2 Residential buildings energy demand in Ireland by end use, 2021, and space heating by fuel, 2005-2021



Source: IEA (2023), Energy Efficiency Indicators (database).

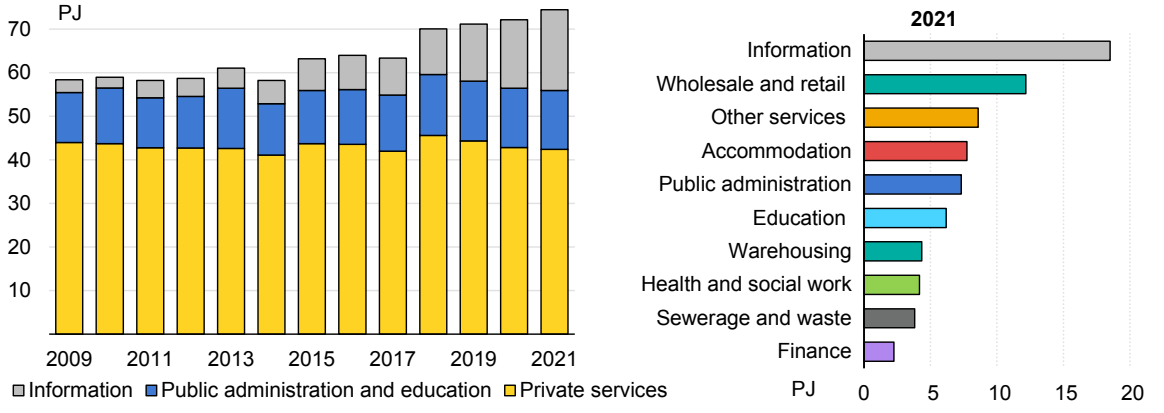
Ireland is expecting strong population growth to 2030 and an increase in its residential building stock. The National Development Plan supports the realisation of the Housing for All plan, allocating EUR 12 billion for constructing 33 000 homes per year, including 9 500 social housing units and 6 000 affordable homes.

Most energy demand in residential buildings is used for space heating (61% in 2021), which is primarily supplied by oil (54%), gas (23%), and coal and peat (18%), with smaller shares from electricity (4%) and bioenergy (1%). From 2005 to 2021, the use of coal and peat decreased by 30% while that of natural gas, electricity and bioenergy stayed relatively stable. The use of oil for space heating peaked in 2010 (an exceptionally cold year) then decreased significantly until 2014. Since then, however, the use of oil started to increase again due to the limited gas infrastructure.

Service sector buildings

In 2021, the energy demand of buildings in the service sector was primarily driven by information services (25%), followed by wholesale and retail (16%), accommodation (10%), public administration (10%), and education (8%) (Figure 2.3). Energy consumption from information services increased more than sevenfold from 2009 to 2021 (from 2.9 PJ to 18.5 PJ), driving up the energy demand of the entire sector. This is linked to the expansion of data centres (see Chapter 3).

Figure 2.3 Service sector buildings energy demand by end use in Ireland, 2009-2021



Source: IEA (2023) Energy Efficiency Indicators (database).

Regulations drive the decarbonisation of buildings

Ireland's building codes ensure that new buildings are efficient and use clean energy sources. All new residential buildings starting construction from 1 November 2019 need to comply with the nearly zero energy building (NZEB)

standard and as of 2030 with the Zero Emission Building standards. For non-residential buildings, the NZEB standard was introduced in 2018 for new buildings and those undergoing major renovations. The effects of stricter building codes are clearly visible in terms of reduced energy consumption in new buildings and the growth of electric heating systems, which are used in nearly 90% of buildings constructed since 2020. Ireland plans to further strengthen its building codes starting in 2028 by including embodied carbon emissions requirements, as done in Denmark, France and Sweden.

Ireland effectively banned the installation of oil boilers in new buildings from 2022 and that of gas boilers in those built from 2025 onwards. The NZEB standard already implies that all fossil fuels will be effectively phased out in new residential buildings by the end of 2023, completely replaced by heat pumps. This is important progress, as Ireland is expecting the strong population growth to continue along with the subsequent increasing building stock. Already in 2023, 97% of new buildings installed electric heating systems, the majority of which were heat pumps.

Fossil fuel heating systems can still be installed in existing buildings and the country has not set a date for phasing out fossil fuel heating systems in all houses. Ireland could consider introducing a ban on the installation of fossil fuel heating systems (especially oil-fired ones) in buildings undergoing major renovations, like regulations already in place for public buildings. Denmark, for example, has developed energy requirements for buildings that also cover buildings undergoing different types of renovations, and sets a clear timeline for progressively tightening required energy performances to ultimately achieve class A or NZEB.

Ireland should target the large share of buildings using oil-fired heating systems. Households with these systems are also more exposed to fluctuations in the market price for oil: the end-use price of light fuel oil for households doubled from USD 602 per 1 000 litres at the end of 2020 to USD 1 204 per 1 000 litres at the end of 2022. With the roadmap for the phase-out of fossil fuel boilers and a heat policy statement, Ireland has committed to establishing a pathway for phasing out fossil fuel heating systems. They will be replaced by heat pumps, and in some cases district heating, as the most appropriate methods of decarbonising heating. Ireland should ensure that any financial support is commensurable/sufficient for the requirements and provides investors with certainty.

Incentives needed to spur building renovation and heating system upgrades

Under the National Retrofit Plan, published as part of CAP21, Ireland committed to retrofit the equivalent of 120 000 homes from 2019 to 2025 and the equivalent

of 500 000 homes by 2030 to a building energy rating (BER)[1] certificate standard of B2. It also aims to install 400 000 heat pumps in existing homes and 280 000 heat pumps in new buildings by 2030. These measures are expected to generate 21.2 PJ (5.89 terawatt hours [TWh]) of energy savings. The government estimates that reaching the retrofit targets will cost around EUR 28 billion.

Ireland has made an unprecedented financial commitment to support the residential retrofit targets to 2030 by providing EUR 8 billion of exchequer funding, including EUR 5 billion of carbon tax revenues. It plans to supplement this with funding from the European Regional Development Plan for households at risk of energy poverty and for retrofitting of local authority homes.

The government has introduced several retrofitting support schemes managed by the Sustainable Energy Authority of Ireland (SEAI). Three funding schemes are available for home energy upgrades: 1) the Better Energy Homes and Solar PV Schemes (individual energy upgrade grants); 2) the Warmer Homes Scheme (fully funded energy upgrades for households at risk of energy poverty); and 3) the National Home Energy Upgrade Scheme (one-stop shop service). Individual energy upgrade grants provide funding to upgrade homes on a step-by-step basis. It provides grants for attic and wall insulation, heat pump installation, solar PV and solar thermal, and heating controls.

For households at risk of energy poverty, the Fully Funded Energy Upgrades, co-funded by the European Union, provide free energy efficiency upgrades for eligible homes. These upgrades are available for households that already receive certain welfare benefits. The budget has increased from EUR 39.8 million in 2019 to EUR 208 million in 2024, reflecting the high demand for the Scheme and the government's priority to address energy poverty. Ireland has also secured an additional EUR 248 million from the European Regional Development Fund for the scheme for the period 2022-27, which will allow higher budget allocations in the years to come.

There is a long waiting time for the Scheme, however, which nevertheless reduced from 26 months in 2022 to 20 months in 2023 following some changes made to the Scheme. The government should aim to reduce the waiting time further. Once waiting times have further been reduced, the government could consider expanding the Scheme to cover other vulnerable households while decreasing funding to those in better economic conditions, as is the case in France's MaPrimeRénov' scheme.

[1] In Ireland, building energy ratings classify buildings into 15 categories from least efficient (G) to most efficient (A1), depending on the estimated energy use per unit floor area per year, measured in kWh/m^2/year. An energy rating of B2 corresponds to an energy use between 100 kWh/m^2/year and 125 kWh/m^2/year.

In 2022, the government introduced the One Stop Shop Service with a start-to-finish project management service, including access to financing, for multiple energy upgrades to achieve a minimum final energy efficiency performance of B2 BER. The scheme has been successful with 18 One Stop Shop Services in place across different counties in Ireland and more are expected. Making retrofitting as easy as possible for homeowners is an important element in its success. The IEA encourages the government to continue its efforts in this area.

From 2019 to 2023, a total of 132 720 homes were upgraded, of which 36 113 reached BER B2 or higher after renovation and 10 596 heat pumps were installed. Annual renovations and heat pump installations have been increasing each year since 2019 but have not yet reached the rate required to reach the targets. For this, more than 600 000 homes need to be upgraded between now and 2030. Most energy upgrades (109 408) were funded through the Individual Energy Upgrade Grants, providing a total of EUR 239 million from 2019 to 2023, while Fully Funded Energy Upgrades provided EUR 302 million for a total of 17 632 fully renovated homes.

While the Fully Funded Energy Upgrade scheme prioritises houses with the lowest ratings, this is not the case for the other schemes. Carrying out deep retrofits in relatively new buildings can have less impact compared to more shallow retrofits in older houses. Currently, old houses with the lowest energy performance risk receiving less attention. These houses are often heated by oil or solid fuels, such as peat, wood and coal, which in some cases cause local air quality problems.

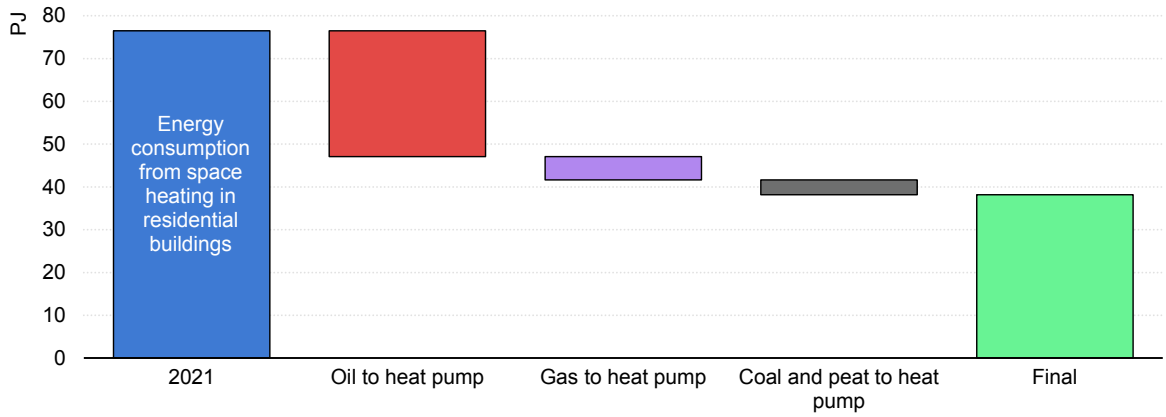
To support fuel switching, the government provides grants for heat pump installations in both residential and commercial buildings. For households, the support is provided based on the “fabric-first” principle, which requires consumers to first improve the heat loss of the building envelope. This principle (applicable to houses built before 2011) ensures that energy efficiency is prioritised and avoids the installation of oversized heating systems (and/or higher fuel bills). It, however, risks leading to a slower uptake of heat pumps. The government needs to strike the right balance on this as one study noted that the current requirement for deep energy retrofits before being able to obtain a grant for installing a heat pumps makes the project financially unattractive, with payback times that can exceed 100 years. A pilot is underway to examine the relaxation of these requirements.

Given the high share of oil and solid fuels in existing homes, Ireland should target grants for heat pumps to houses with carbon-intensive heating systems. For example, Canada’s Oil to Heat Pump Affordability programme provides an

advance payment of up to CAD 10 000[2] (Canadian dollars) to households with an oil heating system that have after-tax income below the median.

Energy savings from a total switch of space heating from fossil fuels to heat pumps can potentially deliver energy savings of 38 PJ (1.3 million tonnes of energy equivalent), without considering the energy savings from improvements of energy efficiency improvements that will be carried out alongside the installation of heat pumps.

Figure 2.4 Potential energy savings when switching from fossil fuels to heat pumps in Ireland



Notes: Mtoe = million tonnes of oil equivalent. Coefficient of performance (COP) of oil boilers = 0.85; COP of natural gas = 0.93; COP of coal and peat = 0.75; COP of heat pumps = 3.
Source: IEA (2023), Energy Efficiency Indicators (database).

Use information campaigns to raise awareness

Consumers, particularly households at risk of energy poverty, also need to have information easily available on how to save energy and money. More information on the multiple benefits of energy efficiency, including the potential for saving money and increasing comfort levels, can also improve consumer engagement. To this end, the Sustainable Energy Community Programme includes support for communities, including a local SEAI mentor that guides consumers to identify their interests and needs, community platforms, trainings, events, and webinars. In addition, a Home Energy Saving Kit is available to borrow, free of charge, from selected libraries across Ireland.

Ireland is part of the CampaignXchange project, led by the IEA within Users TCP programme, together with eight other IEA countries. The Irish awareness campaigns "Reduce your use" and "Keeping well and warm" were presented as a

[2] Exchange rate: 1 EUR 1 = CAD 1.4592 (as of 22 April 2024).

case study within the project. The IEA suggests the government increase the tracking of the uptake of energy savings and measures recommended in the campaigns, both in terms of uptake of funding schemes and behavioural changes. Awareness campaigns and programmes should also target, in particular, consumers in energy poverty and coal-consuming households on how to reduce energy consumption and save money.

Ireland delivered a specific version of the Reduce your use campaign for public bodies from September 2022 to March 2023, encouraging energy savings in public buildings. A total of 220 public bodies signed up, representing 80% of the energy use in the public sector. The Office of Public Works reported that average energy savings of almost 20% were achieved between October 2022 and March 2023, compared to the same period in 2019/20. The IEA commends Ireland for launching a 2023/24 version of this campaign and recommends expanding its scope to the business and commercial sector.

Behavioural insight experts play an important role when designing and implementing policies and to effectively engage with the public to get buy-in to the clean energy transition. SEAI's behavioural economics team has operated over a number of years and plays an important role in informing relevant policies and campaigns similar to the Dutch Behavioural Insights Network, which stimulates and facilitates the application of behavioural knowledge within the government.

Grid-interactive buildings provide flexibility to the system and benefits to consumers

Buildings equipped with smart sensors and meters can communicate with the grid, offering flexibility in managing energy loads by utilising behind-the-meter generation, energy storage and participation in demand response programmes (see Chapter 4). This can allow buildings to become more active players in the energy system, communicating with electricity grids and responding to their needs by adjusting use, especially during surges in demand. Mandating smart and interactive features in building energy codes while implementing measures on improving cyber and grid security is an important step to enabling buildings to become grid-interactive.

Smart meters are key components of a grid-interactive efficient building. The IEA encourages Ireland to complete the roll-out of smart meters that is already planned by the end of 2024, when the government expects that 2.4 million smart meters will be installed (see Chapter 4). Minimum functional requirements of smart meters, such as meter-reading updates of at least every 15 minutes and interfaces equipped with consumer-oriented tools, should be ensured and in line with recommendations from the European Commission.

Grid-interactive efficient buildings also benefit from smart communication-enabled equipment. Smart heat pumps coupled with thermal energy storage and smart EV charging points can be used for demand-side flexibility, shifting loads to help balance the grid. Ireland should require suppliers and installers to provide smart equipment when the renovation is financed with public funding.

Services and public sector buildings should lead the renovation wave

For commercial buildings, the Minister for Enterprise, Trade and Employment is charged with delivering the sectoral emissions ceilings. Support schemes are administered by SEAI, Enterprise Ireland and IDA and have seen a high uptake of schemes offering grants and support for undertaking energy audits.

The government aims to publish a long-term decarbonisation roadmap for the commercial sector in 2024. Already, the "enabling commercial retrofit" initiative aims to find ways to address the financial, technical, knowledge and behavioural challenge in the commercial sector. There are an estimated 109 000 commercial buildings in Ireland.

A similar roadmap will also be published for the public sector in 2024. For the public sector, Ireland has set targets to reduce energy-related GHG emissions by 51% and achieve 50% energy efficiency improvements by 2030. Launched in 2023, the Public Sector Climate Action Mandate sets a range of actions for the public sector, including phasing out fossil fuel heating systems. Since 2023, public sector buildings are no longer allowed to install heating systems that use fossil fuels in new buildings and in buildings undergoing major renovations.

The public sector other than schools, local authorities and commercial semi-states must produce a Climate Action Roadmap detailing how it will meet the Climate Action Mandate. Every public sector organisation must also implement energy management programmes, have a Display Energy Certificate showing their Building Energy Rating (if greater than 250 m^2) and publish annual statements describing the actions undertaken to improve energy performances. The Public Sector Energy Programme provides guidance on energy management (including ISO 50001), energy efficiency design and advisory services in public buildings.

District heating can help decarbonise buildings in an efficient way

Ireland is looking at DH as a solution for decarbonising heating. In 2021, DH only accounted for less than 1% of Ireland's heating needs. SEAI's National Heat Study from 2022 states that district heating has the potential to supply as much as half of heating demand in buildings. The government has set a target of supplying up to 9 PJ (up to 2.7 TWh) of district heating by 2030 and has formed a District

Heating Steering Group to support this development. Following the publication of its report, the District Heating Steering Group is now working jointly with the Heat and Building Environment Delivery Taskforce on the delivery and implementation.

A small DH system was recently developed in south Dublin, including by using waste heat from Amazon Web Services data centres. The local government initiated the project to supply heat to public buildings in the area. Another project is planned in connection with Dublin's waste-to-energy plant. A Dublin city geothermal working group was formed in 2023 to deliver large geothermal demonstration projects in the city centre.

To assess the potential for DH in more detail, SEAI has mapped Ireland's heat demand and potential. This provides an excellent starting point for more in-depth feasibility assessments on where the conditions are the most suitable for establishing cost-effective DH networks. Ireland will need to explore and map potential heat sources, particularly waste and renewable energy (solar thermal, geothermal and biomass), to be compliant with European Commission directives on "efficient" DH. The heat demand mapping should be used in spatial planning of large electricity consumers, such as data centres or electrolysers, to increase the potential for cost-efficient waste heat in DH networks.

Waste heat can be recovered from the many data centres located in Ireland. In Denmark, waste heat from Facebook's Odense Data Centre provides heat to raise the temperature of water before it is fed to a heat pump and ultimately delivered to a DH network. In Finland, the Telia Helsinki Data Centre facility already uses the heat generated by the hardware and a heat pump to provide at least 1.3 times as much heat as it consumes as electricity. Lowering the electricity tax on heat pumps in Finland from July 2022 has also supported the progress of the project and acted as a financial incentive.

Developing DH in Ireland will require a collaborative approach and working through structures such as the District Heating Steering Group and the Heat and Built Environment Delivery Taskforce, Ireland is embracing that approach. The government should continue using the experience from the existing projects in Dublin and engage local authorities in the process. Collaboration with other countries with mature or developing DH markets and industries can also provide useful guidance to this work, as there are different approaches to regulation and support to consider for Ireland. In Denmark, DH covers two-fifths of the energy consumption of buildings and is sourced mainly by renewables, with an increasing share also coming from waste heat from industry. DH also offers opportunities for system integration with the electricity sector. Finland is looking into increasing its share of DH from non-combustion solutions such as electricity and geothermal, and is a pioneer in the utilisation of thermal storage, a technology that contributes to providing flexibility options much needed in modern electricity networks.

A renewable heating obligation would boost a shift towards clean heating

Ireland achieved just about half of its 2020 target for renewable heating. However, it has doubled its 2020 target for 2030, which will be difficult to reach without additional measures. The installation of heat pumps in the period to 2030, as set in national targets, will contribute to achieving the 2030 target, while the share of renewables in electricity generation increases (see Chapter 4).

The government also launched a Support Scheme for Renewable Heat. The Scheme provides an installation grant for heat pumps and operational support for up to 15 years for biomass and biogas heating systems in all types of buildings and installations that are not part of the EU Emissions Trading System (ETS). The government aims for the Scheme to deliver an additional 3% of heat consumption from renewable energy sources and has established a budget of EUR 300 million for the period up to 2027.

To support the need to decarbonise heating, the government has agreed to introduce a Renewable Heat Obligation (RHO). In 2021, the government launched a public consultation on the RHO, receiving wide support for the introduction of an RHO. Using feedback from the consultation, the government has completed a scoping exercise, including a national breakdown of heating energy sources, to examine how to implement the RHO. The government has agreed to introduce the RHO by 2024.

Recommendations

The government of Ireland should:

- Ensure an effective implementation of retrofits and heat pump installations by closely monitoring progress towards the 2030 targets and adjusting the support schemes when needed. This should include increasing outreach to people in houses in need of retrofits and providing guidance on the available support schemes and the One-Stop Shop Service.
- Finalise the development of its roadmap to phase out fossil fuel boilers to accelerate the replacement of existing fossil fuel heating systems, especially oil-fired boilers, with more efficient and cleaner options.
- Continue to increase funding for the Warmer Homes Scheme and continue prioritising the renovation of the worst performing buildings as appropriate.
- Facilitate more demand-side flexibility by requiring smart communication-enabled equipment when providing funding for heat pumps and electric vehicle charging equipment.
- Finalise and publish its district heating strategy, including a regulatory framework to utilise the potential for cost-efficient heating from low-carbon energy sources, including waste heat from data centres and other industrial facilities.

Transport

Energy consumption and emissions from transport need to decrease significantly to achieve 2030 targets

Ireland's transport sector accounts for one-third of the country's energy-related emissions and TFEC and is heavily dependent on fossil fuels. After peaking in 2007, energy consumption and emissions from the sector decreased until 2012 due to the economic slowdown. They increased again until 2016 then stabilised until 2019. The Covid pandemic caused a dip of energy demand and emissions from the transport sector in 2020. Despite a consumption rebound in 2021, 2022 levels were still lower than in 2019. However, transport sector emissions were around 7% higher in 2022 than in 2021, showing an increasing trend (Figure 2.5).

From 2005 to 2021, there was a significant decrease in the use of gasoline and a remarkable increase of the share of diesel and at a smaller magnitude of biofuels. In 2022, the share of gasoline consumption increased for the first time since 2006. In 2021, road transport accounted for 95% of total transport consumption, of which passenger cars accounted for 59%, freight transport 34% and buses 2%. Water transport has a higher share in Ireland than in other IEA member countries at 4%, while rail is low at 1%.

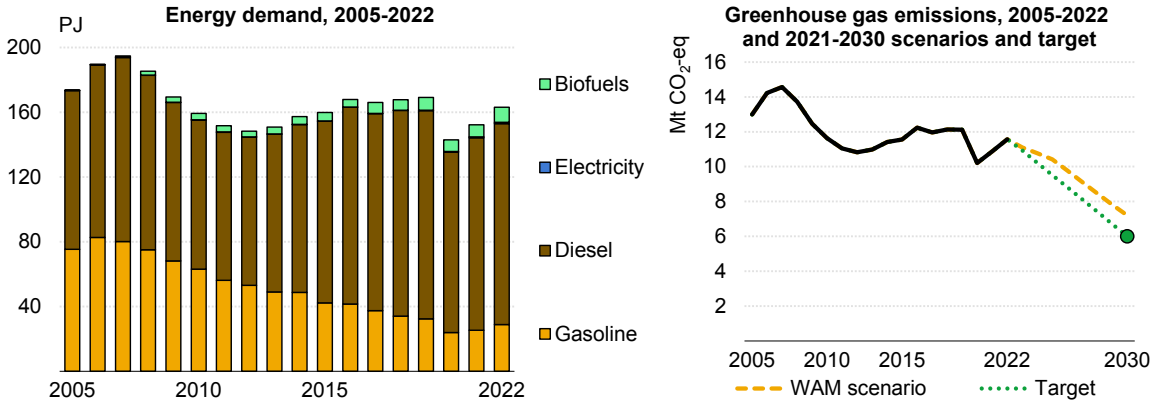
The Climate Act sets carbon budgets for the transport sector of 54 Mt CO_2-eq for 2021-25 and 37 Mt CO_2-eq for 2026-30. These legally binding targets obligate the sector to roughly halve emissions from transport by 2030 with respect to the 2018 level in a manner that is consistent with the sectoral emissions ceiling, suggesting a 20% reduction from 2018 to 2025. This implies an average emissions reduction of 4.1% per year from 2021 to 2025 and of 9.4% per year from 2026 to 2030. Emissions decreased on average by just 1% from 2005 to 2021. Projections released in 2023 by the Irish Environmental Protection Agency show that current measures are far from being sufficient, and even in the "with additional measures" scenario, emissions do not decrease enough by 2030 to reach the targets.

The government recognises that the decarbonisation of the transport sector presents several challenges. Travel preferences in Ireland, as in many IEA countries, are deeply embedded in citizens favouring the use of private cars over more sustainable transport modes. In addition, dispersed and low population density has caused certain regions and cohorts of the society to have less sustainable transport options, especially in rural areas.

To put the transport sector on the emissions pathway necessary to reach Ireland's sectoral emissions ceiling requires a 20% reduction in vehicle kilometres travelled (with respect to a business-as-usual scenario), a 50% reduction in fuel usage (with

respect to 2018), a significant increase in the use of other transport means (a 130% increase in daily public transport journeys and a 50% increase in daily active travel journeys), and a 30% share of battery electric vehicles in the private car fleet by 2030. Ireland's 2020 Programme for Government commits to ban the sale of new internal combustion engine cars by 2030. However, legislation on the ban for fossil car sales is likely going to be driven by the European Union, which has set the phase-out for 2035. Since 2019, no new public sector buses using diesel can be purchased.

Figure 2.5 Ireland's total final energy consumption by fuel and GHG emissions from transport, 2005-2022 and GHG scenarios and targets to 2030



Notes: WAM = with additional measures. Electricity is not visible on this chart's scale and accounted for 0.72 PJ in 2022.
Sources: IEA (2023), World Energy Balances (database),.and IEA analysis based on EPA (2023), Ireland's Greenhouse Gas Projections 2022-2030

Ireland follows the avoid-shift-improve approach

Despite the challenges, Ireland has a vision to decarbonise the transport sector adopting an "avoid-shift-improve" approach that aims to reduce the need for travel, shift to more efficient transport modes (public transport, walking and cycling), and improve the energy efficiency of vehicles, including by replacing fossil fuels with electricity or other low-carbon fuels.

The government has launched numerous work programmes to support the strategy. Avoid and shift measures include spatial planning, improving public transport infrastructure, digitalisation, shared mobility and a demand management strategy. The government has set up work programmes for each of these measures, and in addition to the target to reduce total vehicle kilometres travelled by 20%, has set targets to reduce the share of daily journeys made by private car from over 70% in 2022 to 50% in 2030. At the same time, the government plans to sustain a modal shift to walking and cycling, including through the provision of 500 Safe Routes to School and the roll-out of over 1 000 km of walking and cycling infrastructure by 2025. Ireland is also expanding public transport, with over 60 new

and enhanced bus services in rural areas in 2023, as part of the Connecting Ireland – Rural Mobility Programme.

The National Sustainable Mobility Policy of 2022 and sets out a strategic framework to 2030 for active travel and public transport. The associated Sustainable Mobility Policy Action Plan 2022-2025 includes 91 actions grouped under 10 high-level goals and 3 overarching principles: 1) Safe and Green Mobility; 2) People-focused Mobility; and 3) Better-integrated Mobility. A Pathfinder Programme was launched in October 2022, comprising 35 projects to demonstrate how to develop practical sustainable mobility measures that have a transformative impact on mobility, to provide a template that can be scaled up elsewhere with a strong emphasis on experimental and innovative approaches.

Improvement measures include working programmes for decarbonising public transport, improving EV charging infrastructure and promoting renewable fuels. The government aims to increase the share of EVs in the car fleet to 30% by 2030 and adopt ambitious biofuels blending trajectories to 2030.

Ireland's ambitious targets on emissions reductions, EV deployment and modal shift require a faster transition of the transport sector with respect to current trends. The government should set intermediate milestones to monitor the delivery status of the ambitious 2030 targets and adopt corrective measures if needed.

Boost the deployment of electric vehicles and related infrastructure to achieve targets

EVs[3] in Ireland's fleet have been quickly increasing since 2015 and, according to the Alternative Fuels Observatory, in 2023 there were around 93 000 EVs on the road, accounting for 2.4% of the total fleet and 27% of new registrations. While this represents a promising acceleration of EV deployment, the government's ambitious target of achieving 845 000 private EVs on the road by 2030 (or 30% of total fleet and 100% of new registrations) requires a substantially faster transition in the coming years. More than 2 800 EV recharging points were available in Ireland at the end of 2023. Of these, 518 were fast or ultra-fast recharging points.

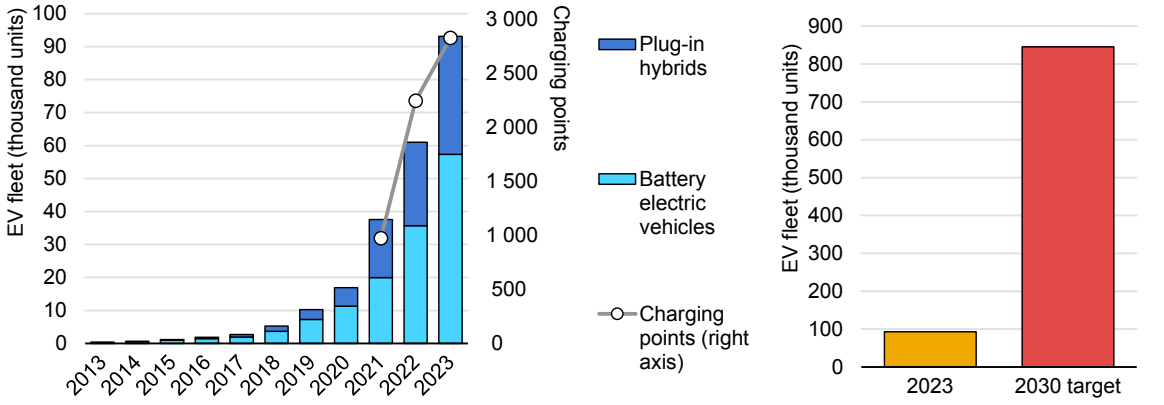
Ireland already committed significant funding to support low-emission vehicles through the National Development Plan (almost EUR 500 million for the period 2021-25), the Climate Action Fund and the Shared Island Fund. In 2023, EUR 110 million were allocated to provide grants for EV purchases and supporting the strengthening of EV charging infrastructure.

A EUR 3 500 grant is provided at the purchase of an EV, and up to EUR 600 for the installation of home chargers. EVs also benefit from a lower rate of the annual

[3] Electric vehicles include battery electric vehicles and plug-in hybrid electric vehicles.

motor tax and vehicle registration tax. The government may need to consider providing higher subsidies for EVs for rural households than for urban ones given the lack of alternative forms of transport in rural areas.

Figure 2.6 Registered electric vehicles and public charging points in Ireland, 2013-2023 and target for 2030



Source: IEA analysis based on EU (2024), Alternative Fuels Observatory.

Market trends show increasing global popularity of sport utility vehicles (SUVs) in the last decade. Even when electric, SUVs require larger batteries, placing additional pressure on battery supply chains and increasing demand for the critical minerals needed to make the batteries. Ireland should consider introducing a penalty on car weight when providing grants to EVs to drive consumer choice towards smaller and more efficient EV models.

The government explicitly aims to keep the expansion of a fast and rapid EV charging network to stay ahead of the demand and make EVs accessible to all. The government has launched the Electric Vehicles Charging Infrastructure Strategy 2022-2025, together with an implementation plan, setting a roadmap for delivering Ireland's EV charging infrastructure by 2025. The strategy includes objectives to make access to EV charging fair and equitable, also securing EV charging options for those who do not have access to a home charger. The government plans to develop new schemes supporting the roll-out of publicly accessible EV charging infrastructure in locations such as hospitals, leisure facilities, local sport clubs and community centres.

The challenge will be ensuring that the charging infrastructure keeps up with the expected growth in EVs and that it reaches the whole population, including rural areas and people in homes without access to parking, such as multifamily houses. Facilitating the roll-out of roadside/on-street chargers, installing chargers into public lampposts, developing community schemes and other options need to be accelerated. In September 2023, the government opened public consultation of

the Draft National En-Route EV Charging Network Plan. Once finalised, it will be a unified reference point and provide impetus for the deployment of en-route charging infrastructure on the national road network.

Additionally, the government will invite consultation in 2024 on a National Destination and Neighbourhood Network Plan, which will eventually form the basis of future developments of destination and neighbourhood charging at a regional and local level. This multi-level approach for the roll-out of EV charging for different purposes and at different geographical locations will ensure access to charging is available to all EV users on a fair and efficient basis and supports a just transition to a decarbonised vehicle fleet. This will also support Ireland in complying with the expected charging infrastructure requirements mandated under the European Union's Alternative Fuels Infrastructure Regulation.

The government should closely monitor the deployment of EVs and charging infrastructure to ensure a sufficient growth rate to meet the 2030 target for transport emissions.

Decarbonisation of freight needs to accelerate after 2030

Ireland relies on heavy goods road transport for moving freight around the country. In fact, emissions from heavy good vehicles (HGV) and light commercial vehicles are estimated to account for around 38% of total transport sector emissions. However, decarbonisation options for HGVs have been emerging more slowly than for passenger vehicles, though new technologies are beginning to become commercially available. In recognition of this, the government has set a target for 30% of new registration for HGVs and medium-heavy duty vehicles to be zero emissions by 2030, in line with Ireland's membership in the Global Memorandum of Understanding on Zero-emission Medium- and Heavy duty Vehicles.

However, diesel will remain the dominant fuel for HGVs into the 2030s and emissions reductions from freight road transport in 2030 are set at about 10% relative to their level in 2018 to 2030. The Road Haulage Strategy 2022-2031 defines 39 specific actions in this regard and the government operates a dedicated grant scheme for alternatively fuelled HGVs.

Biofuel blending mandates support renewables in transport

From 2005 to 2022, the Biofuel Obligation Scheme contributed to an increasing use of biofuels in transport, driving the share of renewables in transport's TFEC up to 6% in 2022 (Figure 2.7). Renewables in the sector consist mainly of biodiesel, with a smaller share of biogasoline and a small but increasing contribution from renewable electricity.

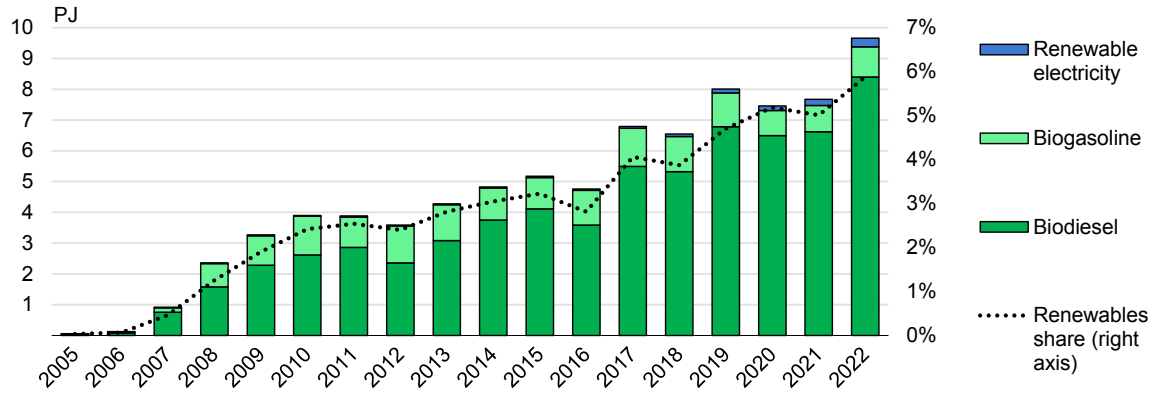
Ireland is committed to increase its renewable transport fuel obligation and reach a biofuel blending target equivalent to a modelled 10% ethanol in gasoline and 20% biodiesel in diesel by 2030. The legal requirement enabling a transition to a 10% blending share for ethanol in gasoline has been in place since 2023.

Domestic production of biofuels is limited, and most are imported. The country's only refinery, the Whitegate Refinery, however, was among the first to produce hydrotreated vegetable oil.

As and when reliance on oil products diminishes notably, Ireland could consider repurposing existing oil infrastructure for storage of carbon-neutral energy sources, as the increased biofuel obligation will make Ireland more reliant on the import of renewable biofuels. With all oil terminals in Ireland strategically located at ports and the infrastructure in the vicinity of more heavily populated areas, repurposing this infrastructure could offer opportunities for increasing the storage of biofuels. Recent studies show that oil terminals can be repurposed for storing biofuels such as ethanol and biodiesel, but also hydrotreated vegetable oil. As a transitional measure, oil terminals could also be converted into blending facilities.

Deployment of biofuels goes beyond road transport, as they are also key to sustaining the decarbonisation of aviation (and heating). Sustainable aviation fuels include sustainable biofuels and synfuels. The RefuelEU initiative sets out goals to build up the production and supply of sustainable aviation fuels. Targeted policies must lead investment and development towards long-term decarbonisation technologies. There could be opportunities for the Irish government to develop more ambitious policies for renewable aviation fuels to substitute jet fuel or kerosene with a view to reducing emissions in the aviation sector in line with global climate goals.

Figure 2.7 Renewables in total energy final consumption in the transport sector in Ireland, 2005-2022



Source: IEA (2023), World Energy Balances (database).

Compressed natural gas for transport

Ireland is developing a national network of compressed natural gas (CNG) refuelling stations for transport. In 2023, it had four public and three private operational CNG refuelling stations with five additional ones expected in the next two years. An additional eight public stations are targeted for the end of the decade. This growing network will help lower but not eliminate emissions in the transport sector.

However, the economics of investments in CNG infrastructure are unclear given the volatility of international gas prices. And there is a risk of locking-in reliance on more natural gas imports or requiring more rapid biomethane production. Further analysis of CNG's competitiveness and net benefits towards reaching Ireland's climate goals would help advance a more robust set of alternatives to reducing emissions in the transport sector. The IEA suggests that the Department of Transport consider these aspects when preparing the updated draft "National Policy Framework for Alternative Fuel Infrastructure" in 2024.

Recommendations

The government of Ireland should:

- Develop intermediate milestones to verify progress towards 2030 targets and implement corrective measures if needed to decrease the use of private cars and boost the deployment of electric vehicles and charging infrastructure.
- Assess the expansion of the compressed natural gas infrastructure against the risk of locked-in reliance on more natural gas use and imports.

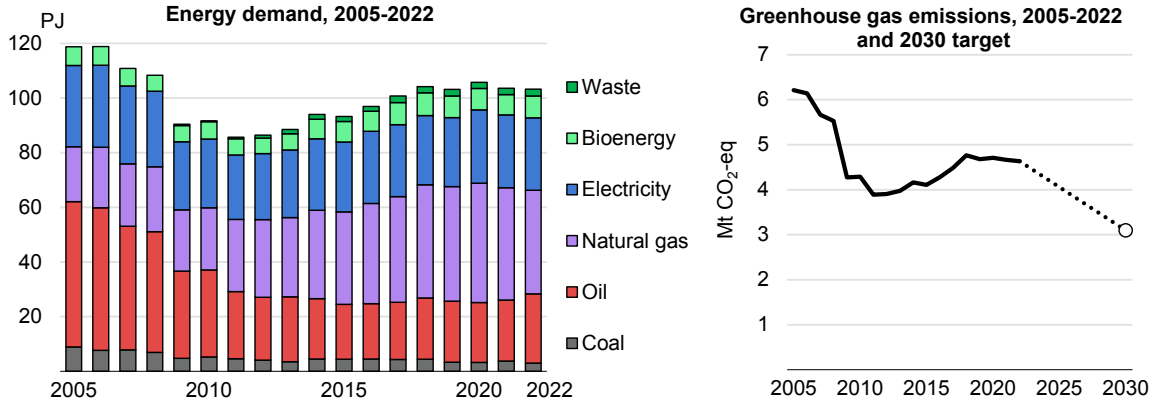
Industry

The energy intensity of Irish industry is low, but emissions reductions are needed to achieve targets

Ireland has a small industry sector with the lowest energy intensity among IEA countries. In 2022, Ireland's industry sector accounted for 23% of TFEC (compared to the IEA average of 28% in 2021) and 14% of GHG emissions (compared to the IEA average of 21% in 2021). In 2022, industrial sector energy demand was covered mainly by natural gas (37% of industry TFEC, compared to the IEA average of 32% in 2021), followed by electricity (26%), oil (25%), bioenergy and waste (8%), and coal (3%) (Figure 2.8).

Ireland has a legally binding target to reduce the GHG emissions of industry by 35% from 2018 to 2030, with an interim target reduction of 20% by 2025 (see Chapter 1). Emissions have plateaued since 2018, after a strong decrease of 37% from 2005 to 2011 and a rebound from 2011 to 2018 (Figure 2.8). The country needs additional policies and measures to bend the curve and bring emissions down towards the 2030 target.

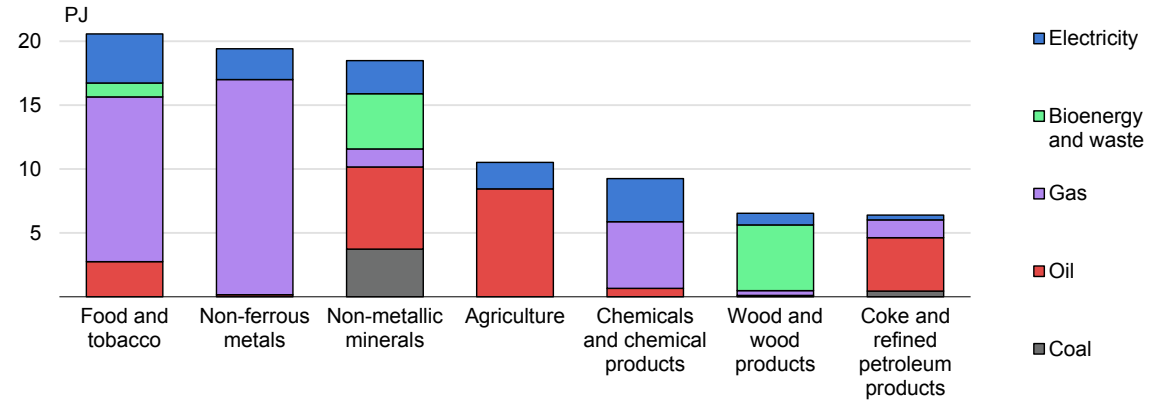
Figure 2.8 Total final energy consumption in industry by source in Ireland, 2005-2022 and greenhouse gas emissions, 2005-2022 and 2030 target



Source: IEA (2023), World Energy Balances (database).

The main industry sub-sectors in Ireland are food, metals, non-metallic minerals (mainly cement industry), agriculture (energy use) and chemicals (Figure 2.9). While natural gas dominates food and metals, the non-metallic minerals sector has shares of oil, coal, electricity and natural gas.

Figure 2.9 Energy consumption by source of the main industry sub-sectors in Ireland, 2021



Source: IEA (2023), Energy Efficiency Indicators (database).

Electrification, bioenergy and biomethane are first key steps for the decarbonisation of industrial heat

CAP23 sets specific targets for the industry sector. Ireland aims to increase the share of carbon-neutral heating in industry to 50-55% in 2025 and 70-75% in 2030, reduce industry fossil fuel demand in manufacturing process by 7% in 2025 and 10% in 2030, and increase the use of zero emission gas to reach at least 1.2 TWh of zero emission gas for industrial heating in 2025 and 2.1 TWh in 2030.

Ireland is preparing a decarbonisation roadmap for industrial heat based on the recommendations of the SEAI National Heat Study. The government sees electrification as key to displacing the use of fossil fuels when possible and as soon as possible in manufacturing processes. The share of electricity in industry TFEC (24%) is lower than the IEA average (32%), despite the overall low energy intensity of the Irish industry sector and the low share of high energy-intensive industries. Strong efforts on increasing electrification of industry are needed to achieve the targets and ultimately economy-wide net zero by 2050. In the IEA's net zero scenario, the share of electricity in low energy intensity industry sectors rises to 50% by 2030.

In the food industry, it is possible to switch heating sources from fossil-fired boilers to DH, heat pumps, electric heaters and microwave systems. As process heating in the food industry occurs at medium-low temperatures, the use of heat pumps would be beneficial to efficiently upgrade low-grade waste heat to higher temperatures. In Denmark, the project "Electrification of the food and beverage industry", a partnership between industry associations, used 20 concrete case studies in selected Danish food companies to illustrate how industrial processes can be converted from fossil fuels to electricity.

The government of Ireland should consider promoting similar initiatives to demonstrate and deploy electric solutions in the food industry, building on local success stories such as Ahascragh Distillery and Ballykilcavan Brewing Company, which switched to electric, local and renewable solutions to decrease their emissions. The IEA report "The Future of Heat Pumps", published in November 2022, provides insights on industrial heat pump application that could help Ireland continue boosting industry electrification, which would drive further efficiency gains and GHG emissions reductions. So far, Ireland sees DH as having a role mainly in the residential and service sectors. Ireland should explore if DH could play a role in decarbonising some industry sectors that require low-temperature heat and are close to existing or planned DH networks.

Other industry sectors such as metals, non-metallic minerals and chemicals are overall more difficult to electrify and decarbonise. However, Ireland should start building a favourable environment for innovation in these sectors and promote those changes that are already possible. Efficient equipment and material recycling should be encouraged in all sectors. Scrap use in metallic inputs considerably lowers emissions.

Bioenergy and biofuels have a central role in Irish policies to decarbonise industries for which electrification is more difficult to achieve. CAP23 sets a target to convert 12% of low/medium temperature heat to sustainable biomass by 2025 and 20% by 2030. For high-temperature heat, the government aims to use biomethane indigenously produced from food waste and agricultural feedstocks (see Chapter 3). Modern solid bioenergy can already be used to replace oil and gas in cement kilns, which in the longer term could be electrified.

After 2030, hydrogen is also expected to play a role for high-temperature heat generation. The Irish government published a National Hydrogen Strategy in July 2023 and aims to have 2 GW of offshore wind capacity dedicated to hydrogen, or other off-grid solutions, to be in production by 2030 (see Chapter 4).

Ireland promotes the use of alternative materials and lower carbon content of cement

CAP23 includes a target to decrease embodied carbon in construction material produced and used in Ireland by 10% in 2025 and at least 30% in 2030. To achieve these targets, it aims to publish a report and identify case studies for alternative construction materials.

The roadmap for sustainable future cement production suggests decreasing the amount of clinker content in cement to reduce carbon content in construction. The traditional cement used in Ireland is Portland cement, based on 95% clinker content. The IEA Net Zero Roadmap suggests decreasing the clinker-to-cement ratio worldwide from 0.71 in 2022 to 0.65 in 2030 and 0.57 in 2050.

The Irish government aims for the public sector to lead by example in reducing the carbon content of materials. CAP23 expects public procurement policy to facilitate the principle of low-carbon construction methods and materials in all publicly procured projects. A new Green Public Procurement Strategy and Action Plan will be published in 2024 to facilitate public tenders favouring low-carbon construction.

The Irish Carbon Tax levied on solid fuels, natural gas and oil aims to incentivise companies outside the EU ETS to lower their emissions (see Chapter 1). The 2024 level of 56 EUR/t CO_2 emitted is too low to effectively push for strong decarbonisation of industries outside the EU ETS and is also significantly lower than the average carbon price under the EU ETS in recent years. Ireland's commitment to a trajectory with annual increases to reach 100 EUR/t CO_2 by 2030 is welcome.

In the medium and long term, CCS needs to be considered for hard-to-abate industry sectors, such as the cement industry. CCS is critical for achieving net zero emissions and requires investments well in advance. Ireland aims to develop CCS for the third carbon budget period (2031-35). Advanced planning is needed, particularly around clustering of CCS sites, infrastructure, and the creation of the needed regulatory and policy framework (see Chapter 1). SEAI's publication of the Carbon Capture Utilisation and Storage study in 2022, exploring options for carbon capture, utilisation and storage in Ireland, is a welcome first step. The creation of CCS clusters, as done in the United Kingdom, helps bring together industries that aim to capture their carbon, build shared infrastructure and achieve economies of scale.

Sector-specific roadmaps would support Irish sectors in their decarbonisation strategies

While the decarbonisation roadmap for industrial heat is a very valuable tool to reduce emissions from industrial processes involving heat production and consumption, sector-specific roadmaps can help all industry sectors identify their pathway towards a lower emissions energy future. Sharing information on efficiency and decarbonisation best practices among similar industrial actors through industry networks could bring down energy use and emissions efficiently. The IEA recommends that the government work with industry stakeholders to develop sectoral low-carbon roadmaps for key industrial energy sectors that cover the key areas (regulation, information and incentives) defined in the IEA Energy Efficiency Policy Toolkit.

In some sectors, entities have already prepared decarbonisation roadmaps, such as the association of cement manufacturing (see above). Co-operation between the government and industries could lead to the preparation of decarbonisation roadmaps for the key Irish industry sectors. Detailed roadmaps for industry have been developed in other IEA counties. Finland has 13 industrial sector roadmaps

that provide the government with estimates of anticipated sectoral development, including GHG emissions and energy demand, and indicate the investment needs of various sectors to support the energy transition. These roadmaps provide clarity to the government and industry on the areas where the most important investments should be made and where additional efforts are needed, for example in relation to increased research and development (R&D) for key technologies or the need for targeted subsidies.

Audits can drive energy efficiency improvements

Electrification of industry is very effective in reducing GHG emissions if electricity generation is decarbonised, but risks overwhelming the electricity sector. Energy efficiency is key in reducing the total amount of energy required by the sector. Cross-cutting energy efficiency measures lowering energy demand also increase energy security.

Energy management systems are key for Ireland to improve energy efficiency in the industry sector. The EU Energy Efficiency Directive requires large companies to complete an energy audit every four years or to implement certain environmental or energy management systems (ISO 14001, ISO 50001 or Eco-Management and Audit Scheme) and submit a summary of energy demand every four years.

Ireland transposed these requirements into law and CAP23 aims to introduce mandatory energy audits for companies using more than 10 terajoules (TJ) of energy annually, and a mandatory energy management system for those using more than 100 TJ. SEAI supports the process by providing free training for businesses as well as financial support for energy efficiency improvements through the Excellence in Energy Efficiency Design programme. CAP23 proposes making it mandatory to implement the measures identified in the audits with payback periods of less than five years within two years of the energy audit. This is already common practice in other IEA countries. For example, the Netherlands' Energy Savings Obligation requires companies with high energy demand to implement measures with a payback period of five years or less, similar to the regulation of the Brussels-Capital Region in Belgium.

SEAI prepared a detailed Energy Audit Handbook which provides useful details for a wide range of company types to be audited. This is a commendable practice, guiding auditors to be consistent. However, the handbook does not provide extensive guidance for fuel switching. As Ireland considers fuel switching, for example to biomass or biogas, as a main option to decarbonise industries for which electrification is more difficult to achieve, the IEA recommends it consider expanding the scope of the audits to focus more on fuel switching.

Recommendation

The government of Ireland should:

- Implement the action in CAP23 requiring industries to implement measures with a short payback period identified in the energy audits. Consider expanding the scope of the audits to include fuel switching.

3. Energy security

Ireland's dependency on the United Kingdom for gas and electricity transit is likely to increase

Ireland is concerned with ensuring electricity and gas supply security while transitioning to a (variable) renewables-based energy system and advancing the electrification of the heating and transport sectors to meet the ambitious climate targets to 2030 and beyond to net zero emissions by 2050.

In November 2023, Ireland issued a comprehensive "Energy Security in Ireland to 2030" package. The actions set out in the package are supported by six strands of analysis:

- The Review of the Energy Security of Ireland's Electricity and Gas networks, the studies by Cambridge Economic Policy Associates to support this, and the 450+ consultation responses to this analysis.
- The Independent Review of the Security of Electricity Supply (the McCarthy Report).
- The conclusion of the National Energy Security Framework initiated by the government in April 2022, partly also in response to the Russia's invasion of Ukraine.
- The CAPs.
- The "Summit on Energy Independence: Realising the Opportunities for Ireland", which was hosted by the government in July 2023.
- Ongoing policy analysis on oil security of supply.

The package sets out permanent measures to ensure long-term security of supply to ensure net zero emissions in 2050 and short-term, transitional measures to 2030 that will allow Ireland to stay within its emissions budgets. Ireland is obliged to reduce electricity sector emissions by 75% by 2030 against a 2018 baseline.

More specifically, the package sets out 28 actions across 4 areas covering demand response, ensuring a renewables-led and more resilient energy system, and more risk-focused sector governance. Actions for more risk-focused sector governance include increasing the technical capacity of the relevant government departments, a clearer allocation of responsibilities among stakeholders and establishing a permanent energy security group. Beyond these specific actions, it is imperative that planning for the gas and electricity sectors be undertaken in

tandem and feed into each other; and that all concerned parties are in regular and close co-operation with each other (see Chapter 1).

Given Ireland's geographical location, it currently only has energy infrastructure links with the United Kingdom. However, the Energy Security Package sees the role of natural gas imports reducing over time due to the development of renewable, indigenous gas supply and renewable gas-compatible storage. It also sees new higher efficiency gas plants to complement its growing variable renewable generation portfolio. Energy storage, demand-side response, more interconnections and digitalisation are increasingly important with the rising penetration of variable renewable generation sources.

Gas

Natural gas will remain an important part of Ireland's energy mix at least until the mid-2030s

Natural gas plays an important role in Ireland's energy system, accounting for 33% of total energy supply in 2022. Ireland is a net importer of natural gas. Ireland's indigenous production of natural gas spiked in 2016/17 after exploitation of the Corrib gas field, situated offshore to the north-west of the country, started in 2015. Production from Corrib is slowly depleting and in 2022 Ireland imported 70% of its gas consumption. Corrib, Ireland's only gas production field, is expected to finally cease production not long after 2030. In 2030, Ireland would import just below 90% of its annual natural gas needs but 94% of peak day demand. A very small amount of biomethane, less than 1% of annual demand, was injected into the national system at Cush in 2022.

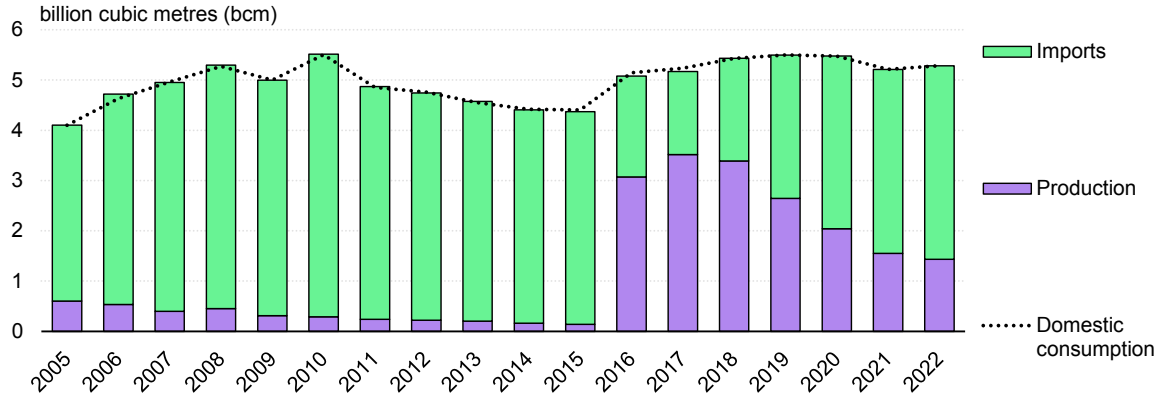
Ireland has decided not to permit new petroleum and natural gas exploration or production licences. Existing licences are not affected by the ban but applications for any additional offshore activities require ministerial consent and must comply with the Irish offshore strategic environmental assessment. Although a dozen or so existing (grandfathered) exploration and production licences remain extant, it is unclear but unlikely that these licences will result in any foreseeable future hydrocarbon production.

Looking towards the end of the decade, Ireland's gas transmission and distribution system operator, Gas Networks Ireland (GNI), has developed three gas demand scenarios. In two of these, demand for natural gas is set to decline to 2030/31 after peaking around 2025. Yet, demand in 2030/31 would still be at around the same level as in 2005.

However, the average year peak day demand is expected to increase under all three gas demand scenarios to 2030/31 driven by gas demand in the power sector, especially in winter. Looking specifically at the peak day gas demand, this

is projected to be 31% higher in 2024/25 and still be 17% higher in 2030/31 than it was in 2021/22, in line with increasing power generation from wind, while coal and peat-fired power generation are phased out and oil as soon as possible. Ireland's reliance on imported gas is, therefore, likely to grow incrementally but quickly to 2030 and beyond.

Figure 3.1 Gas production and import profile of Ireland, 2005-2022



Source: IEA (2023), World Energy Balances (database).

The United Kingdom's exit from the European Union has not impacted gas flows between the United Kingdom and Ireland. However, the United Kingdom is importing around 46% of its own gas consumption. Currently all imports are exclusively from the United Kingdom via the twin interconnector pipelines originating at one entry point in Moffat, Scotland – representing a cluster risk to gas security.

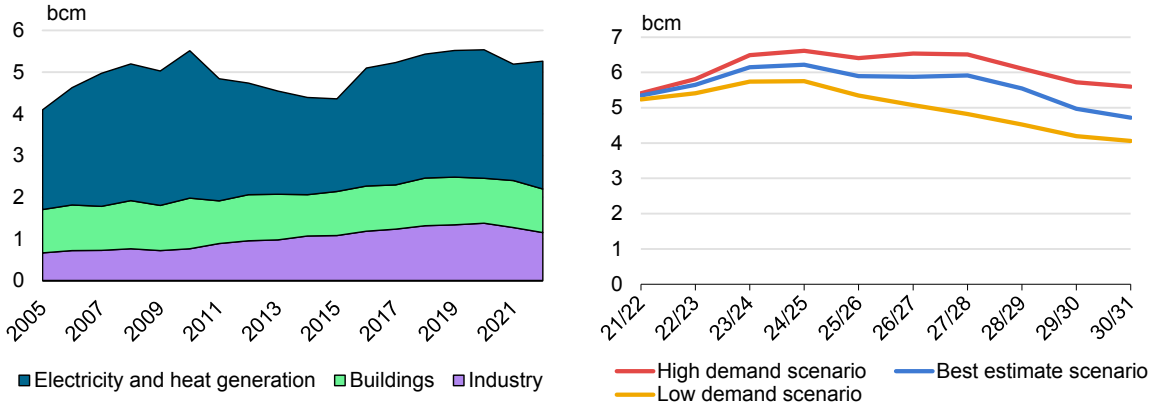
In its 2022 gas forecast statement, GNI noted that while the interconnections are adequate to meet all three gas demand projections, any potential constraint would arise at the associated compressor station installations in Scotland. GNI is pursuing several short-, medium- and long-term options to address this constraint, such as additional investments to increase the capacity of existing assets, short-term operational measures and the addition of electric drive compressors.

Because gas consumption is expected to decline after the mid-2020s, little new gas infrastructure is expected to be built. However, like the electricity grid, the gas grid will need to expand periodically to accommodate new point-sources such as green hydrogen, biomethane or storage. Moreover, the gas infrastructure must accommodate peak demand. The IEA supports the government's plan to develop a gas network transition plan also with a view towards decarbonising gas.

Moreover, Ireland does not have gas storage facilities. The few gas fields off the southern coast of Ireland have already ceased production. One of them, the

Southwest Kinsale field, was briefly used as a seasonal gas storage site but decommissioned in 2022. No new geological gas storage facilities are expected to be built, although various options for this are being considered. It is nevertheless unclear at what stage these plans are (see below). Thus, Ireland is set to be almost completely reliant on natural gas from the United Kingdom after about 2030 unless biomethane and/or low-emission hydrogen can provide substantial replacement for domestic gas production. The trajectory of growth in biomethane and low-emission hydrogen production, however, is uncertain.

Figure 3.2 Ireland's gas demand by sector, 2005-2022 and projections, 2021-2031



IEA. CC BY 4.0.

Source: IEA (2023), World Energy Balances (database) and IEA analysis based on GNI Forecast Statement 2022.

Biomethane and waste-to-energy production contribute to decarbonisation of gas and enhanced security

Ireland recognises decarbonised gases such as biomethane and renewable hydrogen as a critical component of its energy ecosystem. They provide a decarbonisation pathway for combustion emissions arising from medium and high-temperature industrial processes as well as gas-fired generation to cover peaks of demand in a grid with high levels of variable renewable penetration. Moreover, Ireland has plans to develop a national network of CNG refuelling stations for transport to reduce the sector's emissions (see Chapter 2).

Ireland's plans to produce up to 5.7 TWh of biomethane by 2030 (equivalent to 10% of total gas supply in 2022) is a welcome development. The government sees biomethane growing to an even greater level of total supply after 2030. Studies, including one by the European Commission in 2017, suggest that Ireland has the highest per capita potential for the production of biomethane in the European Union. The European Commission's 2023 Ireland biomethane fiche notes that biomethane can bring strong benefits for Ireland and could replace 20% of the current consumption of natural gas. In a recent report prepared by GNI, the potential for annual biomethane production is estimated at 14.8 TWh; however,

this number is based on responses received from actual and prospective producers and does not reflect existing infrastructure or that under construction.

Experience with biomethane injections into the gas network at Cush since 2020 has confirmed the commercial viability of this potentially growing industry and the system's ability to accommodate biomethane. Through its connection policy framework, GNI is now allowing for direct grid injection projects and is currently developing a central grid injection infrastructure to facilitate the development of remote cluster developments of biomethane.

CAP23 foresees the development of a biomethane strategy. The Department of Agriculture, Food and the Marine and the DECC have established a biomethane working group to develop the strategy. Consistent with Ireland's broader goals to decarbonise the agriculture and forestry sectors through land-use change, the working group sees opportunities to use grass as a feedstock for anaerobic digestion. Part of the funding to kick-start production and support a grass biorefinery demonstration and testbed facility will come from the revenues from the carbon tax.

Anaerobic digesting equipment is not required per se. Biogas can also be captured from landfills, concentrated manure sites and sewage treatment facilities. However, it must be further processed into biomethane compatible with natural gas distribution systems and end-use application. In fact, some industries have raised concerns on how the diversification of gas supplies and increased blending of gas could impact gas quality and potentially pose a security risk for system operation.

The IEA's World Energy Outlook special report "Outlook for biogas and biomethane" of 2020 notes their value as a modern source of clean energy and states that supportive policies are required to unlock the potential for biogas and biomethane globally. Ireland is a member of the IEA TCP on Bioenergy and especially active in task 37 that covers the entire biogas production chain from feedstock collection and pre-treatment to biogas upgrading, bio-fertiliser application and process chain sustainability.

Scaling biomethane production requires careful consideration on pricing and feedstock guidance, as the benefits of biomethane production emissions are sensitive to its broader supply chains. The biomethane policy design should avoid creating a revenue stream from waste management that could unintentionally incentivise the creation of waste or otherwise increase overall emissions. This could be particularly problematic in the agriculture sector, where additional revenue may be invested to increase herd numbers or nitrogenous fertiliser use.

Similarly, diverting products in the food value chain, not limited to human-grade food, can cause carbon leakage from the biomethane project. For example,

reducing herd numbers so the fodder can be used to produce biomethane without decreasing meat or dairy consumption will likely increase herd numbers outside the project boundary. Promoting the use of fodder for biomethane production may also incentivise the use of nitrogenous fertilisers, which produce nitrous oxide, a GHG with a warming potential almost 300 times that of CO_2. In this example, biomethane may present no climate advantage over, or be worse than, natural gas. Quality land sector carbon offset methodologies consider these issues in detail and may provide helpful guidance to policy constraints while developing the biomethane strategy.

Ireland's existing biomethane production is concentrated in landfill gas capture and combustion, which is currently supported under the renewable energy feed-in tariff (REFIT[4]) 3 scheme. It supports anaerobic digestion and biomass combustion (for both heat and power). The reference price for each renewable energy category is adjusted for inflation and acts as a floor price for developers, though some industries note that the reference prices do not reflect realised costs.

Industry highlighted that the creation of a long-term and predictable support programme will be key to unlocking the identified production potential. Beyond this, GNI noted that the government needs to put in place speedy and enabling planning and permitting processes (see Chapter 1). In parallel, GNI is proceeding with the development of its own contract and tender process for the procurement of biomethane.

Enabling framework needed if hydrogen is to support energy security and transition post-2030

Ireland plans for hydrogen to play an important role in the gas mix, and published a National Hydrogen Strategy in July 2023 which sets out specific actions. The country does not have yet any significant hydrogen infrastructure but has an ambition to have 2 GW (of the total 7 GW expected) of offshore wind power capacity in place by 2030 to produce hydrogen. Post-2030, Ireland has estimated a potential for at least 30 GW of floating offshore wind capacity, part of which will be used for hydrogen production.

However, the economic viability and infrastructural requirement to support a hydrogen industry have yet to be demonstrated. The enabling factors will likely rely on demonstration projects that will not emerge until Ireland's offshore wind ambitions bear fruit (see Chapters 3 and 4). Hence, at present, Ireland will depend on the United Kingdom's plans to introduce hydrogen into its transmission network, including the interconnectors to Ireland.

[4] REFIT 3 was ended at the end of 2015 for new applications.

GNI has studied the efficacy of transporting hydrogen through its transmission and distribution systems. The distribution system could handle a flow of 100% hydrogen while the transmission system could currently handle at least 20%. GNI is now studying whether the transmission system could safely handle a higher percentage.

In time, using offshore wind for hydrogen production will help address the challenges of hard-to-decarbonise sectors such as heavy goods transport, maritime and aviation, and some industry sectors. Hydrogen (and other e-fuels) could also be stored to provide backup for the power sector to reduce the reliance on fossil fuels and help support and manage the seasonal and long-term variability of wind energy. In the long term, Ireland is considering exporting renewable hydrogen.

Geological carbon storage has not yet been developed in Ireland, although a licensing regime for the geological storage of renewable hydrogen will be advanced through the 2023 National Hydrogen Strategy. However, energy system decarbonisation scenarios aligned with Ireland's objectives suggest that CCS and GHG removal technologies such as bioenergy with carbon capture and storage, will need to be deployed. Opportunities exist in both the industrial (primarily cement sites) and energy-from-waste sectors. According to the National Heat Strategy, these technologies can achieve considerable scales of negative emissions in high-deployment scenarios (nearly 17 Mt CO_2-eq per annum by 2050, including up to 9 Mt CO_2-eq per annum of negative emissions potential from BECCS).

Advanced planning around the role of CCS and BECCS in Ireland is needed, particularly around clustering of sites and infrastructure, if policy seeks to encourage deployment of the technology. This can provide confidence to infrastructure developers about the industry's likely scale, aiding the development of business models.

Gas will remain critical to meet peak electricity demand

In 2022, 58% of Ireland's demand for natural gas was for electricity, around 20% for industry and almost the same share for buildings. Electricity demand is expected to grow strongly with the electrification of the transport and heating sectors as part of Ireland's energy transition but also reflects the government's success in attracting investment in data centres to make Ireland a world hub of Internet connectivity (see Chapter 2). Winter peak gas demand is therefore expected to rise.

Ireland is committed to increase the share of renewable electricity generation to 80% by 2030, most of which will be from wind and solar. The expected fast growth of variable renewable electricity generation implies that Ireland will need to ensure

sufficient flexibility in the electricity system. Looking to 2030, gas-fired generation would appear most suitable given that it can quickly ramp up when needed. Gas-fired generation will be running fewer hours in total but having to cover high demand for capacity when renewable generation is not available. Ireland is planning to install at least 2 GW of new gas-fired capacity by 2030, partly also to replace some existing, outdated plants. The establishment of electricity interconnector capacity supporting peak electricity demand will help reduce peak gas demand as well (see below).

Ensure security of gas supply

With the United Kingdom's exit from the European Union, Ireland relies exclusively on a non-EU member country for its gas imports and gas security of supply. The United Kingdom is not bound by the European Union's framework for security of gas supply, including the sharing of gas supplies in an emergency situation. However, bilateral agreements exist and there is no threat that the United Kingdom would disrupt gas supply for political reasons. Furthermore, Northern Ireland is also supplied through the same single injection point at Moffat.

Ireland does not meet the N-1 criteria for gas security of supply given its dependence on one single gas injection point.[5] Ireland needs to consider this possible single point of failure when assessing security of supply options. The government has excluded additional exploration for domestic resources.

A government policy statement of 2021 positioned Ireland against the import of fracked gas. However, the comprehensive energy security review proposed the installation of a floating storage and regasification unit (FSRU) as one possible mitigation measure. In September 2023, An Bord Pleanála (ABP) rejected an application by a private company for an FSRU terminal, battery energy storage system and combined-cycle gas turbine power plant with reference to the 2021 government policy statement.[6]

The final Energy Security in Ireland to 2030 policy package released in November 2023 has a dedicated report on securing Ireland's gas supplies, which assessed five risk mitigation strategies against the contribution to energy security, sustainability and affordability. From the five assessed options, the government recommends research on potential sites for hydrogen storge supporting the development of renewable gas storage in the future and pursuing the creation a state-led strategic gas emergency reserve but excluded the installation of an

[5] The N-1 criteria of an EU regulation requires that gas demand be met in the event of the loss of a country's largest single piece of gas infrastructure.
[6] An Bord Pleanála is the independent Irish planning appeals body, which is also responsible for the permitting of strategic infrastructure development.

onshore fixed LNG terminal. A final decision is expected to be taken in the first half of 2024 subject to a detailed examination of the optimal approach to deliver emergency gas reserves by GNI.

An FSRU could provide additional security of supply and could also provide strategic gas storage as a security asset (with the option of being a commercially operated asset). It could also be a significant backup gas reserve in the event of renewable energy shortages or a gas supply emergency. These are important attributes as Ireland moves toward a renewable energy-fuelled supply future.

FSRUs can be made operational much faster than an onshore LNG terminal, as demonstrated by Finland, Germany and the Netherlands. Moreover, as the IEA noted in a hearing of the Irish Joint Committee on Environment and Climate Action in May 2023, an FSRU can be term-leased, meaning that Ireland would not have to invest in a permanent facility that locks-in carbon emissions or becomes a stranded asset. Another advantage of an FSRU over a fixed terminal is that it can be decommissioned when it is no longer needed and would have substantially smaller environmental impacts.

Regarding underground gas storage, the only other known alternative in Ireland would be to recommission the Kinsale Head geological reservoirs to be a strategic gas storage site. In late October 2023, ESB partnered with Bord Gáis Energy and dCarbonX to launch the so-called "Kestrel Energy Storage project", which aims to develop the Kinsale Head gas field for storage of initially natural gas and eventually green hydrogen. Neither the cost nor the time frame for this project are yet available. A private developer, Islandmagee Energy Limited, plans to construct a salt cavern gas storage facility in Northern Ireland. A judicial review of the approval and licensing granted to the project in 2021 came out favourably in August 2023. The gas storage facility would be able to store up to 500 million cubic metres of gas and could be converted to store hydrogen.

The government proposes undertaking further analysis for gas storage solutions that are future-proof and can accommodate renewable gases and extend beyond Kinsale Head. Moreover, the government commits to maintaining the existing onshore pipeline from the Kinsale gas field that connects the shoreline to the gas transmission system and to transfer ownership of the so-called Inch gas pipeline to GNI. The government has also noted that the legal and regulatory framework for gas storage must be put in place. In the IEA's view, this should be pursued with urgency, as it is a critical pre-condition for putting strategic gas storage in place.

An FSRU and/or gas storage would provide capacity and flexibility when needed and annual emissions from these would hence be very limited. A technical analysis for the energy security framework has estimated that the commercial operation of an FSRU in Ireland would generate emissions equivalent to about 2% of the total electricity sector emissions ceilings budget.

However, in view of Ireland's emissions commitments to 2030 and beyond, such flexibility services need to eventually be fully decarbonised. The Energy Security Package is clear that the development of long-term gas storage solutions would be renewable gas compatible, and in particular hydrogen.

Recommendations

The government of Ireland should:

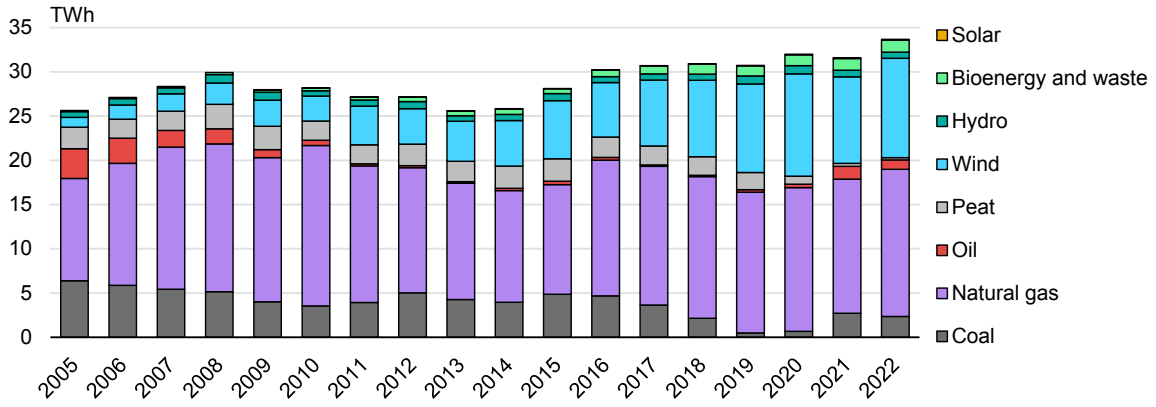
- Prioritise the use of waste, including manure and sewage, in the biomethane strategy. Encourage the growth of domestic biomethane production and its connection to the transmission and distribution systems.
- Ensure the biomethane strategy safeguards against increases in greenhouse gas emissions, especially those resulting from reduced food production, increased herd numbers and nitrogenous fertiliser use.
- Expand the scope of work on geological hydrogen storage to include captured carbon, with consideration given to clustering infrastructure near gas infrastructure, and cement and lime facilities.
- Co-ordinate with the United Kingdom on the future injection of hydrogen into the import pipeline.
- Assess the option of an FSRU as both a strategic gas storage asset with access to world gas markets and a potential backup for renewable energy as Ireland transitions toward a net zero economy.

Electricity

A system with 80% renewable generation requires changes in operational practices and substantial investments

The Irish power sector has one of the highest shares of variable renewable electricity generation globally, at 34% in 2022. The share of renewables in demand reached 37% in the same year. In 2023, the share of renewables reached 42%. Ireland is committed to increase the share of renewables to 80% of electricity demand by 2030. Most of the existing variable generation is wind, with a much lower share of solar. The ambitious target for 2030 will require not only substantial investment in new renewable capacity but also in onshore and offshore transmission and distribution infrastructure, complementary generation capacity, storage, more flexibility in the electricity system, and better demand-side management. Maintaining security of supply throughout the transition in a relatively isolated system with such high shares of variable renewable generation also requires innovative regulatory and operational approaches and substantial modifications to the planning and permitting processes (see Chapter 1).

Figure 3.3 Electricity generation by source in Ireland, 2005-2022



Note: Solar is not visible at this scale; it accounted for 0.12 TWh in 2022.
Source: IEA (2023), World Energy Balances (database).

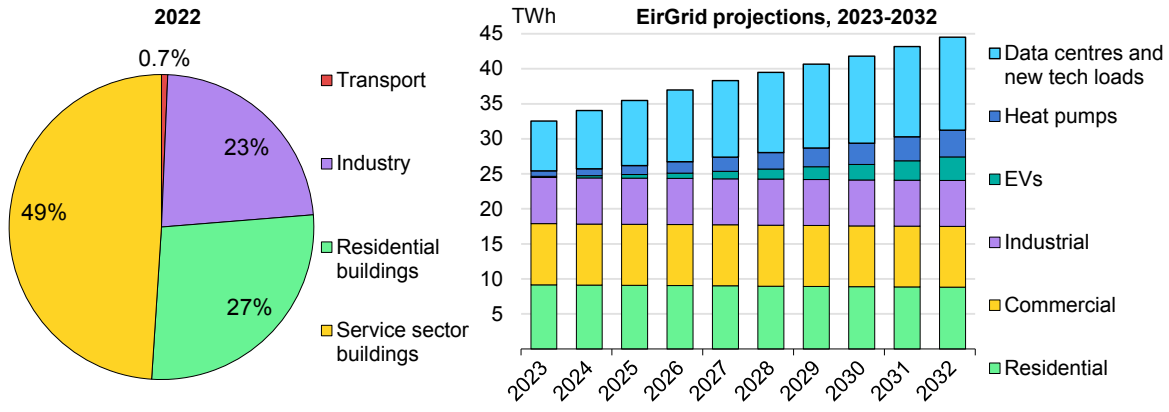
Natural gas accounted for almost half of electricity generation in 2022 and will continue to play an important role in the electricity sector, albeit depending more and more on imported gas. In 2022, Irish electricity demand was 30.5 TWh, the highest so far recorded, and domestic production was 33.7 TWh. Ireland exported 0.2 TWh of electricity, used 0.4 TWh for pumped storage and had 2.5 TWh of distribution losses. Ireland's peak electricity demand occurs during winter.

According to IEA data, electricity demand in Ireland is dominated by service sector buildings (that includes energy consumption from data centres), which accounted for 49% of demand in 2022 and has driven the increase of demand since 2011. Residential buildings account for 27%, industry for 23% and transport for a very small share (0.7%) (Figure 3.4). According to Ireland's electricity transmission operator, EirGrid, data centres and other new technical load accounted for over 16% of total electricity demand in 2022, up from 6% in 2016. This is equivalent to 70% of total electricity demand growth over that period.

Looking towards 2032, the latest year for which EirGrid has published a demand outlook, the share of data centres and other new technical load is expected to account for 30% of total electricity demand. Total electricity demand would grow by 48% over the same period under EirGrid's median demand forecast. Another driver of electricity demand are EVs and heat pumps, whose share would be growing from just under 2% in 2021 to 12.8% of total electricity demand in 2031 as per targets set under CAP21.

This strong demand growth has substantial implications for investment needs in the entire electricity sector value chain and sector management to ensure security of supply while moving forward with decarbonisation. Among the supply side options to ensure security of electricity supply beyond the strong expansion of renewable generation are additional gas-fired generation, pumped hydro storage, a biomass plant, batteries, increasing the requirement of secondary fuel storage and eventually converting a combined-cycle gas turbine to hydrogen. Work on a strategy to explore the potential of demand-side flexibility is ongoing (see below).

Figure 3.4 Electricity demand by sector in Ireland, 2022 and projections, 2023-2032



Sources: IEA (2023), World Energy Balances (database) and IEA analysis based on EirGrid (2022), Generation Capacity Statement Data Workbook.

As early as the winter of 2020/21, Ireland started to go through a period of so-called system alerts, defined as periods with particularly tight margins between

electricity supply and demand due to insufficient firm capacity. This was partly attributable to unforeseen outages of large generation plants, a cold snap and increasing demand. While in 2021, EirGrid anticipated increasing system alerts in the future, for the winter of 2023/24, it expects fewer hours during which a system alert may occur than during the previous winter due to the capacity delivered under the government's security of electricity supply programme. Despite this short-term improvement, EirGrid remains overall cautious about generation capacity adequacy.

The Commission for Regulation of Utilities (CRU), the independent energy and water regulator, issued a "Security of Electricity Supply – Programme of Actions" in 2021 to improve the short-term reliability of the electricity system. CRU noted the need to revisit the closing date of older and more polluting plants until new additional and enduring capacity becomes operational. Likewise, EirGrid warned that Ireland may experience a generation adequacy issue from 2026 onwards if the country's last coal-fired power plant, the Moneypoint plant, which is also Ireland's single largest power plant, closes as scheduled at the end of 2025. Or if similar large capacity becomes unavailable. Contracts were recently signed with the Moneypoint plant to retain its capacity as a backup electricity generator only and to run on heavy fuel oil instead of coal.

Spotlight: Data centres

Data centres are driving electricity demand in Ireland. According to Bitpower consultants, by June 2023, there were 82 data centres operating in Ireland with a connected load of 1 261 megawatts (MW); 14 were under construction with a connected load of 356 MW; 40 had their planning approved for 1 286 MW additional load; and 12 applications for expansion of their operation were under consideration for 390 MW.

According to EirGrid, in 2022, 1 700 megavolt-amperes (MVA) from data centres was contracted at the transmission level and 600 MVA at the distribution level. Data centres used 34% of contracted capacity. EirGrid also noted that it has received requests for an additional 2 000 MVA of connections. Irish peak electricity demand was around 5 500 MVA in 2021.

In addition, GNI has contracted 11 data centres, 5 of which are connected to the gas grid but only 3 of which were consuming gas as of January 2024. GNI has received applications and/or enquiries for gas connections from 20 additional data centres. However, this is potentially adding pressure on both securing gas security of supply and Ireland's emissions reduction targets. Considering these concerns, the government requested GNI halt giving any further connections to the gas grid.

Despite this dominant role of data centres on electricity demand, there is no official oversight about either data centres' exact electricity consumption nor the exact

number of data centres and/or units in operation. When applying for electricity grid connections, data centres are not required to identify as such, and are not required to provide metered electricity data or inform about the extent of their onsite generation. The IEA supports SEAI's position that data centres should be required to provide this information, which will not only improve the accuracy of energy use data but also allow for better system planning and contribute to system security of supply. It is also welcome that under a new EU directive, by 15 May 2024, data centres with more than 500 kilowatts (kW) installed information technology capacity will need to report on their energy performance annually.

CRU does not collect the data, as it is not tasked with regulating data centres; the Central Statistical Office (CSO) relies on information provided by ESB Networks that operates Ireland's distribution system and by EirGrid on all meters connected to the network from which it then deducts information by applying three methodologies. Hence, official consumption data and forecasts for data centre consumption may not be accurate.

The government should identify which institution should be tasked with creating and maintaining a register while ensuring the confidentiality of sensitive commercial information. The IEA encourages CRU and other concerned actors to quickly complete the demand-side strategy (under consultation) and accelerate its implementation, with a particular view on the connection policy for large energy users to the electricity and the gas grid, equally under consultation.

Growing electricity consumption is putting a considerable strain on Ireland's electricity system, especially as almost all data centres (existing and planned) are clustered around the Greater Dublin area, which is already experiencing immense stress on its power transmission system. In late 2021, CRU issued a direction to EirGrid and ESB Networks regarding the connection of new data centres. It directs and empowers EirGrid and ESB Networks to assess any new applications from data centres against four criteria to ensure system stability and reliability needs:

(i) the location of the proposed data centre
(ii) the ability to install onsite dispatchable generation and/or storage capacity at least equivalent to the demand of the data centre
(iii) the ability of the data centre to provide demand flexibility, if needed, by using their dispatchable capacity
(iv) the ability of the data centre to provide demand flexibility by reducing consumption to support security of supply and avoid system alerts.

Since the direction was issued, EirGrid has imposed a *de facto* stop on connecting any new data centres to the grid in the Greater Dublin Area until 2028; this is not applicable to those that have already received their permits. This reflects the generation and transmission constraints in the region. However, EirGrid is still

processing connection requests outside of the Greater Dublin Area on a case-by-case basis while applying the four criteria set out by CRU.

In July 2022, the government issued a second statement on the role of data centres in Ireland's Enterprise Strategy for sustainable data centre development to enable the twin transitions of digitalisation and decarbonisation. It noted that the growth of data centres without electricity grid connection could result in security of supply risk being transferred from the electricity to the gas supply, which would be a significant challenge given Ireland's reliance on gas imports.

However, data centres have a large potential to offer flexibility services that are critical to a system with a dominant share of variable generation by shifting/reducing their demand and/or feeding their onsite generation to the grid (see below). Moreover, as the IEA noted in its 2019 review of Ireland's energy policies, the waste heat produced by data centres' can be used to set up small local DH systems that can contribute to reducing emissions from heating. CRU is considering plans to require new data centres to be built ready to export their heat (see Chapter 2).

Capacity investments must be financially attractive and free of red tape

To complement the planned build-out of renewable capacity, CAP24 foresees the construction of at least 2 GW of new flexible gas-fired generation capacity by 2030. According to EirGrid, part of the new capacity will replace existing thermal plants with a capacity of around 1.6 GW. Those plants are mainly closing due environmental restrictions. The new capacity will be complemented by electricity imports and demand-side measures.

The Irish electricity system is operated as an all-Island system, the Single Electricity Market (SEM) (see below). Since 2018, the SEM operates a capacity market, the so-called capacity remuneration mechanism (CRM) and organises yearly auctions. It allows generators to recover their fixed costs for making their capacity available to the market with capacity compensated on a per MW basis. The Irish authorities set the amount of new capacity in the CRM and thereby determine a significant portion of investment in new capacity. It is important to ensure that capacity delivered is both adequate and cost-efficient. Other technologies eligible for the CRM auctions include pumped hydro and battery storage, demand-side units, and interconnections.

The delivery of capacity through the CRM has not been sufficient to secure the additional firm generation capacity needed. Around 650 MW of new capacity awarded under the CRM for delivery by 2023 and 2024 has been withdrawn by developers, and delivery of additional awarded capacity is delayed beyond the target years of the auctions. Moreover, further CRM auctions have not yet resulted

in sufficient outcomes to fully deliver the capacity needed from 2024 onward, leaving a capacity gap of around 1 250 MW in 2025, falling to 550 MW in 2028. Further CRM auctions will be held to address the capacity gap.

Increased costs and supply chain shortages rendered some projects uneconomical at the set bid price, forcing project developers to terminate their contracts and pay a penalty. Delays by equipment manufacturers caused some projects to be postponed beyond the target year. A recurrent reason for delays and contract terminations is the lengthy permitting and environmental approval process, which further increase costs for developers (see Chapter 1). New capacity is typically bid four years ahead of project delivery and questions have been raised about whether this time frame is realistic considering these well-known issues of obtaining permits. Also, there is currently not one single entity responsible for the entire planning and permitting process.

Indeed, in both its 2012 and its 2019 Energy Policy Reviews of Ireland, the IEA noted that planning consent remains a significant obstacle to the deployment of the generation and network infrastructure. The reports recommended more effective cross-departmental, cross-agency and upfront stakeholder interaction to reduce delays in building critical energy infrastructure and a revision of the planning and approval consent regime.

The IEA therefore congratulates Ireland for the introduction of the Planning and Development Bill 2023 into Parliament in November 2023. The bill was developed by the office of Ireland's Attorney General jointly with the Department of Housing, Local Government and Heritage and will be "enhancing clarity, improving consistency and increasing confidence in the planning system". Among other innovations, it sets statutory mandatory timelines for all consent processes, including for decisions taken by ABP, which is being renamed An Coimisiún Pleanála and whose remit is enlarged. Certain energy infrastructure will be legally designated as critical infrastructure development and would then benefit from the statutory approval periods.

However, Ireland has made notable progress in attracting storage capacity under the CRM. The combined electricity storage capacity connected to the grid is around 792 MW. This consists of approximately 500 megavolt batteries, with an average duration of less than one hour, and 292 MW of pumped storage. Another 500 megavolts contracted to connect over the next five years. By 2026, the system operator expects an additional 400 MW of batteries to provide further capacity and longer storage duration to the all-island power system. The government is now developing an electricity storage policy framework, which is expected to be published in early 2024. In parallel, CRU is reviewing the regulatory treatment of electricity storage including licensing, charging and market incentives.

Ireland is implementing recommendations following a review of the performance of the CRM after extensive consultation with stakeholders. The effects of the resulting changes should be monitored closely to allow corrective measures to be taken as early as possible. The failure of the CRM auction has resulted in very costly short-term capacity procurement. EirGrid was authorised to purchase around 450 MW of temporary mobile emergency generation capacity to prepare for the winter peak period as of 2023/24. This was in addition to a prior procurement of around 200 MW of temporary emergency generation capacity. The cost will be paid by consumers through a designated levy on electricity tariffs. The emergency plants would only be allowed to operate until the end of March 2027 although a one-year extension is possible under certain conditions.

Of the contracted capacity, 192 MW became operational in December 2023 and the remainder is expected to become available during 2024. However, the total emergency generation capacity for 2023 was not delivered, even though the Irish parliament passed the Development (Emergency Electricity Generation Action) in 2022 and the Environmental Protection Agency (Emergency Electricity Generation) Amendment Act in 2023.

The Act allows for exemptions from certain aspects of the planning and environmental procedures and instead allows a shortened process; this approach is similar to the ones taken by several IEA countries over the last year which were equally under pressure to ensure security of supply due to the geopolitical situation. Other reasons for the expected delay relate to pressure in the international supply chain and the cost of inflation.

Another government measure to address the projected shortage of additional firm capacity is the intention to retain the possibility of operating conventional plants that were expected to close due to environmental considerations until new firm conventional generation has been secured. The Moneypoint coal-fired plant will convert to heavy fuel oil and continue operation until 2029. This ensures that 820 MW of capacity remain available if needed while also reducing emissions as coal and peat are phased out from power generation.

Targeting the demand side, agreement was reached with around 30 large commercial and data centres to increase flexibility in the load. In the event of severe supply shortages, contracted parties will be given a one-hour notice before supply is interrupted. A similar policy is being explored for the new demand-side policy currently under development by CRU that is committed to deliver 15-20% of demand flexibility by 2050 (see below).

Grid development is at risk of becoming a strong bottleneck for the renewable target

The development of electricity grid infrastructure is key to allow for both demand growth due to electrification and Ireland's success in attracting data centres to the country, and the large-scale deployment of renewable electricity generation. Just as for the development of renewable energy, the connection of large loads should follow a plan-led approach to allow for the timely expansion of the electricity grid.

The planning of grid extension and reinforcement should assess the attractiveness of sites for renewable energy developers and strike a balance between the available renewable energy potential and the projected grid costs. Moreover, grid users need to be able to see where there is capacity in the grid for new connections. This could be indicated on maps or signalled through differentiated tariffs. Such measures will benefit new projects – both consumption and generation. They will also reduce the need for non-firm grid connections of renewable energy. It is encouraging that EirGrid has rolled out plans for the creation of energy and grid clusters.

Ireland's electricity system planning is based on a network plan (the transmission forecast statement) and an adequacy assessment (the regular generation capacity statements) that each have a ten-year time horizon and are regularly updated. In addition, the Shaping Our Electricity Future Roadmap, originally published in 2021, looked at needs for power system transition, security of supply and transmission network development to meet Ireland's, at that time, 70% renewables target. This assessment was updated in 2023 in line with the new 80% renewables target and the carbon budgets.

An extension of these analyses to provide for integrated energy systems planning accounting for the expansion and increased flexibility of electricity transmission, generation and storage; gas infrastructure; electrification of heat and transport; and demand response, in alignment with Ireland's net zero goals, will be critical to providing guidance for the efficient future development of all sectors. Ensuring sufficient grid capacity is available to accommodate the planned renewable generation also requires changes to the current regulations, including dealing with the protracted planning and approval processes. In addition, such analyses, if carried out transparently and with meaningful stakeholder engagement, can raise community awareness of the role of infrastructure development in achieving the climate goals. And can also increase investor certainty.

Eirgrid is to be lauded for the extensive stakeholder consultations and engagements undertaken and its commitment to continue regular engagement to ensure the needed support for the grid infrastructure. Consultants have clearly identified the desire of affected communities to directly benefit from the energy

transition and the creation of new infrastructure in their localities and interest in micro-generation and community-owned energy projects appears strong.

The IEA suggests that the connection charging methodologies under consideration be carefully analysed to avoid it becoming a barrier to community energy projects. This is due to oftentimes large upfront connection charges that might be reduced later, when other users connect to the grid in the same location. Given the critical importance of community engagement, Ireland should consider how to enable community energy projects to successfully connect to the grid.

To make the electricity system more flexible, the government plans to enable hybrid grid connections and introduce local flexibility market arrangements to encourage investment in storage including batteries. Hybrid grid connections combining variable production with storage or combining wind and solar production behind a common connection point has the potential to reduce grid costs. This requires a legal framework to allow for multiple plant owners behind the meter and the provision of adequate information to EirGrid to maintain secure system operations. Moreover, efficient system operation also includes the distribution system operator and Ireland is to be lauded for its ongoing close co-operation between the system operators through a dedicated workplan.

To alleviate high electricity prices during 2022, Ireland, like most IEA countries, provided financial support to households. However, the government has chosen to provide all household electricity consumers with bill relief via electricity suppliers. This approach has led to an inefficient allocation of financial relief and a large administrative burden for electricity suppliers. Preferably such help should be targeted to vulnerable consumers only and should be delivered through existing social support channels.

More interconnection and storage capacity are needed to ensure security of supply

Electricity interconnections can play an important role in relieving pressure on the Irish electricity grid and will also impact on the peak demand for gas, as electricity imports will reduce the need for gas-fired electricity generation during peak times. The Irish government, therefore, plans several new electricity interconnections to enhance security of electricity supply. It published its first electricity interconnection policy in 2018 and a revised version in 2023 committing to more integrated onshore and offshore forward planning.

Although the Irish electricity system operates as an SEM, there is only one line – the tie-line – between the two jurisdictions. It allows a maximum flow of 300 MW in either direction, which has been creating a bottleneck for cross-border electricity

flows for well over a decade. Initial conceptualisation and planning for a second North-South Interconnector started in 2008, which is designed for capacity flows of up to1 500 MW.

The second North-South Interconnector was originally expected to become operational by 2023 but legal challenges to the planning consent in both jurisdictions have significantly slowed progress. The interconnector is now due for completion by 2026/27, though some court cases are still pending. To address the remaining concerns from affected communities and landowners, EirGrid is pursuing an innovative approach by setting up community fora to allow for constant dialogue and information sharing with a large group of stakeholders, including local communities, SEAI, ESB Networks and local authorities. Moreover, EirGrid is creating a community benefit fund to support local projects and services. EirGrid will apply both engagement tools to all strategic infrastructure projects moving forward including the additional interconnector projects discussed below. If EirGrid's approach successfully mobilises local support and accelerates project implementation, it would be a best practice example for other countries to follow.

Since 2012, Ireland has also been importing electricity directly from the United Kingdom through a single interconnector to Wales, the 500 MW East-West Interconnector. The second interconnection with Wales, known as Greenlink, is expected to become operational in the fourth quarter of 2024, doubling the current capacity. Further interconnections to Great Britain by 2030 may be pursued; for example, the MaresConcept project would bring 750 MW of additional interconnection capacity likely by 2029.

Ideally, Ireland would be connected to multiple countries in continental Europe, subject to a cost-benefit analysis and adherence to the N-1 requirements for system security. The proposal for an interconnector with France, the Celtic Interconnector, was initiated in 2011. Physical work commenced in November 2023 and is expected to be completed in late 2026, with full commercial operations commencing in 2027. The Celtic Interconnector is designed to allow electricity to be transferred in either direction to accommodate possible electricity exports from Ireland to France/continental Europe given Ireland's ambitions for creating wind capacity and would also contribute to minimising possible curtailment of wind energy. By 2030, Ireland could have a renewable electricity generation surplus of 20% which could be exported or converted for innovative uses if all related projects proceed and are completed as currently planned.

Ireland's geographical location implies that costs for interconnections are higher than for continental European countries and there is only a limited number of countries Ireland can feasibly connect with. The United Kingdom is likely to remain its major interconnection partner. With a view to Ireland's ambition to create 37 GW of offshore wind capacity by 2050, Ireland and France signed a joint

declaration of intent on energy transition co-operation in November 2023. The Irish and French transmission system operators are examining the feasibility of a second interconnector.

Table 3.1 Existing and new interconnection projects in Ireland

Projects (existing)	Capacity (MW)	Countries	Status	Timeline
Tie-Line	300	Ireland and Northern Ireland	Operating	
East-West Interconnector	500	Ireland and Wales	Operating	
Total capacity	800			
Projects (under construction)				
Second North-South Interconnector	1 500	Ireland and Northern Ireland	Delayed	Original date: 2023 New date: 2026/27
Greenlink Interconnector	500	Ireland and Wales	Delayed	Original date: 2023 New date: 2024
Celtic Interconnector	700	Ireland and France	On schedule	2026
MaresConcept	750	Ireland and Wales	On schedule	2029
Total capacity	3 450			

Innovation and digitalisation in the electricity market to complement infrastructure investments

The single interconnection between the two jurisdictions creates a single bidding zone wholesale market. The SEM is the wholesale electricity market for the island of Ireland (including Northern Ireland). The CRU regulates the all-island wholesale single electricity market jointly with its counterpart in Northern Ireland, the Utility Regulator, through the Single Electricity Market Committee.

In 2022, the SEM reached a 75% system non-synchronous penetration level. To do so, major technical challenges relating to the integration from wind, solar and interconnectors were addressed. Operational developments played a critical role in providing this system service and, in particular, the DS3 (Delivering a Secure Sustainable Electricity System) programme designed to facilitate the greater penetration of renewables. The DS3 programme was launched in 2011; its current arrangements will expire in April 2024 and work on a successor programme is ongoing with a Future Arrangement for System Services. The current design of the DS3 programme is sufficient for short duration storage technologies, less than two hours. As Ireland is moving towards an 80% share of variable renewables by

2030, it is considering the cost and benefits of introducing longer duration storge technologies for which the current DS3 is likely insufficient.

Payments for system services through the DS3 programme play an important role in providing flexibility to the electricity system. EirGrid is responsible for administering DS3 and procures a set of system services from a range of service providers, including conventional generators, wind farms, interconnectors, storage and demand-side response. Twelve services are currently available for providers to tender for, ranging from inertia to reserves, voltage and ramping. As renewable energy penetration increases, new services may be needed, and others could become obsolete. Therefore, the procurement of ancillary services, including the types of services, needs to be further developed in close co-operation with stakeholders. The Future Arrangement for System Services includes work on this.

As ancillary services can provide an important revenue stream for flexible resources, it is important that remuneration reflects the value of the service fairly and allows for the needed investment, for instance in storage capacity. To that end, long-term agreements spanning multiple years will be helpful.

Demand response is facetted; ranging from demand reduction through increasing energy efficiency such as through better insulated buildings to demand flexibility, which aligns the timing of energy consumption with production; which is becoming more and more important in a system based on variable renewables; and even mandatory demand curtailment.

Demand-side flexibility is playing an increasingly important role in the Irish electricity system. As directed by CAP23, CRU is preparing an energy demand-side strategy covering electricity and natural gas. The strategy will focus on enabling smart services, demand flexibility and response, and developing a new approach for assessing new connection requests of very large electricity and gas users. The strategy aims to deliver the 30% demand flexibility target set in CAP23 and, in particular, to identify ways to moderate demand from data centres during peak demand times.

For small users, the focus is on the roll-put out of smart meters and smart meter services. Over 1.2 million smart meters had been deployed by May 2023, equivalent to around 50% of all electricity meters. Third parties, in particular electricity suppliers, face regulatory barriers to access and make use of smart meter data. This is hindering the development of smart services needed to enable consumers to actively provide flexibility and contribute to the government's demand-side flexibility targets. Data access can be improved through the swift implementation of the Commission Implementing Regulation adopted in 2023 on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data. The government is also in the process of preparing a Smart Metering Data Access Code, which would allow

making consumption data available to third parties. The IEA supports these efforts and suggests they be implemented quickly.

At the same time, the installation of smart meters does not equal the use of smart services. In May 2023, only 14% of those with a smart meter were using either smart tariffs or time-of-use tariffs. While this is a first step towards consumers gaining a better understanding of their consumption, it is a long way from implementing and using a smart system as needed for the increasing share of renewable energy sources. The IEA therefore welcomes CRU's ongoing efforts to find ways to accelerate the uptake of smart tariffs as part of its demand-side strategy and encourages a speedy implementation.

Towards a new approach to measure security of supply

Eirgrid currently uses the loss of load expectation (LOLE) target for assessing the needed capacity. EirGrid and CRU are jointly working to develop and implement a national resource adequacy methodology to align with the relevant EU regulation from 2019 (EU Regulation 943/2019).

LOLE expresses the number of hours each year during which supply is expected to be insufficient to reach demand. It provides the statistical probability over the long term but does not predict what will happen in a given year. For large shares of renewable energy, the use of LOLE alone may become less suitable and energy-based indictors, such as expected energy not served, could be used in addition. The introduction of stochastic reliability assessments can allow the system operator to identify in advance any structural shifts and account for other relevant measures of reliability, such as the depth or duration of loss of load events.

Ireland may like to study the models used by other system operators. The Danish Energy Agency uses the SISYFOS stochastic model to evaluate system capacity adequacy. The model calculates a loss of probability of the annual minutes of capacity shortage. It has recently been updated into the SisyfosR model, which is substantially faster in calculating the situations during which the country faces insufficient capacity and cannot meet demand. The Belgium transmission system operator Elia has adopted the French tool Antares (that is freely available) for its system adequacy studies while ENTSO-E has been using Monte Carlo simulations for its adequacy assessments, which are also noted in ENTSO-E's 2024 10-year Network Development Plan. The approach used by Australia's Energy Market Operator for its electricity statement of opportunity could also be of interest. Eirgrid announced that it will be using a Monte Carlo simulation based tool for the annual generation capacity statement from 2025 onwards.

Recommendations

The government of Ireland should:

- Diversify interconnections with other countries where it is cost-effective.
- Monitor the demand for new system services and assess the technical options for non-thermal delivery of both frequency response and non-frequency ancillary services.
- Ensure a fair remuneration of ancillary services to attract the required capacity. This could include the use of long-term agreements for ancillary services where investments in new units are required.
- Regularly assess the suitability of the current adequacy standard in terms of loss of load expectation, or loss of load expectation expanded by energy-based criteria, to provide acceptable levels of reliability as the system progresses towards very high shares of variable renewables.
- Create the legal basis for third-party and customer access to smart meter data in real time enabling price signals to incentivise demand-side response, while complying with data protection standards and maintaining a swift roll-out of smart meters.
- Ensure that the wholesale and capacity markets deliver the technologies and services, including flexible resources, that Ireland needs to achieve a cost-efficient net zero transformation, and to this end assess the long-term potential for the production of renewable hydrogen and its use by industry and to provide flexibility.
- Define a trajectory for the connection of large loads, such as data centres, to allow the necessary grid infrastructure, generation and flexibility resources to be put in place. In addition, avoid potential onsite backup generation from compromising the renewables target.
- Ensure that the plan-led approach to renewables and grid development accounts for the renewables resource potential as well as cost-effective grid expansion, enabling anticipatory grid investments. The available capacity for new connections to the grid should be signalled transparently to network users, for example using locational elements in network charges or by capacity maps.
- Commission a study on reforming Ireland's electricity market for net zero with a special focus on how different technologies contribute to stability, ramping flexibility, peak capacity and supply of energy.

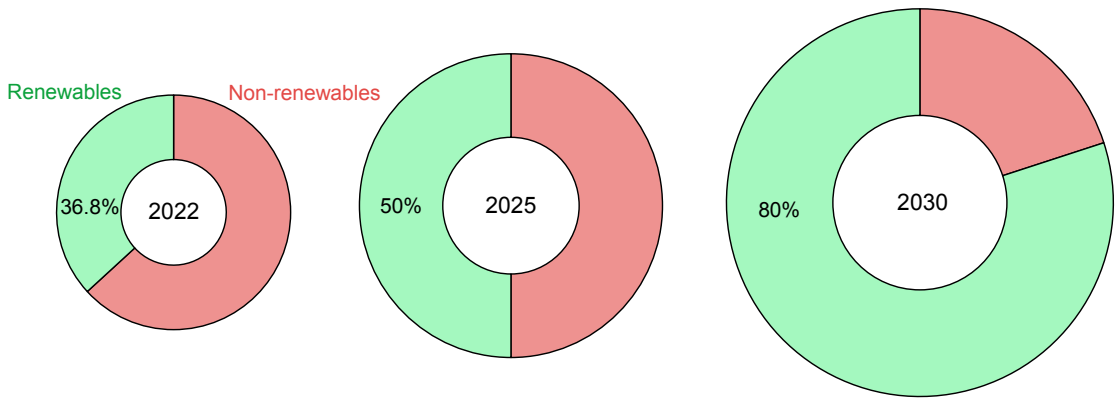
4. Renewable electricity

Renewables will dominate electricity generation by 2030

Ireland has an enormous, largely untapped, renewable energy potential and has to date built almost 6 GW of capacity of mostly onshore wind and solar PV. It has ambitious goals for offshore wind, which offers the opportunity to enable the decarbonisation of the power sector but also turn the country into a net exporter of electricity and eventually hydrogen. This would allow meeting current and future electricity demand, including for new data centres, and for heating and transport. Offshore renewables in Ireland have the potential to also support the energy transition in other areas of the economy. This, in turn, offers substantial economic and social benefits and contributes to a just transition.

In 2022, Ireland's total electricity generation was 34 TWh, with 13 TWh from renewable energy sources. Fossil fuels generation was made up of natural gas (49%), coal (7%), oil (3%) and peat (1%). In CAP23 and the draft CAP24, Ireland committed to reach a target of 50% renewables in electricity demand by 2025 and 80% by 2030. The 2022 share of renewables according to EU regulation (RES-E) was 36.8% (Figure 4.1).

Figure 4.1 Share of renewables in electricity generation in Ireland, 2022 and 2025 and 2030 targets



Sources IEA analysis based on: SEAI (2023), Energy in Ireland; Irish Government (2022), CAP23.

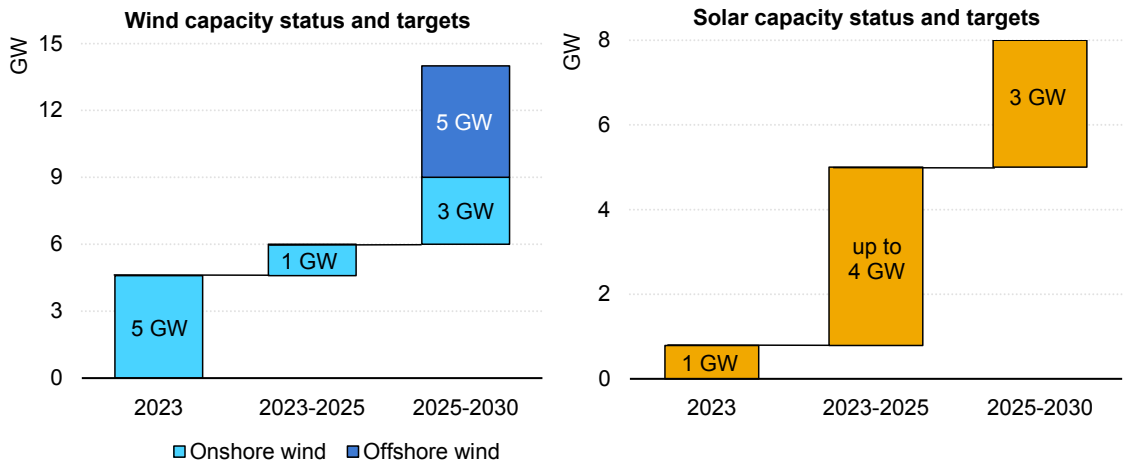
In line with commitments in the CAP, electricity production from peat ceased in 2023; coal is expected to follow in 2025. ESB's Moneypoint power station has submitted a planning application to convert from using coal to heavy fuel oil by the end of 2025. The retention of Moneypoint on heavy fuel oil post-2025 will only be

to ensure security of supply as a backup unit. Ireland is targeting the delivery of at least 2 GW of new gas-fired power by 2030 to replace the need to retain older power plants such as Moneypoint. Coupled with the integration of larger volumes of variable renewable resources, Ireland could face a temporary heightened reliance on natural gas-fired generation to maintain security of supply during periods of low wind activity. It could address this risk with the timely completion of additional interconnector projects.

To reach the 80% renewable generation target by 2030, Ireland plans to have 22 GW of renewable electricity capacity installed, up from 6 GW at the end of 2023. Specifically, Ireland has set targets to achieve the deployment of 9 GW of onshore wind, 8 GW of solar PV and at least 5 GW of offshore wind capacity by 2030 (Figure 4.2). Beyond 2030, Ireland expects offshore wind to account for the dominant share of new renewable capacity additions; however, further deployment of new and repowered onshore wind and solar is expected throughout the 2030s.

The accompanying challenges of this accelerated delivery of renewable capacity, however, need to be carefully managed to ensure a sustainable and affordable energy transition is delivered within the projected time frame. This chapter focuses on actions the government should take to ensure the rapid build-out of renewables capacities and the supporting infrastructure. Ireland should afford special attention to offshore wind development, which is a special focus of this review.

Figure 4.2 Wind and solar installed capacity in Ireland, 2023, and 2025 and 2030 targets



Sources: IEA (2024), World Energy Balances (database) and IEA analysis based on Irish Government (2022), CAP23.

Supporting the transition to a renewables-led power sector

Since 2020, Ireland's main instrument to reach its 2030 targets is the RESS that auctions grid-scale capacity additions across eligible technologies. The RESS-1 auction awarded 479 MW of onshore wind capacity and 796 MW of solar capacity.

The country's first grid-scale solar project of 8 MW was connected in April 2022. However, the strike prices for solar were notably higher than in auctions in other European countries and the industry expressed concerns about high grid connection costs in addition to the difficulty in obtaining connections and lack of indexation to inflation.

The RESS-2 auction in 2022 awarded over 1.9 GW of renewable generation capacity, of which solar accounted for almost 80%. Eligible technologies included onshore wind, solar and, for the first time, so-called hybrids, the co-location of storage coupled with renewable generation to better utilise renewable energy sources and support security of supply. One hybrid solar and battery farm project and ten community projects were among the successful bids. The RESS-3 auction was held in 2023 and awarded 646 MW, of which solar accounted for 77% of the awarded capacity or around 50% of the anticipated delivered electricity. The auction outcome in terms of total MW awarded, however, was well below the government's expectations, despite offering an inflation-indexed offer price in the first auction alongside the removal of curtailment risk for bidders. Nonetheless, the RESS-3 auction targeted mature projects capable of early delivery and reinforced the government's commitment to annual auctions. Ireland anticipates a larger RESS-4 auction in 2024.

Market observers note the drawn out and unpredictable planning and consenting regime coupled with the risk of extensive judicial challenges as one of the reasons for the low interest in the RESS-3 auction. The long and complex planning permission, consenting, approval and licensing processes delay the delivery of much-needed infrastructure across the economy. These processes also impact the entire energy sector value chain. The IEA identified them as a key impediment to reach the 2030 renewable targets (and beyond) (see Chapter 1). Previous IEA energy policy reviews highlighted this weakness and Ireland continues to lack a clear strategy on how to convert public support for the energy transition into practical acceptance for infrastructure investments in the electricity sector (and other sectors of the economy as well). The Minister for Housing, Local Government and Heritage's announcement in December 2023 to commence the process of revising the National Planning Framework is welcome and amendments should be brought to an early conclusion and implemented as soon as possible.

Researchers have noted that a growing number of solar farms in Ireland are connecting directly to the transmission network. This is partly attributable to limits in the distribution network but also to the growing scale of individual solar parks. This underlines the urgent need to expand and reinforce the transmission system. This will require the development of new skill sets during the engineering, procurement, construction and operations of solar farms to ensure alignment with transmission grid codes and operational management requirements.

Holistic spatial planning and effective public engagement underpins a successful transition

The ambitious renewable targets require a stronger focus on spatial planning. Spatial planning needs to take a comprehensive approach, as it is relevant to several areas such as developing grids, including for offshore wind; identifying the best locations for renewables considering existing and planned infrastructure, using energy clusters; and reducing curtailment. Spatial planning also informs infrastructure requirements and the supply chains for offshore developments and heat recovery from data centres (see Chapter 2).

Digitalisation can play a vital role in, for example, accelerating permitting processes; sharing spatial planning information with eligible stakeholders, such as potential project developers and relevant hosting communities; and fostering demand-side measures and strengthening connections between distributed renewables and smart end-use devices (see Chapter 2).

The ambitious targets for solar and onshore wind farms will impact on land use planned on existing and brownfield sites or greenfield sites such as agricultural land (see Chapter 1). Spatial planning should effectively and efficiently engage the public through the early involvement of the hosting communities. Planning exercises should also carefully assess and consider environmental protection and biodiversity, ensuring environmental sustainability is taken into account upfront by design, thus lowering the risks of local and legal challenges at a later stage of project design or licensing. The process implemented by EirGrid for the Celtic Interconnector is an example of best practice from Ireland. Ireland could refine this process further and apply it to upcoming infrastructure investments (see Chapter 3).

The three regional assemblies in Ireland are preparing regional renewable electricity strategies that are expected to be adopted at the end of 2024. These will support the development of a preferred approach on how to best deliver renewable electricity generation capacity within each region. The IEA welcomes this approach, as it allows hosting communities directly benefit from deploying solar and wind farms, electricity grids, and other needed infrastructure (see

below). The government is also updating the methodology for Local Authority Renewable Energy Strategies and expects to complete this in 2024.

Auctions under the RESS use a developer-led approach, which has been successful in obtaining new capacity. Conversely, the absence of resources to manage the foreseen volumes of new capacity has, along with other factors such as challenges in the planning and construction of network upgrades and increased load, contributed to enhanced congestion on the electricity network. Greater alignment between regional and local renewable energy planning and the development of the electricity network, including through the identification of renewable energy acceleration areas and the development of renewable energy hubs, will be important in this regard.

A new framework to develop Ireland's vast offshore renewable energy

Ireland is conscious that its ambitious renewable targets require close engagement by the government and other state actors during the transition from the current decentralised developer-led to a plan-led and eventually the so-called enduring regime for the period beyond 2030. Key to this transition is the Offshore Renewable Energy Future Framework Policy Statement, which signposts the plan-led approach for offshore renewable energy (ORE) development from 2030 to 2050 and will be published in 2024. A key action is an ORE Roadmap for Designated Maritime Area Plans, which is informed by the country's first National Marine Planning Framework, its first national marine spatial plan and the Maritime Area Planning Act, both of 2021. The Act requires each project developer to obtain maritime area consents as a pre-condition to apply for planning permission. For this, the Act foresaw the creation of a new and independent state agency, the Maritime Area Regulatory Authority (MARA), which was established in July 2023. MARA is tasked with, among other functions, assessing and granting maritime area consent applications, monitoring compliance with legislation, an enforcement role relating to consents and, to a certain extent, planning.

This a highly commendable decision and the IEA encourages Ireland to ensure that MARA is provided with the necessary financial and skill resources to carry out its responsibilities. Budgetary provisions for MARA should grow commensurate with its increasing responsibilities. Sufficient staff with the necessary skills to treat the environmental aspects of licensing is important. Ireland many need to attract foreign expertise in the beginning, while creating educational programmes and the sufficient competitive positions to attract local expertise in the medium term.

Maritime area consents function as a necessary gateway into the planning process. Ireland streamlined its processes by means of a single environmental assessment conducted by ABP covering both maritime and terrestrial elements of

developments. ABP has a co-ordinating role on EU projects of common interest and the Maritime Area Planning Act contains provisions for co-ordination and co-operation in the maritime area via MARA.

Lastly, Ireland should promote facilitating future developments in maritime spatial planning as needed, as well as consenting and permitting processes, including in environmental impact assessments considering innovative areas such as the analysis of cumulative impacts. The government should also promote the development of scientific and academic research on areas of benefit to Ireland and its offshore wind farm deployment, as well as improving instalment, operation and maintenance, including of offshore floating wind. Public access to data from offshore developers and wind farm operators can support the necessary research and improvement of state processes.

The ORE Future Framework policy addresses these suggestions by determining actions to enable the long-term, sustainable and planned development of Ireland's offshore wind, tidal and wave resources. For this purpose, statutory designated maritime area plans, which are regional spatial plans, are required, as per the Maritime Area Planning Act. The upcoming Roadmap for Designated Maritime Area Plans will enable the proactive construction and upgrading of required complementary infrastructure. The National Policy Statement on Electricity Interconnection signalled an integrated approach to transmission grid development. The upcoming Offshore Transmission Strategy will build upon the Future Framework, seeking to align both forward planning and the delivery of infrastructure.

Ireland actively participates in international renewable energy organisations and forums, including the North Seas Energy Cooperation and the Global Offshore Wind Alliance, among others. Ireland should continue its ongoing meaningful multilateral engagement to help deliver its strategic priorities, including in respect to connecting its future supply to end users in other countries via transmission. In this regard, it should make use of its multilateral relationships to explore options for future collaboration with countries of a similar size and renewable potential.

Ireland's first offshore wind auction designed for success

While the new frameworks are being developed, Ireland held its first dedicated offshore wind auction (ORESS-1) in 2023 under the developer-led model. ORESS-1 awarded over 3 GW capacity. Winning bids received a 20-year contract for difference. The IEA congratulates Ireland on the successful auction design and outcome of ORESS, which addressed industry concerns about price increases by fully indexing operation and maintenance costs to inflation. The auction design also includes compensation in case of curtailment or oversupply (the same

condition applies to onshore wind). It is important, therefore, that grid development move ahead swiftly as curtailment is expected to increase. The average strike price is 86 EUR/MWh, compared to a maximum bid price of 150 EUR/MWh and is among the lowest prices obtained globally although slightly higher than in some European countries. Wind Europe has highlighted ORESS-1 as a good model for other countries. The IEA supports this assessment and has already used it as a best practice example for other IEA countries with offshore ambitions.

Ireland will host two more auctions before 2030 to meet the 5 GW of grid-connected and fixed-bottom wind power installation target. ORESS-2 is the first auction under this transition to the plan-led regime and will invite bids for 900 MW in the newly designated maritime areas. A policy statement for this was issued in March 2023 to set out the framework for the next auctions.

Ireland will publish a policy setting out the long-term future regime for offshore wind, the "Future Framework", in 2024 to optimise appropriate maritime areas for future offshore renewable development to guide permitting and decision making. The Future Framework policy statement is aligned with and complementary to Ireland's existing climate, renewable energy and ORE policy and legislative frameworks. It sets out several key actions, future directions and intergovernmental dependencies that will be addressed through subsequent policy to develop and initiate the long-term, plan-led approach to Ireland's ORE future. The IEA welcomes these initiatives and encourages they be rapidly implemented to allow Ireland to remain on track for its 2030 energy and climate commitments.

Ireland is also preparing to invite bids for 2 GW of offshore wind power for non-grid limited use by 2030. Beyond 2030, Ireland targets the installation of 20 GW offshore wind by 2040 and at least 37 GW by 2050.

Corporate power purchase agreements will complement capacity additions

The government has prepared a roadmap on how to create a market for corporate power purchase agreements (CPPAs) as per CAP21. CPPAs are especially attractive to data centres and the pharmaceutical industry, both of which account for a strongly growing share in Ireland's electricity consumption (see Chapter 4), are committed to reduce their carbon emissions and support Ireland's energy transition. In fact, Ireland is considering making planning permission for new data centres subject to signing a CPPA for renewables and requiring that the amount of renewable energy be at least equal to the demand at any given time (and not only when the renewable project is generating). CPPAs also offer an alternative route to market to complement RESS and ORESS.

An important factor in the CPPA roadmap is that CPPAs satisfy the principles of transparency, provide additional renewable generation, minimise system costs,

allow for consumer equity, and provide consumer and community benefits. In this regard, SEAI recently commissioned a study to identify the options for implementing an electricity emissions reporting framework for large electricity users. This will support transparency around the claimed Scope 2 emissions reductions from CPPAs entered by them. The framework will include consideration of temporal and locational matching of renewable energy supply to demand. Furthermore, in the Irish context, spatial planning and the location of projects entering CPPAs is also a critical parameter given the tightness in the electricity grid. This is not only with a view to limit curtailment but also to ensure that other users are not required to unduly pay for network extensions needed for specific CPPAs but instead are aligned with EirGrid plans. The seven core good practice principles for CPPAs for renewable generation set out in the Irish roadmap are a good policy example for other countries exploring them.

Scale up the grid to accommodate offshore renewables

Ireland's transmission network requires substantial investments to cope with the expected development of onshore and offshore capacities, the need for new offshore grids, and onshore reinforcements to link such offshore production to demand centres. In addition, the network needs to connect the vast amount of new renewable capacities and account for new demand, including EVs, heat pumps and data centres. Currently, electricity grid development is at risk of becoming a bottleneck to achieving the 80% RES-E target.

The transition to a plan-led offshore renewable energy system requires a corresponding transition for the offshore electricity transmission system. In 2021, the government approved a policy framework to guide the phased transition from a decentralised model to a centralised model, with the transmission system assets eventually being exclusively planned, developed, owned and operated by EirGrid.

Successful bidders under ORESS-1 are responsible for the development of the transmission infrastructure to connect to the onshore grid, ownership of which will be transferred to EirGrid. For ORESS-2, it is likely that the new plan-led system will apply and EirGrid will be tasked with developing the required transmission infrastructure. EirGrid is the owner of all assets of the offshore transmission system, independent from their developer.

The IEA encourages Ireland to quickly decide on how to manage the ORESS-2 auction and to facilitate the move to the centralised system with a view to the need for a holistic spatial development plan to deliver the other energy sector objectives set out in CAP23 and CAP24.

With more public visibility on the network hosting capacity, more conscious decisions can be taken in generation planning and specific location proposals in

project-specific developments. This can, in turn, reduce new non-firm connections, improve the business cases of new generation developers, and support government planners in their decisions on locating activities dependent on network connection. It can also benefit new demand to be located efficiently. A similar exercise has been developed in the Netherlands.

The planned strong build-up of renewable capacity by 2030 (22 GW) could result in significant amounts of curtailed renewables (volumes and costs), as the current targets vastly exceed domestic demand projections (expected peak demand of 13 GW in 2030). There is a need to have sufficient dispatchable capability in the system due to uncertainty in demand and to contain increasing forecasting errors owing to high variable renewable penetration. Such uncertainties are likely to grow during the next decade. Moreover, renewables delivered through power electronic converters reduce system inertia, which is relevant in the Irish system, and which is not (yet) synchronised with the rest of continental Europe.

Make better use of existing renewable resources

Ireland can make better use of existing renewable resources by increasing flexibility in licensing, repowering and hybridisation. This will also support the affordability objective, lower the impact on land use and reduce the need for flexible firm generation capacity. Ireland has a large potential to maximise the utilisation of existing assets and promote the co-existence of technologies in single connection points. Repowering of existing installations and hybridisation are ways of efficiently maximising the use of existing grid capacities and to limit grid expansion needs (though grids may need reinforcement) and the government should, therefore, support and facilitate this as much as possible.

To make efficient and effective use of existing renewable electricity resources and supporting infrastructure, projects should seek to maximise the renewable electricity generation capacity potential of a site by means of planned upgrades of renewable generation technology.

In line with the requirements of the recast EU Renewable Energy Directive, the government should initiate work on establishing a streamlined and simplified permit-granting process for repowering (in addition to a streamlined process for new projects), with short deadlines and assessing only those impacts related to substantial changes in technological changes that have a clear impact on the environment or local communities. It should not assess the entire project as if it were a greenfield development, when in fact it is not. The focus should thus be based on the delta with the existing project.

The government's policy statement on the framework for phase 2 offshore wind commits to the development of a policy to enable multi-purpose interconnectors; in other words, using a single connection point for both onshore thermal generation plans and offshore wind farms to the onshore transmission system. The future framework envisages a generation hub approach and a transmission strategy that will indicate that the offshore grid will be developed to support those hubs – multiple generators feeding into the same grid and aligning with multi-purpose interconnection if possible. Ireland may like to assess the benefits of working with the IEA's Task 50 of the Wind TCP to analyse the benefits (or not) of allowing the co-existence of multiple legal entities in a single connection point. The Commission for Regulation of Utilities should assess matters such as pricing and maximum import/export capacities.

Establish resilient supply chains to support offshore wind

If Ireland wants to remain on track for its expected delivery in 2030, it urgently needs to start investing in the supporting infrastructure needed for the development of offshore wind. Ports in particular require immediate investments to be ready to convey the equipment out to the wind farms. Presently, however, no Irish port possesses the required facilities or capabilities to support the delivery of Ireland's renewable energy ambitions. Irish ports do not have the financial resources to deliver projects of the scale needed and access to private investment may be difficult. Some form of government support will be needed to enable the necessary investment and unlock the opportunity Ireland's renewable resources offer. In this regard, the IEA welcomes the development of a new National Ports Policy for Ireland, for which a consultation closed in January 2024.

Upscaling port infrastructure and commensurate investments need to be aligned with Ireland's long-term perspective. Many floating wind designs are competing for commercial deployment, which have different infrastructure requirements. Floating wind, as opposed to bottom-fixed wind, carries most of the assembly onshore. Therefore, ports will need to expand their land area, quay reinforcement, storage for components, carrying capacity, cranes and other retrofits to host the mass production of floaters and other turbine components. These factors need to be taken into account in the port and spatial planning process by, for example, the provision of designated maritime area plans.

Similarly, another requirement is an optimised upgrade of the ports, taking into account the available capacity in the port of Belfast (in Northern Ireland) but not completely dependent on it. At present, Belfast is the only port fully equipped to serve as a construction base for offshore wind farms. Marshalling and assembly requirements should be analysed, together with an assessment of annual commissioning needs, to deliver on the government's auctions, including

implications for port space, heavy-loading quaysides and deep berths for installation vessels. Mindful of State Aid rules and the existing National Ports Policy, the government should encourage regional optimisation and explore financing opportunities.

Supply along the offshore wind energy chain is a big constraint. Ireland has a limited maritime sector in general, and no offshore wind-dedicated supply chain, with only pilot capacities installed in the past. While it is not realistic nor beneficial to try to localise all of the necessary supply chain in Ireland, small and medium-sized enterprises such as service providers or component developers could become locally placed soon. One example of a gap in the wind energy supply chain, for example, is the absence of indigenous cable manufacturing and laying supply chain, both to enable Ireland's offshore ambitions and facilitate disaster recovery.

Ireland's overall workforce and skills shortage (see Chapter 1) will affect its offshore wind ambitions. It is welcome that Ireland has already established an expert advisory group to assess the skills and workforce requirements and collaborates closely with Enterprise Ireland's Gael Offshore Network initiative.

To help the supply chain, in ports and at large, Ireland should continue to provide as long-term and granular visibility as possible for stakeholders with a clear auction schedule, splitting between bottom-fixed and floating offshore wind, which have different supply chain requirements, and clarifying the necessary uncertainties (e.g. on timing) upfront.

Renewable power generation offers multiple benefits to local communities

A key feature of the RESS and the ORESS is the requirement for successful projects to establish a community benefit fund into which they must pay 2 EUR/MWh to ensure that local hosting communities benefit directly. Payments into the fund commence before the projects become operational and continue for the entire duration of the contract. For ORESS-I, the government estimates that marine and coastal communities will benefit from over EUR 24 million annually. For the onshore RESS auctions held to date, additional funds of over EUR 8 million annually will also be available to communities with further funds coming from future auctions.

SEAI has established a Community Benefit Fund National Register and generators have access to a good practice principle handbook that the government developed for RESS-1. The handbook provides guidance and recommendations on how to comply with the Community Benefit Fund. Central to the Community Benefit Fund is that communities are fully involved in decision making and that projects support Ireland's transition path and align with

the United Nations Sustainable Development Goals. A professional fund administrator will assist local communities. For ORESS-1, the government issued a dedicated rulebook for generators and fund administrators to ensure regulatory and compliance obligations. The IEA welcomes the creation of the local community funds as they help realise the wider societal benefits of the energy transition.

Renewable energy communities can be powerful tools to enhance the active participation and benefits of the local population in the energy transition, increasing public acceptance of renewable projects. They make it easier for citizens to team up and jointly invest in energy assets.

Ireland provides dedicated support for community-led renewables projects in line with the country's international leadership in ensuring a just transition. Interested energy communities receive technical, legal and financial support through SEAI to help them establish projects for RESS. CAP21 introduced two schemes. The Small-scale Renewable Electricity Support Scheme targets non-domestic installations above 50 kW and up to 6 MW and aims to support small and medium-sized enterprises and community projects. The dedicated Micro-generation Support Scheme aims for the installation of 380 MW micro-generation by 2030. The scheme supports domestic and non-domestic installation of up to 50 kW. They will not necessarily connect to the grid, but projects that do connect to the grid can export their surplus generation under the specifically created clean export guarantee tariff. The scheme targets small farms, businesses, schools and communities.

Recommendations

The government of Ireland should:

- Encourage corporate power purchase agreements to foster additional market-based financing and promote partnerships between renewable and energy-intensive industry projects, including electrolysers and data centres.
- Design a streamlined system for repowering renewables, upgrading grids and facilitating hybrid connections (i.e. solar PV/wind/batteries).
- Ensure that the recently established Maritime Area Regulatory Authority is sufficiently resourced in terms of staff numbers and skill set.
- Explore avenues for information sharing and collaboration with European countries of a similar size and high offshore renewable energy potential, with a view to developing strategic options for at-scale connection of this potential with future demand.
- In its review of the National Ports Policy, assess the opportunities to attract the necessary finance to the sector, increase marine planning capability and capacity, and introduce measures to upskill and diversify the maritime labour force, to support the development of offshore wind projects.

5. Research, development and innovation

A dedicated energy research, development and innovation strategy is needed to meet climate targets

Energy innovation in Ireland is closely linked to the country's overall energy policy, focusing on decarbonising the energy sector while significantly increasing clean energy assets. In 2022, the government spent nearly EUR 1 billion in overall research, development and innovation (RDI), a fourfold increase since 2000. The European Innovation Scoreboard 2023 places Ireland among the strong innovators, thanks to above average performance in education and research, digitalisation, and public-private co-operation. Nevertheless, its performance lead over the EU average is narrowing. Low non-RDI innovation expenditures and RDI expenditures in the public sector are mentioned as areas for further action.

Impact 2030: Ireland's Research and Innovation Strategy, launched in 2022, is Ireland's national overall strategy on RDI towards 2030. It defines Ireland's RDI agenda until 2030 and illustrates the overall impact that RDI investments have had on the economy's prosperity. The Strategy comprises five pillars, the first of which includes a priority area on climate, environment and sustainability, and highlights the role that RDI will have in the decarbonisation of energy systems, renewable energy, low-emission industry and sustainable transport. The Strategy's strategic objectives will be implemented through three work programmes, each spanning three years until 2030. The first covers the period 2022-24. The objectives on climate, environment and sustainability generally revolve around the necessity of meeting climate action targets and articulating the role of RDI in CAP24.

Despite the focus on climate targets and the clean energy transition in the Impact 2030 strategy and in CAP23, Ireland does not have a dedicated energy RDI strategy. It should be able to capitalise on the strong RDI ecosystem built over the years to ensure the sector makes a greater contribution to the country's energy and climate goals. This could be achieved by means of a dedicated RDI strategy for the energy and climate sector.

A dedicated energy RDI strategy would highlight key energy research priorities for Ireland in the short, medium and long term up to 2050, the identification of which would support the government in fulfilling its energy and climate commitments. This would send a strong signal to enterprises and research organisations on

which areas to focus and highlight those sectors where funding could be made available. A strategy can also set a vision for longer term pathways, including, for example, the exploration of carbon capture for heavy industrial facilities. The scope and coverage of the three-year work programmes should clearly outline the actions to be taken over time. Consistent with Ireland's ambitious energy and climate targets, the Irish government should leverage existing RDI infrastructure and strengthen its focus on activities related to offshore wind, in particular floating, hydrogen, geothermal, electricity (storage and smart services) and behavioural insights.

In areas where technologies have not advanced in line with expectations, consideration should be given to consolidating or redirecting limited research and innovation resources to current emerging priorities. An optimal operating model should be investigated to identify the most appropriate model for the Irish context. Some IEA countries have created a single entity to manage research infrastructure, including testing sites to improve complementarity and efficiency.

Enhanced co-ordination among RDI institutions for a co-ordinated clean energy transition

The Irish government allocates around 95% of public RDI investments to five government departments. Among those five departments, the DECC received only 3.9% of total funding, the lowest share. The DECC is the main government body responsible for funding climate and environment research programmes, even though, to some extent, all five departments contribute to energy innovation, as outlined in CAP23, and drive and co-ordinate the progress of the strategy.

SEAI, an agency under the DECC, directly co-ordinates and funds energy research projects on energy production, energy supply, energy use and consumers' energy behaviours. SEAI experienced the highest increase in government funding from 2021 to 2022 (+131%), thanks to increased funding for renewable development and deployment projects. Its National Energy RD&D Funding programme is the main energy research investing programme. SEAI organises annual cross-governmental and agency stakeholder consultations to define emerging research and policy priorities to inform the yearly programme call under the funding programme. The overall number of energy-related RDI projects fluctuates over the years, maintaining an average of 80 energy-related projects since 2018. In 2021, 224 projects were active in Ireland; of these, SEAI funded about 50.

The Department for Further and Higher Education, Research, Innovation and Science funds and sets RDI policy. Recently, its focus has been shifting to the

development of skills needed for Ireland's energy transition. Skills development focuses on energy efficiency improvements in the buildings sector, renewables and electric mobility.

The DECC, SEAI and Science Foundation Ireland play a key role in ensuring research organisations work closely together, including through strategic cross-government partnerships. The IEA welcomes the collaboration led by Science Foundation Ireland between government organisations, enterprises and academic researchers by means of its outcome-based EUR 65 million National Challenge Fund. This research fund was launched in 2022 and funds projects on the clean and digital transitions.

Greater co-ordination among government departments would increase synergies between the country's energy, environmental, climate change, transport, agricultural and land-use policies, and would also support stronger outcomes. With this in mind, SEAI established the National Energy Research Funders' Forum in 2022. It aims to improve co-ordination and collaboration among funding organisations on energy research, including the government departments and other agencies, such as Science Foundation Ireland, to accelerate transformational and impactful energy research in Ireland. The IEA welcomes the creation of the Climate Action Delivery Board co-chaired by the DECC and the Office of the Taoiseach (Prime Minister) to provide strategic leadership and co-ordination on the implementation of the climate and energy agenda. Since 2019, SEAI has hosted an annual National Research and Policy Conference that brings together researchers and policy makers to focus on current and future energy priorities for Ireland.

Public investment is increasing but lacking behind the targets

In 2022, the budget for energy-related RDI accounted for 0.064% of gross domestic product, one of the lowest shares among IEA countries. Despite having one of the lowest shares of public energy-related RDI spending among IEA countries, Ireland has significant energy RDI output.

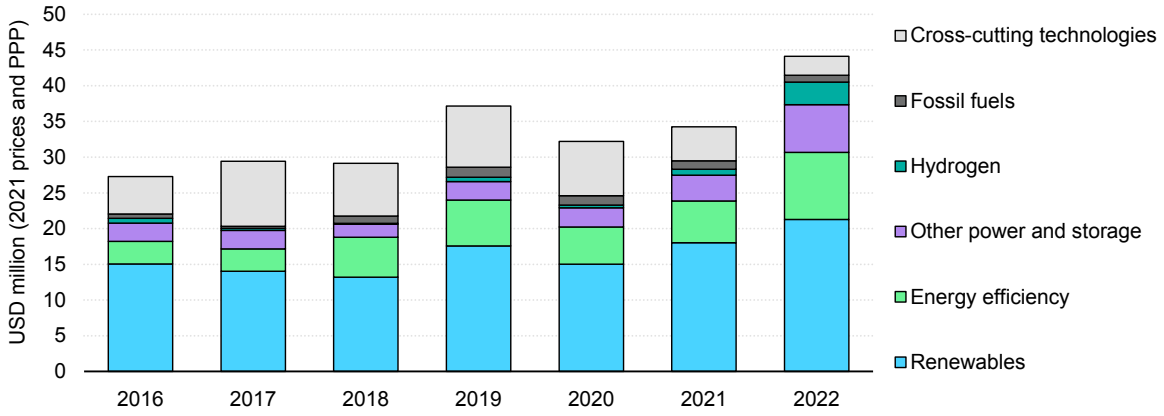
In 2022, Ireland's public budget on energy related RDI was USD 44 million, 29% higher than the previous year (Figure 5.1). Renewables accounted for the largest share (48%), followed by energy efficiency (21%), other power and storage (15%), hydrogen (7%) and cross-cutting research (6%). In 2022, among renewables, wind took the largest share (30%), followed by tide (20%), biofuels (12%), geothermal (11%), solar (8.1%) and others (19%).

As noted in the Impact 2030 strategy, Ireland has not yet met its previous target to increase the investment in total RDI to 2.5% of gross national product by 2020,

lagging behind at 1.63% in 2020. Expenditure by enterprises, in contrast, outweighs public total RDI expenditure, totalling EUR 3.4 billion in 2020.

Once a dedicated RDI energy strategy is in place, ensuring sufficient investment to meet Ireland's ambitious energy targets and ensuring funding sustainability for Irish research organisations to attract and retain skilled and experienced researchers is needed. Further resourcing measures should be considered, including public sector research placements and fellowships. Increasing funding towards innovation to assist Ireland's energy transition is important, as energy-related emissions account for over half of all emissions in Ireland.

Figure 5.1 Energy-related public research, development and innovation budget by sector in Ireland, 2016-2022



Notes: PPP = purchasing power parity. In 2016, there was a shift in the reporting methodology, from actual expenditure to awarded budget. Data prior to 2016 are thus not comparable.

Source: IEA (2023), Energy Technology RD&D Budgets (database).

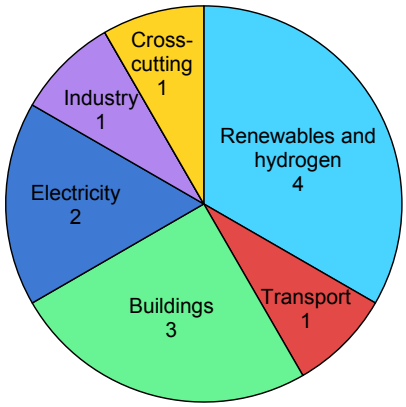
Expand international engagement to better leverage Ireland's RDI targets and community

In September 2023, Ireland was participating as a Contracting Party in 11 TCPs (Figure 7.2), and in an additional one as a sponsor. In 2022, Ireland joined the Hydrogen TCP and in 2023 the Heat Pumping Technologies TCP (Figure 5.2).

Participation in TCPs is aligned with Ireland's energy priorities and focuses on renewable energies and end-use sectors. SEAI is the dedicated authority for membership in the IEA TCPs. Given the government's interest in exploring agrivoltaics, Ireland is encouraged to consider joining with the Photovoltaic Power Systems TCP (see Chapter 1). Supporting engagement and participation in IEA activities is one of the actions of the annex of actions of the CAP23, within the energy research and innovation area.

Ireland is active in European RDI programmes in areas of particular interest to the country. In 2022, it successfully applied for financial support from the EU Technical Support Instrument to develop an offshore renewable energy policy. Ireland's project proposal focuses on developing a plan to guide the roll-out of offshore renewable energy, the development of hybrid grid connections and a digital tool for planning. All these are key priority areas for reaching Ireland's energy and climate targets. An additional project phase supports accelerating permissions for offshore renewable energy by, among others, supporting the establishment of a single environmental permitting process.

Figure 5.2 Ireland's participation in IEA technology collaboration programmes, 2023



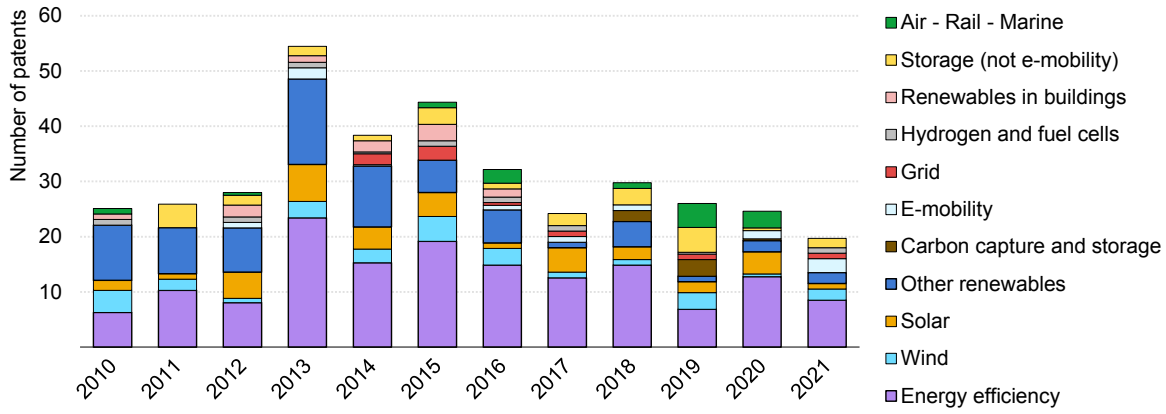
Source: IEA (2023), Technology Collaboration Programme.

Intellectual property

Innovation in energy technologies can be measured by analysing International Patent Families (IPFs)[7]. The number of energy-related IPFs is a proxy measure of a country's innovation ecosystem. The number of IPFs in energy-related technologies from Irish inventors has declined since 2018 (Figure 5.3). In 2021, there were 20 new IPFs, 56% less than in 2015 and 64% less than in 2013. In 2021, more than 40% of the IPFs were on energy efficiency. Of the patents on energy efficiency, 3 were on buildings, 3.5 on industry, 1 on fuel efficiency and 1 on agriculture (based on fractional counts, related to the contribution of each inventor country to the invention). Five patents were on technologies related to renewables (two on wind, one on solar, one on hydro and one on bioenergy).

[7] A proxy of a distinct invention, corresponding to a set of patent applications published to at least two counties.

Figure 5.3 Count of IPFs in energy-related technologies in Ireland, 2010-2021



Note: The year identifies the first filing date of the invention worldwide, and each country is accounted a fraction of a patent, based on how many inventors from the country contributed to the invention; should two inventors from two different countries contribute to a patent, each country of origin will be assigned with a count of 0.5.

Source: IEA (2023), Energy Technology Patents Data Explorer.

Improved data collection of private RDI spending and gender diversity in RDI could help inform policy making

The international energy community recognises the importance of encouraging more females to be involved in the clean energy transition. Gender diversity brings economic growth, income equality and social inclusion. Ireland is engaged in ensuring gender equality throughout its society. In 2022, SEAI published a strategic plan in which equality is one strategic goal and objective towards 2025.

The IEA Gender and Energy Data Explorer showcases several indicators on gender gaps in the energy sector. In Ireland, the share of female inventors of clean energy transition technologies was 14% in 2021. In 2023, the share of female senior managers in the energy sector was 10%, compared to 26% in non-energy sectors.

No specific information about monitoring and evaluation of RDI initiatives is available. Ireland undertakes RDI monitoring and evaluation as part of its regular reporting of the implementation of CAP 23 and to the European Commission for the National Energy and Climate Plan.

The IEA welcomes Ireland's National Energy Modelling Framework and its scenario-based pathway evaluation for decarbonisation, including the National Heat Study released in 2022. With the implementation of sectoral carbon budgets, continued scenario modelling can provide insight to policy makers and outline various pathways to meeting targets based on the latest information and data.

SEAI has developed a National Energy Research Database which provides an overview of publicly funded energy R&D projects. However, the tracking of private sector R&D spending and related energy R&D projects is incomplete. The IEA welcomes SEAI's additional efforts to consolidate information and reporting of private sector energy R&D investment and better analysis of grant programme impacts. SEAI relies on voluntary submissions of energy data from enterprises and is considering legislation to mandate the provision of energy data to the organisation. The IEA is supportive of this initiative as it will help foster synergies with public RDI funding to advance the energy transition.

In line with growing international practice and in compliance with privacy directives, the government should collect public and private data around important indicators such as gender and age. This information would provide the government with a clear picture of energy innovation activities in the country and provide insight into the areas private enterprises focus on alongside diversity and inclusion considerations, ensuring there are equal opportunities in the energy sector.

Recommendations

The government of Ireland should:

- Prepare a dedicated energy research, development and innovation strategy setting out key energy research priorities for Ireland in the short, medium and long term up to 2050. This should include establishing, prioritising and publishing strategic research and innovation focus areas that are critical to reaching the government's energy and climate commitments.
- Increase public funding for energy RDI to support the delivery and implementation of the government's ambitious energy targets and increase the capacity of Ireland's energy innovation ecosystem.
- Collect energy-related RDI data from the public and private sectors to establish a holistic understanding of the energy innovation sector in Ireland.

Annexes

Acknowledgements

The IEA review team visited Dublin from 17 to 24 April 2023 and met with government officials and public and private sector stakeholders across the energy sector. This report is based on information from these meetings, the review team's assessment of Ireland's energy policy and detailed research by the IEA. The members of the review team were Sue Harrison (United Kingdom and team leader), Shevaun Fitzmyers (Australia), Linde D'hooge (Belgium), Geoffrey Lyon (United States), Petri Hirvonen (Finland), Ricardo Renedo Williams (European Commission), Oskar Kvarnström, (Sweden), Travis Dagg (Canada), Jonas Katz (Denmark), and Dagmar Graczyk and Kiyomi Hyoe from the IEA Secretariat.

Dagmar Graczyk managed the review and is the main author of the report. Alessio Scanziani wrote the sections on buildings, transport and industry in Chapter 2. Anders Caratozzolo wrote Chapter 5. The following IEA colleagues provided valuable contributions in the preparation, drafting and publication of the report: Aya Abu Shaqra, Ismail Aykin, François Brien, Han Young Chang, Anders Caratozzolo, Astrid Dumond, Paolo Frankl, Liselott Frederiksson, Pablo Hevia-Koch, Zoe Hungerford, Kieran McNamara, Gergely Molnar, Emma Mooney, Jeremy Moorhouse, Isabelle Nonain-Semelin, KseniaPetrichenko, Brendan Reidenbach, Alessio Scanziani and Jacques Warichet. Roberta Quadrelli, Zakia Adam, Stève Gervais and Konstantina Kalogianni provided support on statistics and data. Isabelle Nonain-Semelin managed the editing process and Astrid Dumond the production process. Jennifer Allain edited the report. Nicolette Groot supported the organisation of the energy review team's visit.

The IEA extends thanks Assistant Secretary Matt Collins who helped to clarify how this report could be most valuable to Ireland, and to Sophie Bunyan, Deirdre Durnin, Conor McCabe, Eoin McShane, Edwina Steel and John Twomey for their tireless efforts throughout report production process.

The IEA also thanks the numerous individuals from the following organisations who provided valuable insights for the report: An Taisce; the Association of Consulting Engineers Ireland; BirdWatch Ireland; Bonkers; Bord Gáis Energy; Bord na Móna; the Chamber of Commerce; the Climate Change Advisory Council; Coastwatch; the Competition and Consumer Protection Commission; the Commission for Regulation of Utilities; the Department of the Environment, Climate and Communications; the Department of Enterprise, Trade and Employment; the Department of Finance; the Department of Housing, Local Government and Heritage; the Department of Transport; Diageo; Dublin Airport

Authority; Dublin Waste to Energy; Echelon Data Centres; the Economic and Social Research Institute; EirGrid; Electric Ireland; Electricity Association Ireland; Energia; Engineers Ireland; Enterprise Ireland; ESB Generators; ESB Networks; ESB Smart Energy Services; Fingleton White; Flogas; Friends of the Earth; Gas Networks Ireland; International Development Agency Ireland; the Irish Bioenergy Association; the Irish Energy Storage Association; the Irish Green Building Council; the Irish Offshore Operators Association; the Irish Solar Energy Association; Lumcloon Energy; MaREI; Marex; the Marine Institute; Not Here Not Anywhere; the Royal Institute of Architects of Ireland; Science Foundation Ireland; Shannon Airport Group; the Society of St Vincent de Paul; SSE Airtricity; Stop Climate Chaos; the Sustainable Energy Authority Ireland; the Union of Students Ireland; University College Cork; University College Dublin; Vivid Edge; and Wind Energy Ireland.

Abbreviations and acronyms

ABP	An Bord Pleanála
BECCS	bioenergy with carbon capture and storage
BER	building energy rating
CAP	Climate Action Plan
CCS	carbon capture and storage
CNG	compressed natural gas
COP	coefficient of performance
CPPA	corporate power purchase agreement
CRM	capacity remuneration mechanism
CRU	Commission for Regulation of Utilities
CSO	Central Statistical Office
DECC	Department of the Environment, Climate and Communications
DH	district heating
DS3	Delivering a Secure Sustainable Electricity System
ETS	Emissions Trading System
EU	European Union
FSRU	floating storage and regasification unit
GHG	greenhouse gas
GNI	Gas Networks Ireland
HGV	heavy good vehicle
LNG	liquefied natural gas
LOLE	loss of load expectation
LULUCF	land use, land-use change and forestry
MARA	Maritime Area Regulatory Authority
NECP	National Energy and Climate Plan
NZEB	nearly zero energy building
ORE	offshore renewable energy
ORESS	Offshore Renewable Electricity Support Scheme

PV	photovoltaic
R&D	research and development
RDI	research, development and innovation
RESS	Renewable Electricity Support Scheme
RHO	Renewable Heat Obligation
SEAI	Sustainable Energy Authority of Ireland
SEM	Single Electricity Market
SUV	sport utility vehicle
TCP	Technology Collaboration Programme
TFEC	total final energy consumption
VAT	value-added tax

Units of measure

GW	gigawatt
kW	kilowatt
Mt CO_2-eq	million tonnes carbon dioxide equivalent
Mtoe	million tonnes of oil equivalent
MVA	megavolt-amperes
MW	megawatt
MWh	megawatt hour
PJ	petajoule
t CO_2	tonne carbon dioxide
TWh	terawatt hour

International Energy Agency (IEA)

IEA Publications
International Energy Agency
Website: www.iea.org
Contact information: www.iea.org/contact

Typeset in France by IEA - May 2024
Cover design: IEA

Ireland 2024

Energy Policy Review

Government action plays a pivotal role in ensuring secure and sustainable energy transitions and combatting the climate crisis. Energy policy is critical not just for the energy sector but also for meeting environmental, economic and social goals. Governments need to respond to their country's specific needs, adapt to regional contexts and help address global challenges. In this context, the International Energy Agency (IEA) conducts Energy Policy Reviews to support governments in developing more impactful energy and climate policies.

This *Energy Policy Review* was prepared in partnership between the Government of Ireland and the IEA. It draws on the IEA's extensive knowledge and the inputs of expert peers from IEA member countries to assess Ireland's most pressing energy sector challenges and provide recommendations on how to address them, backed by international best practices. The report also highlights areas where Ireland's leadership can serve as an example in promoting secure clean energy transitions. It also promotes the exchange of best practices among countries to foster learning, build consensus and strengthen political will for a sustainable and affordable clean energy future.