



Ireland's Future Power System and Economic Resilience

National Economic & Social Council

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Ireland's Future Power System and Economic Resilience

COUNCIL REPORT

No.167 April 2025

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Abbreviations

BCM	Billion Cubic Meters	GVA	Gross Value Added
CAP	Climate Action Plan	GW	Gigawatts
CPPA	Corporate Power Purchase Agreement	IC	Interconnector [1 & 2]
D/Defence	Department of Defence	IEA	International Energy Agency
DECC	Department of the Environment, Climate and Communications	LACE	Levelised Avoided Cost of Electricity
DETE	Department of Enterprise, Trade and Employment	LCOE	Levelised Cost of Energy
DFHERIS	Department of Further and Higher Education, Research, Innovation and Science	LEU	Large Energy User
DHLGH	Department of Housing, Local Government and Heritage	LOLE	Loss of Load Expectation
DMAP	Designated Maritime Area Plan	MARA	Maritime Area Regulatory Authority
DPENDR	Department of Public Expenditure, NDP Delivery and Reform	NCPC	National Competitiveness and Productivity Council
D/Transport	Department of Transport	ORE	Offshore Renewable Energy
EEZ	Exclusive Economic Zone	ORESS	Offshore Renewable Electricity Support Scheme
EGFSN	Expert Group on Future Skills Needs	OWE	Offshore Wind Energy
EIGL	Energy and Industry Geography Lab	RESS	Renewable Electricity Support Scheme
EPA	Environmental Protection Agency	SAF	Sustainable Aviation Fuel
EU	European Union	SEM	Single Electricity Market
EWIC	East-West Interconnector	SNSP	System Non-Synchronous Penetration
FDI	Foreign Direct Investment	SWOT	Strengths, Weaknesses, Opportunities and Threats [analysis]
FTE	Full-Time Equivalent	TEN-E	Trans-European Networks for Energy
GB	Great Britain	T/MWh	Tera/Megawatt-hour
GDP	Gross Domestic Product	WEI	Wind Energy Ireland
GHGs	Greenhouse Gases	WTO	World Trade Organization
GNI	Gas Networks Ireland		

Executive Summary

Background

The transition to a decarbonised power system is an essential element of Ireland's action to address the climate and biodiversity emergencies. Every step to assist the delivery of that transition must be taken. In addition to its legally binding carbon budgets, Ireland has committed to reducing harmful emissions by 2030, and to becoming a climate-neutral economy by no later than 2050. Central to delivering on these commitments are ambitious national targets for the power sector.

According to multiple national policies and statements, the energy transition will not only help address urgent environmental concerns but will also deliver substantial economic co-benefits by creating enterprise opportunities, by improving reliability of energy supply, by lowering energy costs, and by enabling Ireland to become a net energy exporter. The National Economic and Social Council's (NESC) own analysis in 2023 argued that 'acting to realise net zero' is a core area of *economic* action to help ensure that Ireland's economy remains resilient (NESC, 2023).

The Council has explored in more detail the link between the delivery of targets for the power sector and the realisation of these economic co-benefits. NESC undertook a broad literature and policy review, international engagement, and an extensive consultation process with over 40 key actors in the power sector. That inquiry by NESC has:

- i. brought into stark relief **the imperative for action to progress the energy transition**;
- ii. produced a range of recommended **actions which the Council believes must be taken now, next and later** to help ensure Ireland achieves its decarbonisation potential.

These two findings are set out in detail in Parts 1 and 2 of this report.

Part 1: The Imperative for Action

NESC has examined **four key aspects of Ireland's energy transition** which are important for national economic resilience: enterprise opportunities, the export of energy, the reliability of power supply, and the cost of energy. Each of these issues is dealt with in turn in the four chapters of Part 1 of this report.

First, on the **enterprise opportunities** (Chapter 1), NESC finds that there is currently a disparate and complex landscape of quantitative assessments of impact. There is no single, comprehensive estimate available to policymakers of the sales, exports, and jobs, etc that can be expected from delivering transition targets. This poses a risk to policy development in many areas (e.g. enterprise, skills, planning, investment, etc) as well as to the transition narrative. There are lessons from assessments undertaken in Scotland.

Second, in relation to the **export of energy** (Chapter 2), the Council finds that the required model is currently incomplete. Key questions about renewable capacity requirements, the rationale for surplus power generation, its optimal use, price competitiveness, and method of export remain unanswered. There is a risk that the export scenario – and necessary associated new demand – will become an end in itself, as opposed to the energy transition being planned to respond to environmental, energy, economic, competitiveness and societal needs in the first instance.

The Council believes there is a conundrum, if not contradiction, inherent in the current ‘drive demand to drive supply’ approach. If growth in demand precedes and exceeds renewables development, on top of that needed to decarbonise existing demand, then the State’s climate objectives risk being undermined, while enterprise, energy, investment and climate policy risk being misdirected.

Third, regarding the **reliability of Ireland’s electricity supply** (Chapter 3), this NESC research reveals a lack of clarity or certainty across the transition timeline. While the reliability of power supply has improved, expected reliability may worsen over periods of the transition, if not addressed. There is also no clear visibility of the power system’s reliability beyond 2032, a period when the State plans to significantly expand renewable capacity, and reduce reliance on and phase out fossil fuels.

Fourth, on **cost competitiveness** (Chapter 4), the Council finds that the transition may result in higher, not lower, electricity prices, challenging national competitiveness and the transition narrative. Clarity is needed about the total system cost of transition in the power sector and the distribution of those costs. This is especially important when targeting electricity generation capacity beyond that needed to meet national demand. Again, international research and examples can provide helpful insights for Ireland.

Thus, in Part 1 of this report NESC concludes that **much of Ireland’s policy action for transition in the power sector is headed ‘into fog’, where visibility and certainty are low. Key actors in the necessary transition are not ‘on the same page’ from a strategic standpoint.**

Despite this, the energy transition is of paramount importance and must be delivered despite all the complexities involved. The costs of inaction would be enormous and devastating.

To make sure the transition happens and is successful, there is a strong case – supported by stakeholders in this policy area – for more targeted work. **The Council’s conclusions must not lead to policy paralysis, rather they demand a systematic, evidence-based response – they are an imperative for action.** Rather than new policy, legislation or targets, the imperative is for action which addresses the strategic issues identified by NESC.

Part 2: Actions To Be Taken Now, Next and Later

In response to the imperative emerging from the analysis in Part 1, **the second Part of this report presents the Council’s recommended actions** which must be taken now, next and later to drive progress in Ireland’s energy transition (Chapter 5). This approach reflects and addresses current uncertainty in a manner that maintains momentum and progress towards our national decarbonisation potential.

Ireland’s decarbonisation potential includes:

- the ability to meet all, or almost all, of our power demand from renewable energy sources (‘domestic net zero’);
- the prospect of producing surplus clean energy to power enterprise and spur new opportunities; and
- the possibility of exporting surplus clean energy, if proven practical and viable.

Part 2 of this report presents NESC’s recommended **actions to be taken now, next and later:**

- **Now** – Actions to **deliver** progress in the near term where there is clarity: Moving Ireland from the status quo towards our near-term targets means acting now to improve the framework conditions for clean energy infrastructure delivery (e.g. planning and consents; grid; skills; finance; and ports,

shipping, and supply chains), and installing a new institutional arrangement to facilitate the necessary engagement, coordination, and strategic guidance (Chapter 6).

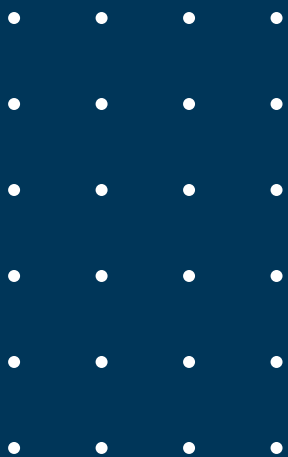
- **Next** – Actions to **design** the way forward in the medium term, though certainty is low: To move beyond our near-term targets, and towards domestic net zero, the next set of actions must be to address the critical knowledge gaps identified by the Council in this report. Further, action is required to demonstrate sustainable demand for renewable power commensurate with national targets, and to ensure that the expected economic 'fruit' of energy transition accrues domestically (Chapter 7)
- **Later** – Actions to **develop** our understanding of the longer-term direction of travel, when visibility is poor: There is the prospect of moving beyond domestic net zero to producing (and perhaps even exporting) surplus clean energy. If that proves to be practical and viable, action will be needed later to produce competitively priced energy for international markets, to develop a viable export method, and to successfully manage security concerns and domestic bias (Chapter 8).

Conclusion

Overall, the Council believes there is **an urgent need to address the strategic gaps identified in this report in a way that reinforces both the energy transition and economic resilience, while moving Ireland forward**. The Council's recommended actions represent an agenda for the policy system to work through immediately to make transition in Ireland's power sector more likely, and more likely to be successful.¹

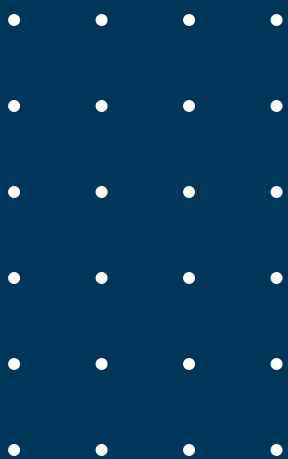
¹ This report is one workstream of a broader NESC programme of research on the energy transition.

PART ONE



**The Imperative for
Action**

Chapter 1



**Transition in the Power
Sector:**
Enterprise Opportunities

1.1 Introduction

The need to address the climate and biodiversity emergencies is clear and urgent. Ireland's transition to a cleaner energy system is shaped by EU policy, and our legally binding commitment to reduce emissions by 51 per cent on 2018 levels by 2030, and to become a climate neutral economy by no later than 2050.

In addition to its legally binding carbon budgets, the Irish State has committed to pursuing and achieving the transition to a climate-resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy, to reduce the extent of further global warming.² An important staging post on that journey will be when Ireland can meet all, or almost all, of its power demand from renewable energy sources – that is, can achieve *domestic net zero*.³

These commitments shape the policy environment, and the resulting carbon budgets, sectoral emissions ceilings, annual Climate Action Plans, and sectoral initiatives. The Government has set targets for emissions reduction within sectoral ceilings, and allocated carbon budgets for two periods (2021-2025 and 2026-2030). Central to delivering on all of these commitments is the suite of ambitious targets for the power sector (see Box 1.1).

Box 1.1: Ireland's Targets for Transition in the Power Sector⁴

- The share of renewable electricity in our generation mix to increase from 41 per cent today to 50 per cent in 2025, and to 80 per cent by 2030.
- Onshore wind generation capacity to increase from 5 gigawatts (GW) today to 6 GW by 2025, and 9 GW by 2030.
- Offshore wind generation capacity to increase from 0.025 GW today to 5 GW by 2030, 20 GW by 2040, and 37 GW by 2050.
- Solar generation capacity to increase from 1 GW today to up to 5 GW by 2025, and 8 GW by 2030.

These targets are the core focus of this NESC research. The Council is interested in the expected impact of achieving these targets on Ireland's economic resilience, in terms of enterprise opportunities, reliability of energy supply, energy costs and net energy export. These are key elements of Ireland's transition narrative.

It is important to note that, under the EU's *Fit for 55* package, Ireland has assumed similarly challenging, related targets, and that these are regulated differently to those under national climate legislation:

- Efforts to reduce emissions from the **electricity generation sector** are governed under the *Emissions Trading Scheme* (ETS), which will require a 61 per cent reduction below 2005 levels by 2030 for the ETS sector. Participating entities will be able to trade emissions units to reach compliance.

² See *Climate Action and Low Carbon Development (Amendment) Act 2021*, at <https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html> [accessed 07/01/25].

³ As noted by the EPA (2023a), there are different interpretations of terms such as 'climate neutrality' and 'net zero'. In line with Ireland's *Climate Action and Low Carbon Development (Amendment) Act 2021*, net zero is interpreted here to describe 'a sustainable economy and society where greenhouse gas emissions are balanced or exceeded by the removal of greenhouse gases'. Domestic net zero is where, under these conditions, all or almost all of Ireland's power demand is met from renewable energy sources, and was the term used most frequently by stakeholders during NESC's consultations.

⁴ See *Climate Action Plan 2024* and *Powering Prosperity* for Ireland's targets for the power system. Note that it is Ireland's five-yearly carbon budgets that must be complied with under climate legislation (Government of Ireland, 2024a, 2024e).

- Similarly, emissions targets under the *Effort Sharing Regulation* (ESR) will require reductions for Ireland of 42 per cent below 2005 levels by 2030 in the non-trading sector, encompassing emissions principally from **agriculture, transport, non-ETS energy industries, and heating** buildings in the commercial and residential sectors. Again, the State can purchase emissions units from other EU member states to reach compliance if domestic reductions are not achieved.

Based on emissions projections and the predicted cost of purchasing emissions units, costs for Ireland to meet its ESR targets have been estimated at between €8bn and €20bn for the period to 2030 (CCAC, 2024a; Conroy & Timoney, 2024). Yakut, McArdele and de Bruin provide estimates of additional economic costs of Ireland not transitioning to a low-carbon economy (Yakut *et al.*, 2024).

The Climate Action Plan sets out how emissions will be reduced from the ESR sector, including through the electrification of transport and heat. The success of such measures will depend on the capacity of the sector to meet this increased electricity demand at affordable prices.

Finally, the *Renewable Energy Directive* sets out targets for the proportion of energy that must be derived from renewable sources. A failure to reach these targets may also incur compliance costs for the State through the requirement to purchase 'statistical transfers' from other EU member states. Projections by SEAI suggest that Ireland is likely to incur such costs to reach compliance with the directive. Together with potential costs under the ESR, these compliance costs may be quite large, and the Council believes that these need to be factored into policy choices.

1.2 Expectations of Enterprise Opportunities

The transition to a low-carbon economy is expected by many to generate increased enterprise opportunities and net job creation, and these are among the most commonly cited co-benefits of climate action (ILO, 2018). Enterprise opportunities linked to the transition, and the creation of 'green jobs', feature prominently in many key Irish policy documents (see Box 1.2).

Assessing enterprise impacts quantitatively is a difficult task, given the challenge of linking any one policy initiative (bar a direct employment scheme) with a specific economic, enterprise or employment outcome. Causation is complex and hard to isolate given the many different mechanisms simultaneously at play. Further, the deployment of technologies may exceed forecasts, meaning that sales, exports, jobs, etc risk being understated; while opportunities will be competing for the same supply chains and resources, meaning that opportunities risk being overstated.

Nevertheless, assessments are seen as important and are undertaken, even at a global level. For example:

- The International Energy Agency estimates that the transition to clean energy will generate 10.3 million net new jobs globally by 2030 which will offset the 2.7 million jobs expected to be lost in fossil-fuel sectors. Further, it provides a sectoral breakdown which reports that most of the anticipated job gains are likely to be in electrical efficiency, power generation and the automotive sector (IEA, 2021; WEF, 2022).
- The International Renewable Energy Agency states that the energy transition could see the number of jobs in the energy sector grow to 134 million by 2030, double the current 67 million jobs (IRENA, 2023).

In this research, the Council is interested in the extent to which the enterprise opportunities and the economic resilience impacts associated with achieving Ireland's national targets have been quantified and presented in a format most useful to the policymaking system, with reference to international examples.

Box 1.2: References to Economic Co-Benefits of the Transition in Key Policies

The previous *Programme for Government* refers to the economic opportunity arising from climate action, and rapid decarbonisation of the energy sector as an opportunity to create new, quality jobs across the country (Government of Ireland, 2020).

The *Climate Action Plan* (CAP) states that its implementation will create jobs and new business models; that climate action can lead to market opportunities that enable sustainable economic growth and green job creation; that Ireland is well positioned to seize new high-growth green export and import substitution opportunities; that a climate-neutral Ireland will bring new, green employment opportunities; and that the CAP will drive the creation of new jobs with alternative skills requirements in individual sectors. In relation to the transition narrative, which is one of the central concerns of this NESC research, the CAP refers to the Government building support for climate action and the opportunity to communicate the wider benefits of climate action such as improved cost of living and green jobs (Government of Ireland, 2024a).

The *Enterprise White Paper* refers to benefits from transition in the power sector such as energy exports. It describes the scale of our offshore wind potential, when coupled with hydrogen production, as a 'once in a century' industrial development opportunity, and while it will not be simple to deliver, with the right policies, and industry buy-in, it has the potential to transform Ireland's economy (Government of Ireland, 2022b).

The *Enterprise Ireland (EI) strategy* refers to taking advantage of the potential areas of growth in sectors such as green energy and hydrogen, maximising the opportunities presented by the low-carbon transition. EI's stated ambitions include strengthening Irish enterprise to capitalise on climate opportunities and green value creation (EI, 2022).

1.3 A Review of Assessments of Enterprise Opportunities

To ascertain the extent to which the enterprise opportunities and the economic resilience impacts have been quantified in Ireland, eight assessments were selected based on the objective set out earlier – i.e. those which reported economic activity as measured via sales and exports of renewable energy-related goods and services, via employment numbers, estimates of foreign direct investment (FDI), and related variables such as gross value added (GVA), and tax receipts, etc (see Appendix).⁵

The Council's review finds that each of the eight individual reports provides informed and informative assessments of the economic impact of the deployment of the relevant renewable technology (or technologies), based on the timeline and scenario chosen. As such, they are a very valuable contribution to the evidence base for policymaking.

While each individual assessment is of a high standard and deals with a specific technology or scenario very well, taken together they present a disparate and complex landscape for the policymaker. The reports, understandably, were not prepared with the need to aggregate the eight different technologies or bundles assessed, the eight different timelines examined, the six different scenarios assessed, or the 10 different measures of success used. This is a limitation, especially as meeting national targets

⁵ The Council is aware that these eight selected reports are only a sample of the many high-quality assessments of impact that have been produced. Further, a number of assessments have been published subsequent to NESC's analysis. For example, the Irish Solar Energy Association has engaged KPMG to assess the economic impacts of the solar energy industry in Ireland. That assessment finds that, if national targets are met, the sector will contribute over €2.3 billion in additional gross value added (GVA) between 2025 and 2030, while supporting up to 7,130 jobs across the country (KPMG & ISEA, 2024). Further, Gas Networks Ireland has highlighted research which indicates the potential of the biogas sector to generate up to 1,800 direct jobs and 4,400 indirect jobs.

necessitates the simultaneous delivery of infrastructure for renewable power generation (e.g. onshore wind, offshore wind, solar, transmission, and interconnection). This also places a focus on the need to constantly enhance infrastructure policy, planning and governance.⁶

Recent analysis in the UK highlights the challenge of making sure all parts of the clean energy system 'deliver simultaneously, in full and at maximum pace, in a way that does not overheat supply chains, [and] is sustainable' (NESO, 2024: 4). The various technologies will 'compete' with each other for resources, such as inputs, logistics, skills, finance and attention within the planning and regulatory systems (see Section 6.2). To the question of whether a policymaker can put their hand on a comprehensive document that sets out the enterprise opportunities arising from the achievement of stated national targets, the answer is 'no'. This is not ideal in terms of making sure that all parts of the system work in the same direction and in a complementary way.

In addition, this NESC analysis is interested in the format of the assessment and data presented. For example, the co-benefit of employment creation (or 'green jobs') is one of the most regularly cited, and, in terms of the supportive narrative needed for the energy transition, is one of the most important. Across numerous policy areas, the jobs dividend is one of the most valuable elements of calls for policy change (e.g. grant aid, tax relief, public investment).

In a number of the assessments reviewed here, including that published by Government to communicate the potential employment creation from offshore renewable energy, the metric used to quantify the co-benefit of employment creation is 'FTE years', which is not an instantly intuitive measure of employment.⁷

The disparate and complex landscape of assessments, and the current use of non-intuitive metrics of important co-benefits are important considerations as the State sets about undertaking further assessments. For example, the first two actions (of 40) set out in the new national offshore wind energy (OWE) strategy *Powering Prosperity* are to conduct a fresh assessment of jobs, exports, etc (Government of Ireland, 2024e):

- Action 1: Establish baseline data and set projected targets for R&D spend in the OWE supply chain, number of jobs in the OWE supply chain, new start-ups in the OWE supply chain, exports, and FDI potential.
- Action 2: Conduct economic impact assessment on the potential of offshore wind in Ireland.

There are enterprise opportunities associated with the development of offshore wind capacity, and additional energy-system-level analysis will provide further insight. Such analysis is necessary and is supported by the *Future Framework for Offshore Renewable Energy* policy statement (Government of Ireland, 2024b). Government departments and agencies are working closely to support concrete actions to capture these opportunities.

The two actions from *Powering Prosperity* above are a recognition of the value of quantitative assessment and the absence of much-needed evidence, as the baseline must be established before targets can be set. There is no doubt that the completion of these two actions will add insight, but the Council also notes the risk of adding further complexity to the landscape. A further crucial consideration regarding how the second action above is completed is the scenario chosen for the assessment.

⁶ The demands for land arising from a wide variety of policy objectives, including solar and other energy infrastructure, is being considered as part of the *Land Use Review* (Phase 2), which is expected to be complete in March 2025.

⁷ One FTE year is the equivalent of one person working full-time for one year, or two people working for six months. For seasonal roles therefore, filling one FTE year will require multiple employees. The assessments reviewed here include estimates for employment creation of 30,400 FTE years up to 2030, 146,700 FTE years to 2040, and 820,000 FTE years out to 2060. These are not immediately intuitive metrics, and it would be understandable if they were not included in communications (e.g. speeches and press releases) given the challenge of explaining them quickly and succinctly.

For example, the assessments reviewed here cover six different scenarios,⁸ and because the infrastructure and activity associated with each one will be different, the expected enterprise opportunities (e.g. jobs, investment, GVA, etc) will be different. The Council's review makes it clear that the shape, output and value of every assessment of the impact of transition rests on which scenario is chosen.

1.4 International Example of Assessment

Every country is undertaking some form of energy transition and, as illustrated above, related quantitative assessments are common exercises internationally. NESC is interested in experiences abroad so as to identify instructive international examples, and to determine what we can learn from what other countries are doing.

Central to this has been recent Ireland-Scotland bilateral engagements, facilitated by the Department of Enterprise, Trade and Employment and the Scottish government Ireland Office.

In this context, NESC engaged with the Net Zero Economy and Climate Change Division within the Scottish government to understand their approach to identifying and capturing the opportunities associated with achieving their national targets for the economy, jobs, trade and investment. This centred on the report *Economic Opportunities in Scotland's Net Zero and Climate Adaptation Economy* (ClimateXChange, 2024).

Scotland's assessment of enterprise opportunities was prepared to provide an 'evidence base for the Scottish government to use in identifying specific policy actions that it and its agencies can take to support the growth of sectors that hold strong opportunities, and to identify its role in removing barriers and enabling positive change. [It applies] a consistent high-level evidence-based approach to a limited number of areas of the economy and drawing out a broader narrative as to Scotland's economy' (*ibid.* 4).

It was designed in the context of many pre-existing assessments which outlined the importance of capturing economic opportunity, and which suggested that different technologies would spur different opportunities and to varying degrees. However, prior to the preparation of this 2024 assessment, it was not possible to make comparisons between sectors.

The exercise in Scotland was not about how to achieve a just transition or how to deliver greater levels of renewable energy, nor was it confined to Scotland's domestic market for goods and services, as this did not define the limits of Scotland's ambition. The assessment was intended to reflect the international picture, and focus on the strengths and weaknesses, opportunities and threats on what businesses are good at and on what they need to grow. It recognised that, for Scotland, offshore wind development requires a strong FDI element, but that project developments should support local activities, meaning that the Scottish government had to get the conditions right for this to happen in terms of skills and supply chains. This is an approach which would be beneficial in Ireland.

The assessment took around one year to devise and complete, and involved scenario-based projections, where baseline data was difficult to get. An external peer-review group helped define sectors of interest, and consultants were engaged to undertake interviews to refine the initial list of sectors. A separate piece of research was undertaken to develop the methodology to examine individual sectors of interest. A SWOT analysis was then undertaken on the smaller number of sectors, a process which took longer than anticipated due to difficulty getting the necessary data.

⁸ The scenarios were: (i) 3.5 GW of offshore wind; CAP 2019 context/targets; (ii) 6.5-7.3 GW of offshore wind; Three port clusters as catalysts for jobs; (iii) 9 GW of onshore wind; (iv) 9 GW onshore wind; 5 GW of offshore wind; 7.32 GW of solar; (v) 37 GW (10 GW fixed + 27 GW floating); 12 GW interconnection; and (vi) Government capacity targets met; Government actively addresses skills shortages and attempts to increase local content in Ireland.

The resulting assessment for Scotland, in contrast to the situation in Ireland, is a report which has the benefit of providing one consistent assessment of their net-zero scenario, with eight technologies included in one assessment rather than separate assessments (see Table 1.1). In addition to providing a comprehensive resource to policymakers, as argued earlier, this makes sense as multiple renewable generation projects must be delivered in parallel and compete for finance, skills, shipping, supply chains, etc. The timelines are clear and consistent, with a baseline of 2022 and estimates for 2030, and 2050, and the metrics are intuitive – absolute numbers of jobs, GVA, and turnover.

Table 1.1: Example of Quantitative Estimates of Economic Impact from Scotland, 2024

Technology/Activity	Year of Outturn	FTE/Headcount	GVA	Turnover
Onshore Wind	2022	3,100	£1.4bn	£4bn
	2030	14,307	£2.3bn	£6bn
	2050	4,436	£712m	£1.9bn
Offshore Wind	2022	3,100	£2bn	£4.2bn
	2030	23,518	£3.1bn	£6.4bn
	2050	4,436	£874m	£1.8bn
Wave and Tidal	2022	<500	-	£30m
	2030	187	£6.2m	£12.2m
	2050	206	£6.8m	£13.4m
Hydrogen	2022	<500	£3m	£37m
	2030	5,191	£286m	£752.7m
	2050	3,793	£209m	£550m
Carbon Capture, Use, and Storage	2022	<100	-	£4m
	2030	1,016	£80m	£190m
	2050	804	£69m	£149m
Low Carbon Fuels	2022	290	£35m	£81.7m
	2030	5,700	£357m	£923m
	2050	5,463	£359m	£871m
Low Carbon Heavy Duty Vehicles	2022	<132	£12m	£25m
	2030	2,337	£209.8m	£441m
	2050	8,255	£687.5m	£1.5bn
Renewable Heat	2022	1,700	£162m	£376.5m
	2030	13,461	£1.08bn	£2.75bn
	2050	9,664	£774.9m	£1.8bn

Source: ClimateXChange, 2024.

The Scottish assessment is now a useful tool for policymakers in their engagement with stakeholders and in helping industry representative bodies work their members to pursue opportunities. The assessment also highlights 'peaks and troughs', illustrating where there may be initial jobs gains, but which fall away as the construction phase concludes. It also assists in setting ambitions and managing sectoral expectations. For example, the solar generation sector is not included in the assessment due to the lack of scale and expertise in this activity in Scotland.

Overall, this Scottish assessment provides many lessons for any similar work proposed here in Ireland. It is worth noting that it is also an instructive international example in terms of its limitations. For example, while the 'FTE/headcount' metric is more intuitive than 'FTE years', an additional step may be needed to report this as 'jobs'.

Also, there is a reliance on extrapolating the existing stratification of activities in Scotland to provide estimates of the future (i.e. the current distribution of sectors is assumed to continue, although growth to different extents). To avoid that limitation, this is something any future assessment exercise in Ireland may wish to address in the design stage.

The first step in any new assessment here will be to decide which transition scenario to model; this question is inextricably linked to Ireland's stated ambition to become a competitive net exporter of energy. This ambition is examined in the next chapter.

1.5 Conclusion

Assessments of the enterprise opportunities linked to the transition – such as the generation of employment, GVA, tax income, and investment – are important inputs to policy formulation, and they feature prominently in many strategies and plans. It is important that such opportunities be presented in a format most useful to the policymaking system and to those presenting a narrative supportive of the necessary transition. A large majority of people believe that climate targets will create new jobs and increase investment; transition policy must ensure that reasonable expectations can be met.⁹

The Council's review of a sample of assessments finds them individually to be very valuable contributions to the evidence base for policymaking. However, taken together they present a disparate and complex landscape for the policymaker, and often provide non-intuitive metrics of important co-benefits.

There is no single, comprehensive estimate available to policymakers of the sales, exports, and jobs, etc that can be expected from delivering transition targets. This poses a risk to policy development in many areas (e.g. enterprise, skills, planning and investment) as well as to the transition narrative.

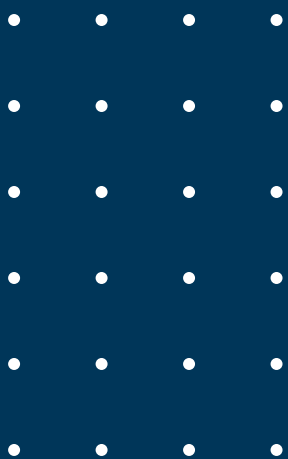
This contrasts with an example of assessment from Scotland which provides one consistent assessment across multiple technologies, with clear and consistent timelines, and more intuitive metrics. There would be benefits in examining not just this output, but also the process by which it was developed and how it has been used. NESC's review also highlights the impact of scenario choice on the shape, output and value of assessments of the impact of transition.

Overall, it is extremely difficult to construct a comprehensive quantitative analysis of the enterprise impacts arising from different energy transition scenarios. This is particularly true in a very tight labour market where job creation must also be considered against displacement in other sectors, wage inflation and opportunity costs. Nonetheless, enterprise and employment opportunities – particularly regional opportunities – will continue to be important aspects of policy assessment of the energy transition. Actions to quantify these impacts – such as those set out in the *Powering Prosperity* strategy – are required by the policy system and wider civil society to give as clear a picture as possible of the economic, enterprise and employment impacts of significant investments in renewable energy and supporting infrastructure.

The Council believes these to be important findings as the State is about to undertake further assessments. There is no doubt that these will add insight, but NESC also notes the risk of adding further complexity to the landscape, where greater clarity of enterprise and economic resilience impacts is needed. The more 'standardised' approach used in Scotland merits further consideration to ensure future assessments do not add noise or complexity but rather help answer 'the big questions'. There is an opportunity now to be more strategic about how we model, plan and then deliver the energy transition.

⁹ A Eurobarometer survey from September 2024, which included Ireland, found that 79 per cent of those surveyed agree that climate targets will spur new jobs and attract investments in the clean energy sector (European Commission, 2024c).

Chapter 2



**Transition in the Power
Sector:**
Exporting Energy

2.1 Introduction

Offshore wind generation is at the heart of the State's ambition for long-run transition in the power sector. Offshore wind offers many advantages relative to other renewable generation sources, such as the accessibility of vast sites, lower visual and noise impacts, robust wind speeds, reduced turbulence, and weak windshear (Desalegn *et al.*, 2023). Ireland's 490,000 square kilometres sea area is approximately seven times its landmass, and offers considerable offshore renewable energy potential (EirGrid, 2024a). Ireland has the best offshore wind resource in Europe, and also has a spatially very homogenous wind resource (Nijs, 2019).¹⁰ The centrality of offshore wind to the transition in Irish policy reflects this endowment.

The Climate Action Plan refers to 'Ireland's enormous potential for offshore wind' (Government of Ireland, 2024a: 159), while the offshore wind industrial strategy notes Ireland's 'clear potential to become a global leader' in offshore wind energy, Ireland's 'unique advantage in Europe', its 'expansive Exclusive Economic Zone (EEZ), which is around seven times our landmass', and 'frequent and powerful wind resource offshore' (Government of Ireland, 2024e: 3).

This view informs the State's ambitious targets for the offshore wind sector, namely, to increase capacity from 0.025 GW today to 5 GW by 2030, 20 GW by 2040 and 37 GW by 2050.

Given that Ireland's renewable energy potential will eventually far exceed domestic energy requirements (see Section 2.3), this stance in turn underpins the view that Ireland's offshore resource can see it become 'a net energy exporter' (Government of Ireland, 2023c: 45). Indeed, the idea of Ireland exporting renewable energy – and the discussion of the opportunities and challenges associated with that – goes back at least twenty years (SEI, 2002). Most recently, the Government's *Offshore Renewable Energy Technology Roadmap* states that 'Ireland [has] confirmed ambitious plans to deliver 37 GW of offshore wind in Irish waters by 2050. Relative to the expected progression of domestic electricity demand, these large volumes represent an opportunity for Ireland to become a significant energy exporter, in the medium to long-term, supporting the wider European energy transition' (SEAI, 2024c: 19).

2.2 The Export Scenario

Ireland's potential to become a net exporter of energy is often described simply as 'the 37 GW export scenario', given the particularly ambitious target for the offshore wind sector. It is important to note that, while the overall export ambition for renewable energy is often described with reference to the 37 GW target for offshore wind capacity, the export scenario discussed here comprises:

- 9 GW of solar capacity;
- 9 GW of onshore wind;
- 37 GW of offshore wind generation; and
- 12 GW of interconnection (BVG Associates, 2024b).¹¹

Thus the '37 GW export scenario' involves a total 55 GW of renewable power generation capacity as well as significant interconnection.

¹⁰ Based on the ENSPRESO dataset and NESC correspondence with the JRC Energy and Industry Geography Lab (EIGL), November 2024.

¹¹ One issue which emerged during NESC's consultations was a tendency for very different technologies, sectors or infrastructure to be bundled under the 'renewables' term. For example, onshore renewables, offshore renewables and solar are very different sectors and must be considered as such. Analysis overall should avoid inferring conclusions for one technology, sector or infrastructure to another.

The pervasiveness of the 37 GW export scenario became obvious during the Council's consultations for this research, and it is the basis of assessments of both the opportunity from transition in the power sector, and of regular and recent statements of Ireland's potential (BVG Associates, 2024b; Government of Ireland, 2023c, 2024e; O'Doherty, 2023; O'Sullivan, 2023; The Economist, 2022).

One example of the prominence given to this export scenario is that, when outlining opportunities from the development of offshore renewable energy, the State's future framework highlights those benefits arising *specifically* from the 37 GW export scenario, as opposed to others modelled (e.g. 16 GW of offshore capacity to achieve a domestic net-zero scenario). Ireland's potential, the framework states, is to create GVA of €69bn, and employment of 820,000 full-time equivalent (FTE) years between 2022 and 2060, reaching a peak of about 31,000 FTE in 2049 (Government of Ireland, 2024b: 66). Further, the 37 GW export scenario is the one referenced for Ireland in the Joint Statement on North Seas Energy Cooperation and it is the scenario used in the recent Offshore Wind Skills Action Plan (Government of Ireland, 2024d; NSEC, 2022).

The State's primary economic analysis applied a power system model using a 37 GW export scenario, among others, 'to support... targets and export ambitions set out in the Future Framework Policy Statement (Government of Ireland, 2024b: 8). That economic analysis includes the 37 GW export scenario as one 'to document the viability and local economic impact of exporting renewable generation and/or hydrogen produced from renewables' (BVG Associates, 2024b: 6), as opposed to the 37 GW export scenario emerging from the sum of capabilities, evidence-based assessment of sustainable demand, successfully addressing barriers (see Part 2) and the likely overall path of transition.

While this economic analysis does reflect ambition and shine a light on the progress needed in multiple areas to decarbonise our power system, it takes a top-down rather than bottom-up approach by setting out some potential benefits of generating a certain level of renewable power, as opposed to setting out the level of renewable power we should aim to generate, taking our environmental, social and economic objectives on board.

This has consequences for the optimal sequence of policy, such as the necessity to demonstrate sustainable demand for renewable power from large energy users (LEUs) and data centres, in advance of delivery (see Section 7.3).

In a contrasting example, under the Joint Declaration of Intent on Cooperation between Ireland and Germany signed in 2023, new research is underway to assess the production of green hydrogen in Ireland, and the potential to export any surplus to Germany. *Project HYreland* analyses the technological and economic potential of the production and transportation of surplus renewable energy, and the routes for export, and contrasts with existing analysis by fully researching potential before setting objectives and related targets.¹²

Overall, a recurring point which emerged during the Council's consultations for this research was the absence of an accepted, evidence-based, readily available explanation for why Ireland is pursuing the 37 GW export scenario. Aligned to this was the widespread uncertainty about its cost and the distribution of those costs (see Chapter 4). That distribution is of course a key aspect of fiscal prudence, social justice, fairness and equity, but also fundamental to policy and investment planning.

Nevertheless, being a net exporter assumes the existence of surplus energy supply, beyond that which is needed to meet domestic demand – i.e. to achieve domestic net zero. This assumption is examined below.

¹² The project is led by ESB, in collaboration with the German government and the Department of the Environment, Climate and Communications.

2.3 Estimating Ireland's Future Power Surplus

The future availability of surplus renewable power has become central to the assessment of the economic impact of the transition and Ireland's ambition to become a competitive net exporter of energy. It has also become a key point in Ireland's transition narrative.

Peak electricity demand to date was recorded on 8 January 2025 – at just over **6 GW** (EirGrid, 2025). Looking ahead, peak demand is expected to continue to rise, driven by greater electrification of transport, heating and industry, and by economic and population growth (Government of Ireland, 2024a: 154). Existing ambition in this area could be insufficient to promote the transition; the Electricity Association of Ireland, for example, recommends a target of 35 per cent electrification in industrial demand by 2030 – an increase on the 27 per cent expected under the CAP (EAI, 2024).

At the same time, projections of future energy demand require care in terms of any assumptions of the level and type of energy use. In NESC's previous analysis of economic resilience, the Council noted that Ireland's transition to net zero will become far easier if there is a reduction in overall energy demand, meaning that demand-reduction measures must feature most prominently among policy actions (NESC, 2023). This approach aligns with the idea of a 'well-being economy', based on energy sufficiency, and innovation to develop products, services and systems which result in an absolute reduction in energy demand (Brischke *et al.*, 2015). Also, in its Energy Security Package decision in November 2023, the Government clarified the importance of gas demand reduction for energy security (Government of Ireland, 2023d).

Further, and as discussed later, NESC's analysis surfaces something of a conundrum – if not an outright contradiction – inherent in the current 'drive demand to drive supply' approach, whereby Ireland's ambition for renewable power appears to rely on ensuring massive levels of energy demand in advance (see Section 7.3).

Figure 2.1 presents an estimate of future peak electricity demand in Ireland out to 2050. The data suggests that peak demand will rise from 6 GW today to 9.6 GW in 2031, to 12.5 GW in 2040, and then level out somewhat to reach almost 13 GW in 2050.

Turning to **generation capacity**, data from 2022 shows that there is currently over 9 GW of generation capacity, provided from gas (4.6 GW), onshore wind (4.5 GW), solar (167 MW) and offshore wind (25 MW). It is critical to note that installed generation capacity will need to significantly exceed peak demand, and be complemented by sufficient storage capacity, as Ireland moves towards having more intermittent renewables on the system.

Looking to the future, under the State's ambitious export scenario, renewable generation capacity is assumed to reach 55 GW in 2050, provided from offshore wind (37 GW), onshore wind (9 GW) and solar (9 GW).

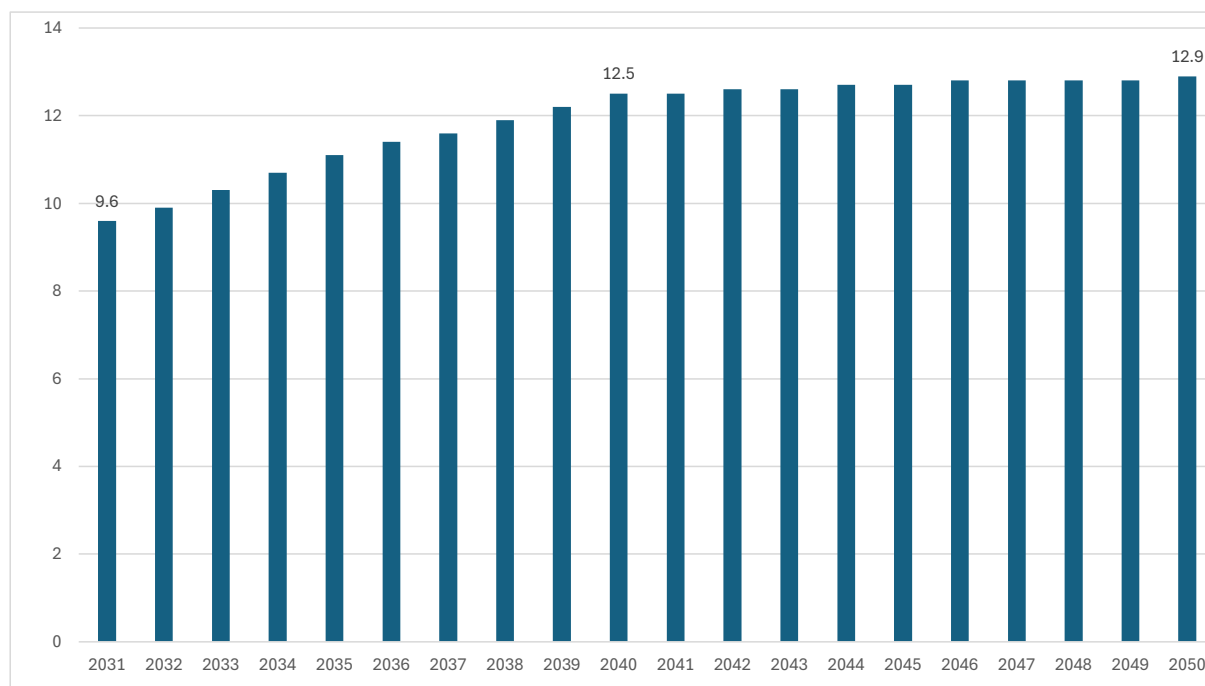
As Figure 2.2 illustrates, the State's ambitious export scenario would see renewable generation capacity grow from 24 GW in 2031 to 37.5 GW in 2040, and on to 55 GW in 2050, at a time when peak electricity demand is expected to plateau at between 12 and 13 GW from 2040.

Therefore, returning to the key question in this section – what is Ireland's expected surplus energy available for export under the current ambition? – the Government's ambition would see renewable generation capacity exceed domestic requirements by over 30 GW in 2040 and by almost 40 GW in 2050 – see Table 2.1.¹³ In that scenario, the surplus in 2050 would be 3.5 times all of today's total

¹³ Data provided to NESC by EirGrid. In terms of annual surpluses, there will be 49 terawatt hours of surplus energy available in excess of domestic electricity requirements in 2040, and 116 terawatt hours of surplus available in 2050. Given the intermittency of renewables such as wind and solar, there may be times when there is very little output to meet demand, including during periods of high demand. As a result, electrical interconnection, other forms of generation (e.g. gas-fired power plants) and storage capacity are required to meet demand during these periods.

electricity demand. If this estimated surplus power does materialise, it could cost households and firms around €4.2bn annually from 2040 for a period of 15 to 20 years.¹⁴

Figure 2.1: Profile of Peak Electricity Demand (GW) in Ireland 2031 – 2050¹⁵



As is explained in later chapters, this is despite considerable uncertainty about the profile of future supply reliability, about the impact on electricity costs and competitiveness, and about how numerous barriers to progress will be addressed.

Feasible and viable methods of offtake (use), storage or export must be developed, clearly articulated and progressed by the policy system.

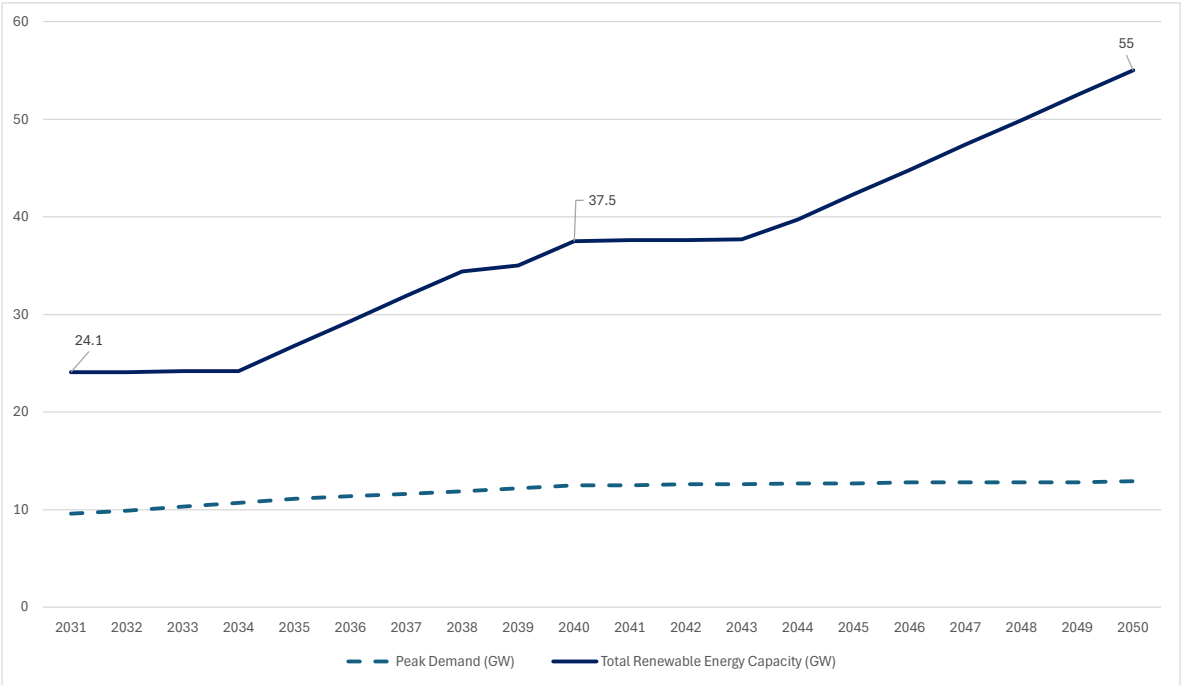
At the same time, it is important that estimation exercises do not result in overly conservative assumptions on the consumption of available energy resources. For example, there will be (currently unclear) interactions between the pace of electrification and economic transformation, where enterprises and sectors evolve in response to the availability of more clean power.

Such developments in industry will affect the levels of demand on the grid at any point in time. There will be a huge number of hours where there is more supply than demand and still some hours where there is not enough supply to meet demand. These are strategic issues to be addressed, as set out in Chapter 5.

¹⁴ Based on a Renewable Electricity Support Scheme contract-for-difference price of €85 per megawatt hour.

¹⁵ Data provided to NES by EirGrid.

Figure 2.2: Peak Electricity Demand and Renewables Capacity (GW), 2031 – 2050¹⁶



¹⁶ Data provided to NESC by EirGrid. Note, the SEAI has published an alternative timeline for offshore project delivery (see (SEAI, 2024c: 13) but that approach has 3.2 GW of offshore capacity delivered by 2030, as opposed to the 5 GW which is the scenario being examined here.

Table 2.1: Estimated Future Annual Electricity Demand, Capacity and Surplus

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Peak Demand (GW)	9.6	9.9	10.3	10.7	11.1	11.4	11.6	11.9	12.2	12.5	12.5	12.6	12.6	12.7	12.7	12.8	12.8	12.8	12.8	12.9
Offshore Wind Capacity (GW)	7	7	7	7	9.5	12	14.5	17	17.5	20	20	20	20	22	24.5	27	29.5	32	34.5	37
Onshore Wind Capacity (GW)	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Solar Capacity (GW)	8.1	8.1	8.2	8.2	8.3	8.3	8.4	8.4	8.5	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.9	8.9	9	9
Total Renewable Energy Capacity (GW)	24.1	24.1	24.2	24.2	26.8	29.3	31.9	34.4	35	37.5	37.6	37.6	37.7	39.7	42.3	44.8	47.4	49.9	52.5	55
Annual Surplus (TWh)	18	17	15	11	17	26	33	42	42	49	49	49	49	57	66	76	86	96	106	116

Source: EirGrid, 'Offshore Opportunity' Scenario.

2.4 Conclusion

Overall, the availability of surplus renewable capacity in the future is central to the assessment of the economic impact of Ireland's energy transition, the State's ambition to become a competitive net exporter of energy, and the transition narrative. The 37 GW export scenario is increasingly prevalent in policy, targets, assessments of co-benefits, and communications.

If Ireland can achieve the ambitious plans set out by Government, Ireland will have a massive surplus of energy in excess of domestic requirements from 2040. Yet there is uncertainty about the future profile of reliability of supply, about the impact on electricity costs and competitiveness, and about how numerous barriers to progress will be addressed.

In short, there are questions over the realism of such a scenario. During the consultations undertaken as part of NESC's research, it was not possible to isolate the evidential underpinning for the export scenario, and there was little confidence expressed that this potential would be realised. In particular, the timescale set out is questionable, not least because the delivery of the first staging post along the way, 5 GW of offshore wind generation by 2030, is likely to be five years or more behind.

It has not been possible in this NESC research or during the associated wide-ranging consultation to identify clear, evidence-based and widely accepted information on key points – i.e. the renewable capacity required to achieve domestic net zero;¹⁷ the rationale for generating renewable power beyond that; how much surplus capacity beyond domestic net zero should/will Ireland produce; the optimal use of any surplus; and rather than exporting it, whether it would be wiser and more practical to use any surplus capacity domestically.

The availability of surplus clean energy is likely to spur new industrial opportunities in advanced manufacturing and in traditional sectors which require significant quantities of power. This potential, connecting energy and industry, would benefit from further exploration and strategic consideration. While these opportunities are still nascent and hypothetical – there are many reasons to anticipate that domestic value-adding industrial or ICT applications for 'surplus' renewable generation may prove a better economic opportunity for the State and its citizens, given its cost profile and productivity, rather than exporting 'raw' energy into international energy/fuel markets where price is volatile and exogenous.

In addition, Ireland is currently set to miss its agreed carbon budget to 2030 (CCAC, 2024b). This may mean more stringent future budgets, which may entail the State becoming even more reliant on rapid decarbonisation through renewables deployment. This could have implications for any assumptions on the use of renewable power, including for export.

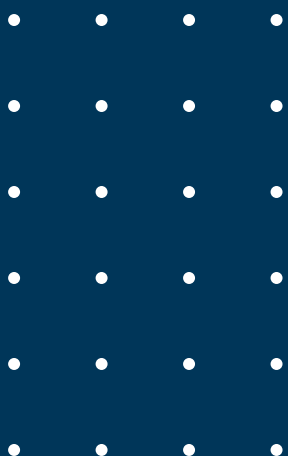
Further, discussions and decisions about the use of any surplus energy must be mindful of concerns around specific societal needs and social justice, such as supporting communities, cohorts or households vulnerable to energy poverty.

More fundamentally, there are concerns about the likelihood of resolving the various obstacles to full delivery of the State's ambition quickly enough, and hence about the realisation of the associated enterprise and economic co-benefits. This is in the context where any additional renewable power generation capacity required ten years from now must be already in progress (White, 2024).

The areas for action recommended by the Council to support the delivery of the State's ambition are discussed later in this report. Before that, the Council's examination of how achieving Ireland's stated targets affects the reliability and cost of supply is set out in the next two chapters.

¹⁷ MaREI has stated that meeting Ireland's domestic climate targets will likely result in an overall annual electricity requirement of between 90 and 110 TWh by 2050, and that 'the offshore wind resource required to meet this future need varies between 11 and 15 GW for the same given potential of onshore wind of 11.5 GW in 2050' (MaREI, 2023).

Chapter 3



**Transition in the Power
Sector:**
Security of Supply

3.1 Introduction

The security and reliability of the national power system is a key aspect of Ireland's economic resilience.¹⁸ Ireland's dependence on imported energy is well documented and is a strategic risk. Over 80 per cent of the country's energy requirement comes from abroad, and over 85 per cent of the requirement is from fossil fuel (SEAI, 2023b). Ireland has 'limited diversity of supply and no gas storage' (Government of Ireland, 2024c: 31). Energy security is one of five technological threats listed in Ireland's *National Risk Assessment* and (as discussed in Section 8.3) geopolitical tensions are heightening concerns across Europe about the location and security of national energy supplies.

The reliable provision of energy is also a national competitiveness issue, and affects Ireland's attractiveness to foreign direct investment (American Chamber of Commerce Ireland, 2023).¹⁹ High forced-outage rates of conventional generation, lack of available capacity during low wind, and reduced imports being available from Great Britain via the interconnectors are among the risks identified in Ireland by the EU Agency for the Cooperation of Energy Regulators (ACER, 2023b).

Ireland's forced-outage statistics improved slightly in 2022 relative to 2021, but 'this was still the second worst year on record' (NCPC, 2024: 108). Supply and reliability issues are linked to costs – as evident when new electricity capacity failed to be commissioned on time and was ultimately cancelled, leading 'to the deterioration of the security of supply outlook in the short- and medium-term, and the implementation of emergency actions that came with a significant cost tag for consumers' (ACER, 2023b: 12).

It is little wonder then that enhanced security and reliability of power supply are co-benefits of the transition and are given a high profile in national policy documents. For example:²⁰

- Ireland's energy security strategy states that **future energy will be secure** by moving from an oil-, peat-, coal- and gas-based energy system to an electricity-led system maximising our renewable energy potential, flexibility and being integrated into Europe's energy systems' (Government of Ireland, 2023c: 2).
- Ireland's White Paper on Enterprise includes '**greater energy security**' (and price stability and energy exports) in the list of benefits from transition in the power sector (Government of Ireland, 2022b: 10).
- The draft revision of the National Planning Framework states that the 'accelerated delivery of additional renewable electricity generation is... essential for Ireland to meet its climate targets, reduce its greenhouse gas emissions, and **improve its energy security** by reducing reliance on imported fossil fuels and diversifying its electricity supply' (Government of Ireland, 2024f: 133).

This chapter examines the current reliability of supply and its expected profile over the period of Ireland's energy targets (out to 2050).

¹⁸ The terms 'security' and 'reliability' of supply have different, technical meanings. While 'security of supply' tends to receive the greatest focus, it is the ability of the power system to deliver electricity in the quantity and quality demanded by energy users (i.e. reliability) that is the primary concern in this research.

¹⁹ Citing Euromonitor International's Global Energy Vulnerability Index where Ireland ranked at number 15 (out of 100) for economic resilience and 29th for accessibility, which measures the infrastructure and reliability of the energy sector.

²⁰ Emphasis added.

3.2 Reliability of Ireland's Electricity Supply

The Government has published an *Energy Security in Ireland to 2030 Energy Security Package* (Government of Ireland, 2023c), which includes a range of measures prioritising the '4Rs': reduced and responsive demand, renewables-led system, more resilient systems, and robust risk governance. The recent independent review of supply issues noted that the power system 'is not designed to give absolute certainty that there will be no shortfall in supply of electricity in any circumstance. The market operates to a reliability standard which is a statement of an accepted level of risk that all demand might not be met for a short period each year' (McCarthy, 2023: 11).

The reliability of the power system is expressed by the Loss of Load Expectation (LOLE) measure: the expected number of hours, in a given geographic area and in a given time period (typically one year), during which capacity resources are insufficient to meet the demand and hence electricity is not served.²¹ LOLE is the accepted measure of reliability in the EU. The higher the LOLE number is, the greater the risk that there will be insufficient generation available to meet the demand at all times (EirGrid, 2024b: 2).

The 'target' for the reliability of Ireland's electricity system ('the LOLE Standard') is set by the Department of the Environment, Climate and Communications (DECC). The LOLE target is the maximum level of risk that DECC has judged the system should be operated at. As of July 2024, the LOLE target is three hours per year (SEM Committee, 2024: 23). According to the latest data (EirGrid, 2024b):

- The LOLE in the winter of 2022/23 was 51 hours.
- The LOLE in the winter of 2023/24 was 21 hours.
- The LOLE in the winter of 2024/25 is 3.6 hours.

Thus, while the reliability of Ireland's power system has improved relative to 2022, it is still operating outside the maximum level of risk that it should be.^{22 23}

3.3 Future Impact of Transition on Supply

Looking ahead, the *Ten Year Generation Capacity Statement* includes an assessment of LOLE out to 2032 (EirGrid & SONI, 2024: 113). Taking that forecast data (along with the actual LOLE for 2022-2024), Figure 3.1 presents the profile of expected power system reliability over the coming years.

From 2022 to 2032, the reliability of the power system overall is expected to improve (Figure 3.1, green solid trend line) as the LOLE falls from 51 to 46 hours. There is a spike in unreliability between 2025 and 2027 – due, NESC understands, to the previously planned closure of Moneypoint coal power station.

For the purposes of this research and its focus on economic resilience as the targets for renewable power generation are progressed, two points stand out from the data:

²¹ See Article 23 of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity, <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R0943> [accessed 21/01/25].

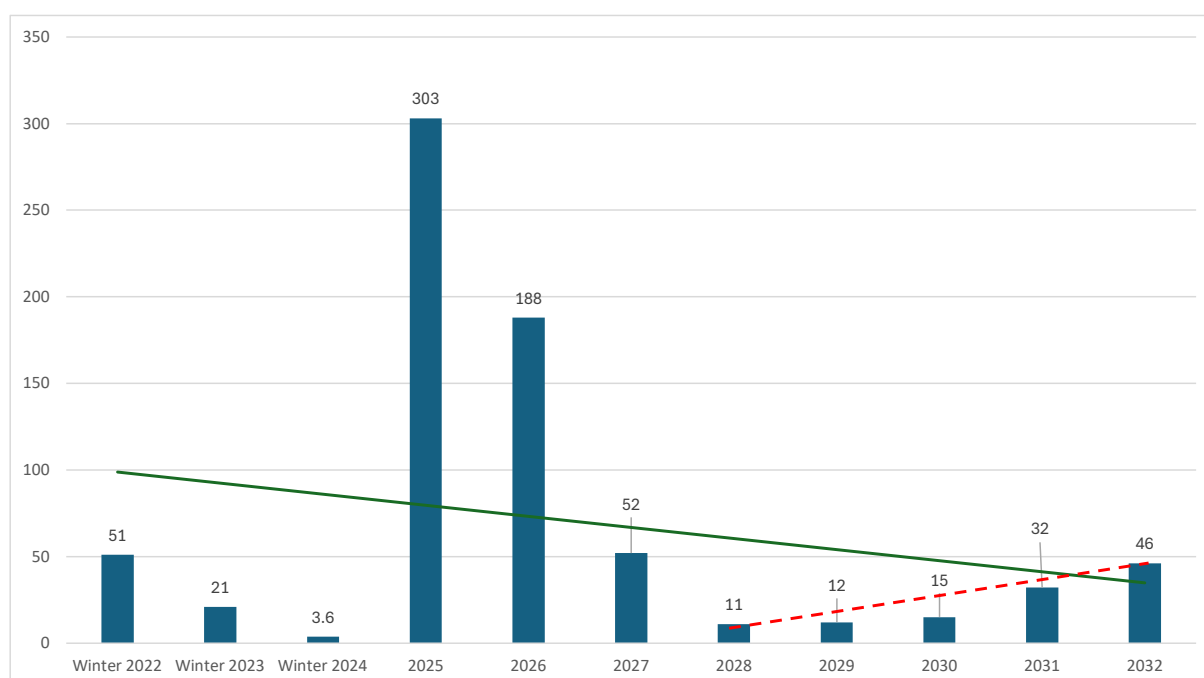
²² The estimated improvement in reliability in 2024 factors in 505 MW of temporary emergency generation, 190 MW of new gas-fired peaker plant, 270 MW of new batteries, and 425 MW of new wind and solar generation.

²³ Regarding the security of gas supply, Ireland continues to fail to meet the standard set out of Regulation (EU) 2017/1938 (CRU, 2023). Ireland is not capable of meeting exceptionally high gas demand in the event of a loss of infrastructure (e.g. the IC2 interconnector with the UK). The proportion of peak-day demand that could be met in the event of a disruption has fallen from 85 per cent in 2018 to 65 per cent in 2022. The Government published *Securing Ireland's Gas Supplies* in 2023 (Government of Ireland, 2023d).

First is the forecasted increase in power system unreliability between 2028 and 2032 (Figure 3.1, red dashed trend line), as the LOLE rises from 11 to 46 hours, which is over 15 times the current target (without mitigation). This is the period which would see, based on the State's ambition, the share of renewables on the system reach 80 per cent, with perhaps 7 GW of offshore wind capacity, 8 GW of solar and 9 GW of onshore wind generation, and the reduced reliance on fossil fuels. This near-term profile contrasts with statements that the security and reliability of power will be enhanced by the greater adoption of renewable energy.

Second is the lack of visibility of expected power system reliability beyond 2032, a period during which the State plans to grow offshore wind capacity – to 20 GW in 2040 and to 37 GW in 2050 – and phase out and reduce reliance on fossil fuels. Again, this lack of certainty contrasts with statements that Ireland's long-term energy security is linked to increased renewable energy capacity.

Figure 3.1: Past and Forecast Loss of Load Expectation (Hours), 2022 – 2032²⁴



One issue, which is not unique to Ireland, is the absence of a single, internally consistent or coherent forecast of power generation, demand, interconnection, reliability and capacity adequacy.²⁵ There is an inability to combine or overlay LOLE data (from the *Ten Year Generation Capacity Statement*) and insights from future capacity scenarios (from *Tomorrow's Energy Scenarios*, EirGrid & SONI, 2023b). Doing so would provide the policy system with an evidence-based sense of the connection between reliability of supply and the increased adoption of renewables in line with targets. The two relevant publications in Ireland are not devised or intended for that purpose, and each follows an approach which is typical across Europe.

²⁴ Based on data provided by EirGrid/SONI. Green solid trend line: improvement in reliability of power system overall. Red dashed trend line: forecasted increase in power system unreliability (without mitigation).

²⁵ DECC's Pillar X project examines different security-of-supply scenarios out to 2030. In addition, SEAI's multi-year Decarbonised Electricity System Study explore pathways to eliminate GHG from the electricity system and the economic impacts of doing so (SEAI, 2023a).

Finally, a broader question arises about the usefulness of LOLE as *the* measure of reliability of supply. An examination was recently undertaken in the UK of whether LOLE remains an appropriate metric for capacity adequacy in a net-zero electricity system with a flexible, low-carbon capacity mix (DESNZ, 2023). It found that, while a single LOLE metric may no longer be appropriate, there is limited evidence to move away from it at this time. A single superior metric was not identified in the literature reviewed in that examination. However, it did report clear indications that a combination of metrics may be beneficial and stated that further development of the theoretical framework is required.

3.4 Conclusion

Ireland's dependence on imported fossil fuels is a strategic risk. Replacing them with renewable power sources in Ireland is regularly described as being central to future security and reliability of supply.

The reliability of supply has improved in Ireland since 2022, and a large majority of people believe that achieving climate targets will improve energy security.²⁶ Yet, replacing conventional generation with intermittent generation puts pressure on reliability. This trade-off has been managed well so far. EirGrid has noted capacity deficits during the 10 years to 2032, and the Government and CRU are taking steps to address this. However, based on the currently available data, it appears that (i) where we have visibility, the reliability of the power system is expected to worsen (unless addressed), and (ii) there is no visibility of expected reliability of the power system beyond 2032, a period during which the State plans to massively increase renewable energy capacity and reduce fossil-fuel use.

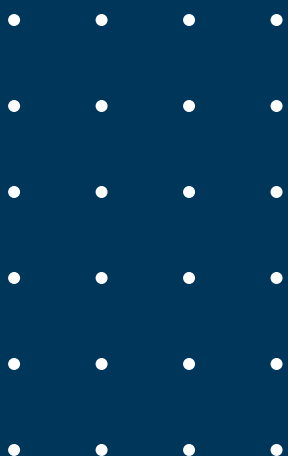
The result is that there is no readily available, intuitive profile of the (predicted) path of the reliability of the power system as ever greater renewable energy capacity is added, in line with the State's objectives. In addition, while we increase renewables and use less conventional generation, the reliance on that last (marginal) unit of conventional generation increases. Its price sets the market price, its availability becomes crucial to the reliability of the system, and the price charged for its availability will increase.

Europe experienced an 'intermittency trap' during a recent *dunkelflaute* (a weather condition which can lead to a sustained reduction of wind and solar power; Li *et al.*, 2021). In 2024, Norway, Sweden and the Netherlands faced extreme costs and Spain rationed industrial power. Transmission, storage and nuclear power are not currently providing an adequate solution, meaning that Europe risks rationing, high costs and increased fossil-fuel use, which are detrimental to climate, energy and economic resilience objectives (Garicano, 2024).

As larger conventional generation plant is decommissioned in Ireland (e.g. Moneypoint) there is less diversity in baseload generation capacity, and greater outage/maintenance requirement on remaining fleet, which to some extent increases the reliability risks. Energy reliability will be an ongoing economic resilience consideration.

²⁶ A Eurobarometer survey from September 2024, which included Ireland, found that 76 per cent of citizens surveyed believe transition policies will reduce dependence on energy imports (European Commission, 2024c).

Chapter 4



**Transition in the Power
Sector:**
Cost Competitiveness

4.1 Introduction

Alongside enterprise opportunities, the potential to export, and more secure energy supply, *lower energy costs* are a key co-benefit promised as part of transition in the power sector. For example, on launching a renewable support scheme in May 2024, the Government stated that such initiatives 'can contribute to lower, long-term energy costs for both households and business..., through lower wholesale electricity prices associated with renewable electricity generation relative to the equivalent fossil fuel generation' (DECC, 2024a). Ireland's auctions for offshore renewable energy capacity have, the Government has said, the potential 'to save Irish consumers hundreds of millions of euros a year in energy bills' (Corcoran, 2024).²⁷

This point is an important element of the stated rationale and narrative in support of the transition. Perhaps more importantly, it speaks to Ireland's national competitiveness and productivity, factors on which much of the country's future economic and social progress relies.

The National Competitiveness and Productivity Council (NCPC) has called for energy costs to be managed through accelerated deployment of decarbonised energy and investment in infrastructure, including grids and cross-border interconnections (NCPC, 2024: 39), with enterprise groups stating that '**low-cost** renewable energy is critical to keeping prices down' (Ibec, 2024: 3, emphasis added).

This chapter examines the competitiveness of Ireland's electricity prices today, and what the profile of those costs might be across the transition timeframe out to 2050, when the State plans to achieve its most ambitious targets.

4.2 Current and Future Electricity Cost Competitiveness

Before discussing Ireland's competitiveness position, it is worth reflecting briefly on the international context. The European Union has had a competitiveness gap with other regions of the world for two decades, and energy has been a key driver of this gap (European Commission, 2024d). The competitiveness gap has deteriorated in the last two years because of the energy crisis:

Electricity retail prices – specifically those for industrial sectors – are currently two to three times those in the US and China. Historically, retail electricity prices in the EU have been up to 80 per cent higher than those in the US while moving around the same level as in China (European Commission, 2024d: 5).

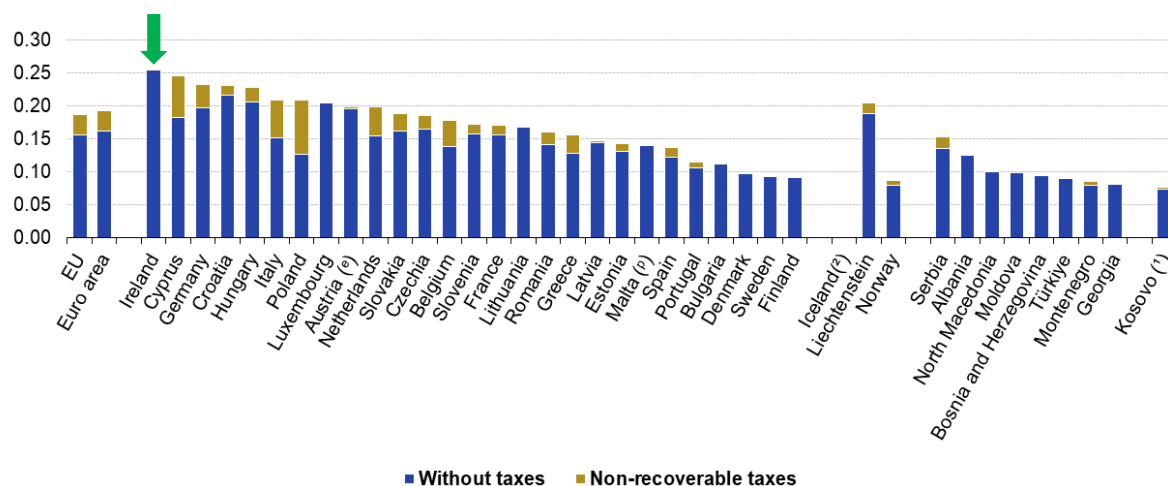
Further, across the EU, firms are passing higher energy costs on to customers and ultimately spreading these costs through the economy. Key proposals for the European power sector are to accelerate the supply of cheaper power generation sources, enabling the development of renewable energy, while maintaining and expanding nuclear and hydropower supply. These suggestions, from *The Future of European Competitiveness Report 2024* (the Draghi Report), are to help limit the impact of fossil-fuel commodity price variations on electricity prices. In addition, the Draghi Report's proposals would support the development of the required grids and flexibility infrastructure to avoid bottlenecks or intermittency leading to higher energy prices, while minimising overall system costs (European Commission, 2024d).²⁸

So, Europe has uncompetitively high electricity prices, and Ireland's electricity prices for non-household users are the highest in Europe. Ireland's high costs are increasing the cost of doing business here and are harming national competitiveness (see Figure 4.1).

²⁷ This benefit depends on, among other things, public support for the associated infrastructure.

²⁸ Note that the consultation process for the Draghi report has come in for criticism (Corporate Europe Observatory, 2024).

Figure 4.1: Electricity Prices for Non-Household Consumers, First Half of 2024, (€ per KWh, Consumption Band IC: 500 MWh to 1 999 MWh)



(1) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.

(2) Not available

(e) Estimate

(p) Provisional

Source: Eurostat, 2024.

In terms of economic resilience, some reduction in the cost of electricity to firms in Ireland relative to economies to which we export, and with which we compete for FDI, is important to businesses. Any reduction in the cost of electricity will be welcomed by households, and there is a need to protect households from price variability to deliver the electrification of heat and transport, as well as power.

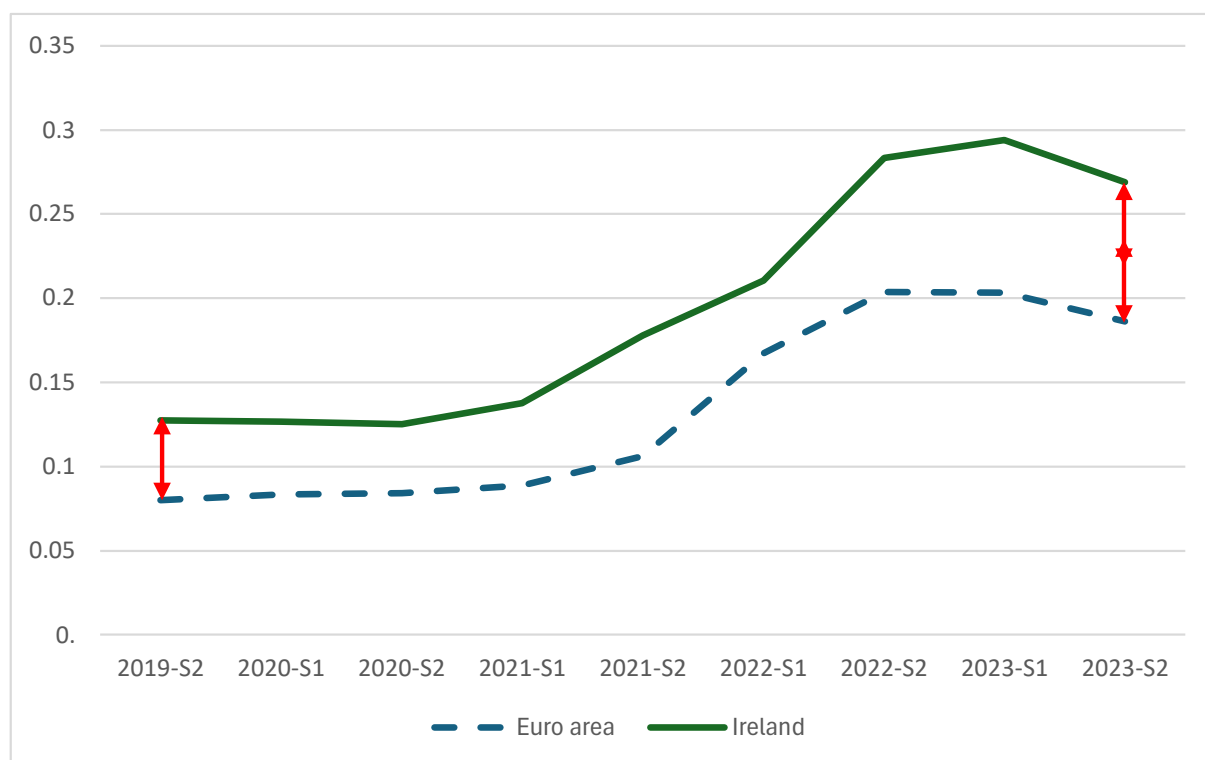
Business groups have highlighted how Ireland has some of the highest electricity prices in Europe or the OECD and that this is a 'major threat to business viability, future investment, and decarbonisation' (Ibec, 2024: 3). They add that they expect prices will remain high in the short to medium term, unless action is taken to address underlying causes and cost drivers.

Ireland's electricity prices for non-household users have consistently tracked the Euro Area price at a higher value for the past four and a half years (Figure 4.2). It is also noticeable that the differential between the price Irish enterprises pay compared to their counterparts in Europe has doubled over that period.

A number of factors contribute to Ireland's higher electricity costs: low-density and highly dispersed population, legacy of underinvestment, infrastructure deficits, relatively small market size, and high dependency on imported natural gas. Wholesale prices across the EU are largely driven by the share of gas generation, and most Irish electricity is generated by gas (Lynch, M., 2023), (see Box 6.3 on market reform).

Another key driver of higher electricity costs is our peripheral location and isolation (in energy terms). As discussed in more detail in Chapter 8, Ireland currently has limited electricity interconnection, though more is planned. Our present interconnection capacity has been estimated to be 20-23 per cent of yearly peak demand for the transition in the short run (BusinessEurope, 2024).

Figure 4.2: Electricity Prices for Non-Household Consumers, Bi-Annual Data, 2020-2024 (€ per KWh, Consumption Band IC: 500 MWh to 1 999 MWh)²⁹



Source: Eurostat, 2024.

Ireland's isolated situation leads to higher power prices despite ambitious targets for renewable capacity; 'power prices are projected to be 13 per cent higher than in GB (+10 €/MWh) and 36 per cent higher than in France (+22 €/MWh) in 2025' (*ibid.* 54).

Competitiveness concerns have often focused on exposure to volatile gas prices as well as high energy system costs due to increasing levels of variable renewable penetration (OECD, 2019). In early 2024, gas prices were lower than those seen in early 2023. As a result, power prices have also fallen, but they remain above historic norms, keeping electricity prices relatively high – the average wholesale price for 2024 was still more than double the 2019 level. Towards the end of 2024, power prices were substantially higher than at the end of 2023, as the price of gas rose on international markets. The price of wholesale electricity in Ireland increased by 19 per cent over the year to November 2024 (CSO, 2024).

It is important to note that high levels of wind penetration on the energy system can depress costs and reduce price volatility (Di Cosmo & Valeri, 2016; Lynch, M.A. & Curtis, 2015). In the absence of wind capacity, Ireland is more reliant on gas and more exposed to gas price spikes. One estimate, from the wind industry, is that around 2.1 billion cubic meters (bcm) of fossil gas was displaced in Ireland in 2024, at a total avoided cost of €748m. According to that analysis, the resulting reduction in emissions equates to 4.1 tonnes of CO₂, and a displacement of €268m worth of carbon credits from the wholesale market in Ireland.³⁰

²⁹ Differential per KWh rose from €0.043 in H1 2020 to €0.0919 in H1 2024.

³⁰ Data provided by Wind Energy Ireland, January 2025.

Given that some of the factors listed above are difficult or impossible to address, the promised downward pressure that increased renewable capacity is to exert on energy prices is crucial.³¹ The lack of competitive energy prices in Ireland gains greater prominence as other aspects of our competitiveness come under threat (e.g. the global taxation and tariff regimes), and the risk of relaxed state aid rules – which would favour larger EU member states – increases.

The NCPC has stated that persistent deficits in respect of our energy (and other) infrastructure present the risk that future demand by enterprise users will outstrip supply, with ramifications for domestic SMEs as well as the investment decisions of internationally mobile foreign-owned firms. This, they say, represents a significant reputational risk for Ireland. They have called for Ireland's ambition for the energy (and digital) transitions 'to be matched by a similar level of ambition in the supply and competitive provision of public utilities' (NCPC, 2024: 10 & 16).

But what evidence is there that the provision of renewable power supply in line with the Government's stated targets will be competitive, and result in lower energy costs for consumers – both enterprises and households?

Similar to the issue raised with reliability of supply in Chapter 3, there is a lack of visibility of the expected cost of electricity to firms for the period during which the State plans to grow renewable energy capacity massively and phase out and reduce reliance on fossil fuels.

The energy transition has increased the uncertainty about future electricity prices and placed a focus on the EU electricity forward market. However, a review by the EU Agency for the Cooperation of Energy Regulators found that the electricity forward market suffers from problems which prevent it being effective in many ways (particularly since the Covid-19 pandemic and the conflict in Ukraine), including acting as a forecast of future prices (ACER, 2023a). Again, this lack of certainty contrasts with statements that lower energy costs are linked to increased renewable energy capacity.

A robust forecast for electricity prices is not available for the near term, not to mention for the years out to 2050 (the transition timeframe for the State's plans to achieve its most ambitious targets). However, one expert in the area has stated:

Looking to the future, there is little evidence to suggest that residential electricity prices will be significantly lower than today. The narrative that electricity will be 'cheap' in the future as we move to a renewable system creates a false expectation because it overlooks the fact that as the cost of generating electricity reduces (likely to levels similar to today's wholesale price), the costs of moving greater volumes of electricity will increase to finance extra network infrastructure. Policymakers instead should focus on the natural characteristic of a well-planned renewable system which can deliver affordable, clean, and secure electricity in contrast to cheap, polluting, and volatile power prices.³²

Examples of supporting research include:

- The economic analysis underpinning Ireland's *Future Framework for Offshore Renewable Energy*, which suggests an additional cost to households of €750–€1,100 per household per year to deliver the targeted 37 GW of offshore wind capacity and 12 GW of interconnection by 2050 (AFRY, 2023). Assuming there are 2 million households, that estimate suggests a cost of between €1.5bn and €2.2bn per year, after including savings in the wholesale cost of power, and on top of any costs of supporting capacity.

³¹ During the consultations for this research there were calls for a review of 'State-determined costs'.

³² Dr Paul Deane, Senior Lecturer in Clean Energy Futures at University College Cork. Comment used with permission. See https://www.linkedin.com/posts/thinkingenergy_household-electricity-prices-across-eu-member-activity-7264919164782272512-7c_q?utm_source=share&utm_medium=member_desktop [accessed 25/01/25].

- Analysis by EY and Eurelectric which suggests that €1.1bn will be required to be invested each year in the national grid out to 2050, which could see an increase in energy costs for firms and households (EY & Eurelectric, 2024; NCPC, 2024: 109).

If higher – as opposed to lower – energy costs emerge, there are implications for competitiveness policy and for the transition narrative. To prevent or minimise disillusionment, competitiveness policy will have to adjust to and seek to address a higher-than-expected ‘cost of doing business’ environment, and the transition narrative will need to place greater emphasis on those co-benefits for which there is greater evidence that they will be delivered.

Further, this could impact on the idea of generating renewable power beyond that needed to meet domestic demand, for export. Electricity produced in Ireland is not competitively priced at present and the issues above raise questions about whether an energy surplus in Ireland can or will be priced competitively (see Section 8.2 also).

The cost of *not* delivering the energy transition may not be known but it will be economically and socially unbearable (Aryanpur *et al.*, 2024). That does not mean that the policy system should not have a clear(er) understanding of the profile of costs over the transition, to inform policy in multiple areas, and to ensure that the supportive narrative is evidence-based and can be delivered on.³³

From the Council's research and consultations, it is unclear how additional and surplus capacity will be paid for, and by whom (e.g. will costs be borne by the State Exchequer, Irish electricity households and firms, and/or those to whom Ireland is exporting to?). The Irish electricity market is of relatively small scale, and the degree to which the costs (and risks) associated with a level of production that are multiples of our current generation could be borne by Irish consumers are limited.

The absence of a robust forecast for electricity prices over the period of the transition, the few estimates available, and the concerns above point to a number of specific issues for further consideration around costs.

4.3 Cost Issues for Consideration

Research finds that, overall, the long-term costs of transitioning to a climate-resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy by 2050 are expected to be relatively limited, as future savings in imports of fossil fuels will largely offset the long-term costs of making the change (McInerney and Fitzgerald, 2024).

Renewable power technologies are already more cost competitive than fossil-fuel alternatives and – coupled with electrification across sectors – can support competitiveness by widening the user and cost base. However, realising the gains of clean energy transitions hinges on ‘unlocking higher levels of upfront investment, [and] clean energy investments are lagging due to real or perceived risks that hinder new projects and access to finance’ (IEA, 2024a).

The Levelised Cost of Energy (LCOE) measures the average, net present cost at which a generator produces each unit of electricity over the asset's lifetime. In 2023, the global average LCOE from offshore wind decreased by 7 per cent, from onshore wind by 3 per cent, and from solar by 12 per cent; over 80 per cent of new electricity capacity from the wind sector is produced more cheaply than fossil-fuel alternatives (IRENA, 2024).³⁴

³³ EirGrid is currently leading a study using the ‘Offshore Opportunity’ scenario for the period out to 2050. The work involves modelling the scenario as well as 12 different sensitivities to understand the total costs of the base case (37 GW offshore wind) to the consumer. The study is expected to draw conclusions and make recommendations for a net-zero market design for the island of Ireland. The final report is currently at the review stage.

³⁴ See DECC's *Economic Bulletin*, Q3 2024. A 2020 analysis for DECC compared the LCOE among different renewable energy technologies for both domestic households and small businesses, farms, etc, to compare the cost-effectiveness of different energy generation technologies.

While LCOE is a critical measure of the costs of generating power, it does not account for many other costs, such as the cost of delivering power to consumers or the cost of ensuring the reliability of intermittent renewable sources (Berlin & Willey, 2023).

LCOE has limitations, as all metrics do. It does not account for the many co-benefits of renewable power, which are central to this research. However, it also excludes energy storage or backup costs, and distribution and transmission costs. As not all electricity is generated the same way, renewable capacity with a low LCOE could incur high transmission costs, depending on its location.

Figure 4.3: Cost and Value Components of Electricity³⁵

LCOE-considered costs	Additional generation costs excluded	Integration costs	Miscellaneous costs	LACE-considered value	Additional generation value
Capital costs	Cost of financing	Interconnection	Regulatory compliance	Capacity/reliability services	Improved health outcomes
Operations and Maintenance	Project delays (political, regulatory, physical)	Transmission and distribution	Legal fees from arbitration or litigation	Non-curtailed electricity sales	Improved environmental outcomes
Fuel costs	Cost of materials/supply chain	Permitting	Greenhouse gas emissions		Government incentives
	Research and development		Operator administrative fees		Progress toward policy goals
	Taxes				

Source: Berlin & Willey, 2023: 9.

While the LCOE metric demonstrates, with some limitations, that renewable power is competitive with fossil-fuel generation on a global scale, it does not analyse the system costs which will be significant and ‘must be understood when planning additions to the energy system’ (Berlin and Willey, 2023: 13). ‘Profitability metrics address some of the limitations of LCOE and lead to a more robust system cost analysis. These more comprehensive measurements emphasise the need to consider all costs beyond generation when transforming the energy mix to address climate change’ (*ibid*).

More generally, assessments of relative costs over time are complicated for policymakers by the variety of metrics and assumptions employed. Future policy considerations and action in Ireland would benefit from the (formal) adoption of some accepted, standardised, comparison metrics and data.

The cost of the energy transition will be considerable, though the cost of *inaction* is vastly higher. Estimating the cost of the transition, and the distribution of those costs, is not straightforward (Casey & Carroll, 2023). Nevertheless, there have been some estimation exercises, for example:

- Estimates of the cost of the transition to 2030 in Ireland have ranged from €60bn to €200bn (IAE, 2021).

³⁵ LACE is the Levelised Avoided Cost of Electricity, a measure of the potential revenues that a generator can acquire over the lifetime of the project.

- The Climate Action Plan includes an estimate of between €119 and €125bn for capital investment needed from 2023 to deliver emissions ceilings and the ambitious transition pathway (Government of Ireland, 2024a: 67).³⁶
- The spending required to deliver the transition-related aspects of the National Development Plan and the Climate Action Plan has been estimated at €129bn (Davy, 2024).
- The total projected costs of expanding offshore wind to the targeted 37 GW capacity is reported to be €131bn, 'which is similar to the State's entire capital budget for nine years' (Gataveckaite, 2024).
- The climate transition may see the Government face annual costs of between €1.6 and €3bn over the years 2026 to 2030, and between €1.1 and €1.9bn over the longer term from 2031 to 2050 (Casey & Carroll, 2023: 4).

As noted in Chapter 2, the 37 GW export scenario has gained prominence in assessments, policy and communications. Whether it's framed as 'costs' or 'investments', the Council believes that further clarity on the total amount and its distribution would be welcome, particularly in relation to the capacity being planned for beyond that needed to achieve domestic net zero.

The policy system would benefit from a clearer picture of costs and investment requirements, and sector profitability. The knowledge gap seems too pronounced at present to conclude with the necessary certainty or confidence that exporting energy from Ireland will be viable, or to state what the costs are, and hence to conclude whether it makes sense or otherwise.

It is accepted that to establish a new offshore renewable market, the State will 'need to provide a higher level of revenue support, to cover a cost premium for the first projects, as the industry gets to understand and manage local risks and supply options' (SEAI, 2024c: 102).

However, the Council's research highlights the absence of a widely accepted estimate of precise renewable capacity required to achieve domestic net zero, the rationale for generating renewable power beyond that, and the demand for any surplus (see Chapters 2 and 7). If the massive surplus power estimated in Section 2.3 materialised, it could cost households and firms around €4.2bn annually from 2040, for 15-20 years. This is despite uncertainty about the future profile of reliability of supply, about the impact on electricity costs and competitiveness, and about how numerous barriers to progress will be addressed. Maximising offtake is critical to limiting the impact on bill payers.

This is a particularly important consideration where new capacity is being supported via a State auction, which can see all energy *produced* (not just that which is *consumed*) being paid for by households and enterprises. For example, it has been estimated that, from January to September 2024, 14 per cent of wind energy production was lost because of challenges with the transmission grid (WEI, 2024d). The estimated retail value of unused renewable wind energy over the past seven years is in excess of €1.8bn (Energy Cloud, 2024). There is additional uncertainty as the compensation arrangements for renewable electricity producers who must alter generation due to grid constraints ('redispatching') are currently being considered by the courts.

If the makeup of electricity bills shifts from being primarily shaped by variable costs to the majority being fixed costs (e.g. the Public Service Obligation levy and standing charge portions), the impact will be regressive, disproportionately affecting poorer households. This makes clarity on the pass-through costs/user charge model particularly important, given that these costs may form an increasing share of users' bills.

³⁶ Further work is needed to estimate/capture the macroeconomic, fiscal and expenditure impacts, including the investment costs of measures published in the Climate Action Plan. The Department of Finance and DPENDR are working with the ESRI and their I3E model to produce robust estimates of the macroeconomic impacts of the transition.

Overall, whether the investments or costs associated with the energy transition total €60bn, €131bn or €200bn, it may result in higher energy costs for households and enterprises, with negative consequences for firm-level and national cost competitiveness.

This is an EU-wide issue, and the EU and individual member states are currently considering how to mobilise the vast public and private investment needed (including savings),³⁷ as called for in the Draghi and Letta reports (European Commission, 2024d; Letta, 2024). The recent *Budapest Declaration*, agreed and issued by the EU Council, affirms this point:

[To pursue] the dual objective of strategic energy sovereignty and climate neutrality by 2050... we will build a genuine Energy Union characterised by a fully integrated and interconnected energy market as a matter of priority, through the decarbonisation of our energy mix and the supply of affordable and clean energy to all our citizens and businesses. Urgent measures will be taken to address the situation resulting from high and volatile electricity prices in Europe and their causes...

The competitiveness challenges we face will require significant investment, mobilising both public and private financing. We are committed to exploring and leveraging all instruments and tools to match our goals: the Multiannual Financial Framework as an essential means to deliver on our strategic priorities; the Capital Markets Union, to mobilise private financing; and the increased involvement of the European Investment Bank. We will explore the development of new instruments. We will continue to work towards the introduction of new own resources. (European Council, 2024).

Following this declaration, the new EU Commission published details of the new economic governance framework, reforms and priority investments (European Commission, 2024a). It recognises that reforms and investments are vital to securing the energy transition and strengthening economic resilience.

Given the scale of investment required for a successful energy transition, Ireland must be at the heart of EU-level policy discussion and actions, including consideration of EU-level funding mechanisms to facilitate trade in energy and investment in infrastructure, as progress here contributes to addressing common priorities of the Union.

4.4 International Example of Assessment

The previous two sections illustrated how the Irish policy system would benefit from more clarity around transition costs, investment and sector profitability. This section looks for instructive international experience. NESC engaged with the Net Zero Economy and Climate Change Division within the Scottish government to understand their approach to generating evidence to inform transition policy there.

The energy transition and decarbonisation of the power sector are crucial, but, as described above, the costs cannot be met by the state alone. This point is true for Ireland and was the starting point for instructive analysis of the transition in Scotland.

A recent report developed an approach for assessing the investment readiness of Scotland's net-zero sectors, and to test this approach in relation to onshore wind, offshore wind and hydrogen as a proof of concept. The research also pointed to key interdependencies, barriers and opportunities for urgent action by the Scottish government or its partners (Hollister *et al.*, 2024).

³⁷ It is estimated that there are €33 trillion in private savings in the EU, predominantly held in currency and deposits. The Letta report states that this wealth is not being fully leveraged to meet the EU's strategic needs, including the energy transition (Letta, 2024: 11).

The concept of *investment readiness* is important in an Irish context given the lack of clarity around the levels of upfront investment required, the associated costs, and their distribution (public vs. private vs. consumer), along with concerns about risks that hinder projects and access to finance (see Chapter 6 also).

In the Scottish analysis, investment readiness is defined as a position where investors can understand the investment opportunity and develop projects with sound understanding of financial fundamentals and risks based on reasonable projections. It is a way of better understanding the minimum standard of attractiveness at which an investor would consider an opportunity, and how risky an investment is, which will affect the return that investors demand and, therefore, the cost of capital for the proposition.

The research in Scotland allowed for the development of a bespoke investment assessment framework, where sectors can be scored against the following criteria:

- Policy support
- Market growth potential
- Market accessibility
- Profitability
- Supporting infrastructure
- Demand
- Overall investment readiness

The findings of the research in Scotland are extensive. To give a sense of what might be learned from undertaking a similar exercise in Ireland in relation to economic resilience, the following points are of note (*ibid.* 2 & 3):

- Onshore and offshore wind sectors in Scotland scored highly in terms of level of **policy support**. There are well-established regulatory pathways supporting project development, and the industry enjoys broad political support across the major political parties in Scotland. Green hydrogen is generally well perceived in political discussions, but potential challenges with its adoption limits policy support. Domestic regulations and incentives are still being developed for green hydrogen.
- **Market growth potential** is strong for both onshore and offshore wind sectors over the forecasted horizon of 5 to 10 years in Scotland, backed by policy support. Based on the evidence collected and presented in their report, the researchers anticipate growth for hydrogen. However, this growth is expected to be modest compared to the wind sectors due to uncertainties surrounding factors such as end-use scenarios and availability of buyers, as well as the ongoing development of export plans.
- Onshore and offshore wind are mature technologies and are crucial for decarbonising the Scottish power sector, resulting in above-average scores for **market accessibility** – for selected technologies only – reflecting the ability of a company to enter a sector.
- There is a low industry **profitability** level for both wind sectors in the short and the long term in Scotland. Maturing global supply chains, increased competition levels and interest rates all reduce future profitability. There is below-average ability to control costs due to reliance on imports of key components. This presents an opportunity to decrease exposure to global supply chains, and mitigate potential profitability erosion risks from proposed changes to network charges, such as those discussed as part of the electricity market reform processes.
- **Supporting infrastructure** scored poorly relative to each sector's overall scores. This presents an opportunity in Scotland to improve investment readiness as sectors continue growing. Existing electricity grids require upgrades to compensate for increasing wind capacity. Grid reinforcements progress has been slow despite plans in place, according to stakeholder interviews, leading to delays

in connecting wind projects. Additionally, stakeholders noted that planning applications for wind developments are tedious and may delay progress. For hydrogen, where supply chains are developing, stakeholders highlighted potential funding gaps for skills and development.

- Stakeholders in Scotland noted that, while the ambition to increase supply of wind is a good indicator of a supportive investment climate, investors would need to consider the offtake of that renewable power. At present, there are well-publicised network constraints on transmitting Scottish wind power to England, where **demand** is greater. This has led to times when that power is curtailed/turned down and may act as a concern for future investment in wind power. Stakeholder discussions pointed to the importance of ensuring that there is offtake for that power; either through transmission to England, export to third countries, or greater demand from Scottish industry, such as hydrogen electrolysis.
- The hydrogen sector in Scotland scores lower with regard to **overall investment readiness** compared to the wind sectors, since it is still developing. This is reflected in domestic regulation and incentives which are still in progress. Developing supply chains are vulnerable to external shocks and demand uncertainty. These challenges offer a chance for Scottish policymakers to make informed decisions on hydrogen market design, ensuring maximum benefits from the evolving market.

There are limitations to this approach – as with any such exercise – and the researchers in Scotland warn against taking scores as absolutes in terms of whether a sector is investment-ready or not.

They also recommend additional analysis if scores are to be used as part of any filtering or ranking process. Nevertheless, the approach does allow a high-level assessment of relative strengths and weaknesses of sectors and a deeper dive into the issues driving the score.

Overall, this is an example of evidence-gathering for policymakers which can provide signals that serve as a basis of discussion as to how the conditions for transition can be improved. It demonstrates that a reasonably robust diagnosis of the environment for investment is possible, which in turns informs policy discussions of the associated costs and their distribution.

The researchers in Scotland believe that, in general, taking action to improve the sectoral scores should lead to improved levels of ‘investability’ and a lower cost of capital.

This international example provides a guide to Ireland about how to periodically ‘test’ to see if policy action is having the desired (or any) impact. The priority areas for policy action recommended by the Council are set out in Part 2.

4.5 Conclusion

Europe's current competitiveness challenge is closely linked to its energy costs being multiples of those in other regions, and, within the EU, Ireland's energy prices are the highest of all. This makes the transition co-benefit of lower energy costs one of the most important to economic resilience, especially as other elements of the State's investment offering come under increasing threat, and because many of the causes of Ireland's higher costs are difficult to address. A large majority of people believe that reaching our climate targets will ensure reduced energy bills.³⁸

However, NESC's analysis finds that there is a lack of evidence-based certainty about future energy prices in Ireland and, if anything, consumers might expect higher rather than lower energy costs as the transition progresses. This is despite the cost of renewable power production being competitive with that of fossil fuels over the long term (as measured by the LCOE).

The Climate Change Advisory Council has stated that, while achieving our objectives 'will involve significant upfront investment costs, delayed action will impose a greater financial burden on society in the longer term from continued fossil fuel dependence, with greater and more costly impacts expected with additional warming. This needs to be compared with the baseline level of investment that would have taken place...' (CCAC, 2024b: 16).

As stated in a recent review, 'achieving the desired level of sustainability and security in the supply of electricity may require accepting a higher level of cost for consumers than might otherwise be the case' (McCarthy, 2023: 67).

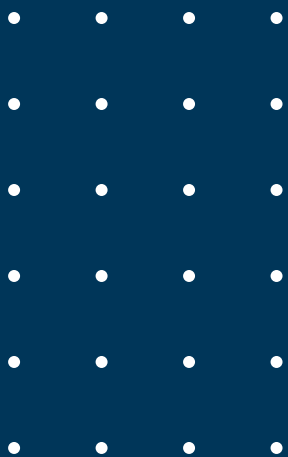
The cost of inaction will dwarf the cost and investment requirement of transition in Ireland's power sector. Whatever the total investments or costs associated with the energy transition are, they may result in higher rather than lower energy costs. This presents a challenge to national cost competitiveness, and the transition narrative.

The Council believes that, to ensure that national competitiveness policy is on a firm footing and that the transition narrative is sound and deliverable, further clarity on the total cost of the transition and its distribution is crucial, as is clarity on the profile of expected energy costs over the transition timeframe.

Policy for the energy transition would also benefit from a comprehensive assessment of the cost drivers for project developers and ways in which these costs could be reduced. These issues are particularly important where capacity beyond that needed to meet domestic net zero is being targeted. There are examples of research abroad which, if undertaken here, could go some way in delivering the necessary clarity, and could be used as a way of engaging stakeholders in discussions about the transition in the power sector.

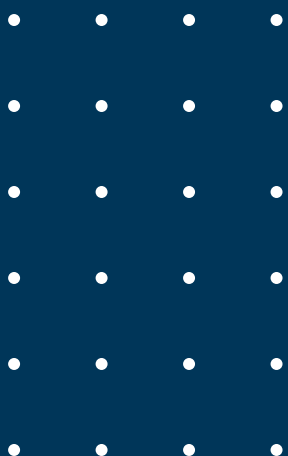
³⁸ A Eurobarometer survey from September 2024, which included Ireland, found that 69 per cent of European citizens believed that transition policies would ensure reduced energy bills for households and businesses (European Commission, 2024c).

PART TWO



**Actions To Be Taken
Now, Next and Later**

Chapter 5



**Transition in the Power
Sector:**
Actions to Reach Ireland's
Potential

5.1 Summary of Conclusions from Part 1

The Council's analysis in Part 1 demonstrates that there are challenges to the delivery of Ireland's ambitious targets for the power sector and the associated co-benefits for the economy, and to the transition narrative. Specifically:

There is currently a disparate and complex landscape of quantitative assessments of the impact of transition on economic resilience. A review of assessments reveals that, while individually valuable for policymaking, they create a complex and fragmented landscape for decision-makers, often offering non-intuitive co-benefit metrics. In contrast, Scotland's unified assessment across technologies with clear timelines and metrics is one example of a more effective approach. NESC's review emphasises the impact of scenario choices on assessments, highlighting the need for clarity as further assessments are undertaken, though there is a risk of adding more complexity to the policy landscape.

There is a lack of clarity or certainty on the profile of energy supply reliability across the transition timeline. While the reliability of power supply has improved since 2022, expected reliability may worsen over periods of the transition if not addressed. There is also no clear visibility of the power system's reliability beyond 2032, a period when the State plans to expand renewable capacity and phase out and reduce reliance on fossil fuels. There is no readily available profile to forecast the reliability of the power system as renewable energy capacity grows in line with Ireland's objectives.

There is a lack of clarity or certainty on the path of expected cost-competitiveness impacts across the transition timeline. The energy transition may result in higher, not lower, energy prices, challenging national competitiveness and the transition narrative. The Council highlights the need for clarity on the total cost of transition and the distribution of these costs. This is especially important when targeting energy capacity beyond domestic net-zero goals. International research and examples could provide insights to help clarify these issues for Ireland.

There is at present an incomplete model for competitive energy export from Ireland. Key questions about renewable capacity requirements, the rationale for surplus power generation and its optimal use remain unanswered. Further exploration is needed into how surplus energy could benefit domestic industry, particularly sectors requiring large energy supplies. Concerns exist about overcoming the challenges to meeting the State's goals in time and realising associated economic benefits. Discussions about surplus energy should consider societal and environmental needs and ensure a balanced approach to transition in the power sector.

Taken together, these findings highlight the risk that policy formulation, adoption and implementation will be suboptimal, and that the necessary supportive narrative for decarbonisation in the power sector will be undermined. It is hoped that some improvement will arise from measures recently approved by Government to speed up climate transition.³⁹

³⁹ In October 2024, the Government approved measures on streamlining and speeding up Ireland's delivery of renewable energy and key climate infrastructure, including a new Accelerating Renewable Electricity Taskforce Implementation Plan focused on speeding up delivery of Ireland's renewable electricity, and amendments to environmental and waste legislation to streamline the Environmental Protection Agency (EPA) licensing regime (DECC, 2024b).

Overall, the Council's extensive consultations and analysis suggest that, essentially, much of Ireland's policy action for transition in the power sector is headed 'into fog', where visibility and certainty are low. Key actors in the necessary transition are not 'on the same page' from a strategic standpoint.

The Council's conclusions must not lead to policy paralysis; rather they demand a systematic, evidence-based response. To make sure the transition happens and is successful, there is a strong imperative – supported by stakeholders in this policy area – for more targeted work. Rather than new policy, legislation or targets, that work should address the strategic issues identified in this report.

Therefore, the Council recommends actions to be taken now, next and later to reinforce Ireland's energy transition and economic resilience, and to help us reach our national decarbonisation potential.

5.2 Actions For Now, Next and Later

Notwithstanding the Council's findings, the energy transition is of paramount importance and must be delivered despite all the complexities involved.

Further, there is an increasing sense that 'the public doesn't buy the idea of a "green jobs" bonanza', and that 'people understand that transitions are hard [so] politicians need to as well' (O'Connor, 2024). The transition in the power sector should not be viewed just as a vehicle for job creation, but rather as a critical enabler for all economic activity within the country, which in turn supports individual and national well-being and the common good. Misinterpreting the purpose of the transition risks undermining public support for the energy transition and public acceptance of related infrastructure.

The Council recognises that target-setting is just the beginning, and that the focus must be on how to achieve necessary and desired outcomes in Ireland's energy transition.

The first step – which the Council has taken here – is to work hard to reveal, articulate and accept where and when things are not working. Research suggests that an excessive reliance on economic narratives can lead to an underestimation of the complex policy and technical hurdles that need to be cleared:

We suggest moving away from a 'Yes, we can!' mode of discussion in which the solution is to set a business model with the goal of achieving a certain set of normalised expectations. We also suggest moving away from a mode of discussion which assumes that 'no matter the problem' human ingenuity and the invisible hands of the market will be capable of solving it. Instead, it may be advantageous to start exploring a mode of discussion based on *Houston, we've had a problem* (Renner & Giampietro, 2020: 9).

A ‘now, next and later’ approach is optimal in situations where progress is essential despite significant uncertainty; where current, imminent and future action is called for, and where an ability to discover and deliver required shifts in approach is necessary while that progress is being made (Bastow, 2019, 2022; González De Villaumbrosia, 2024). NESC’s analysis finds these to be prominent characteristics of Ireland’s energy transition.

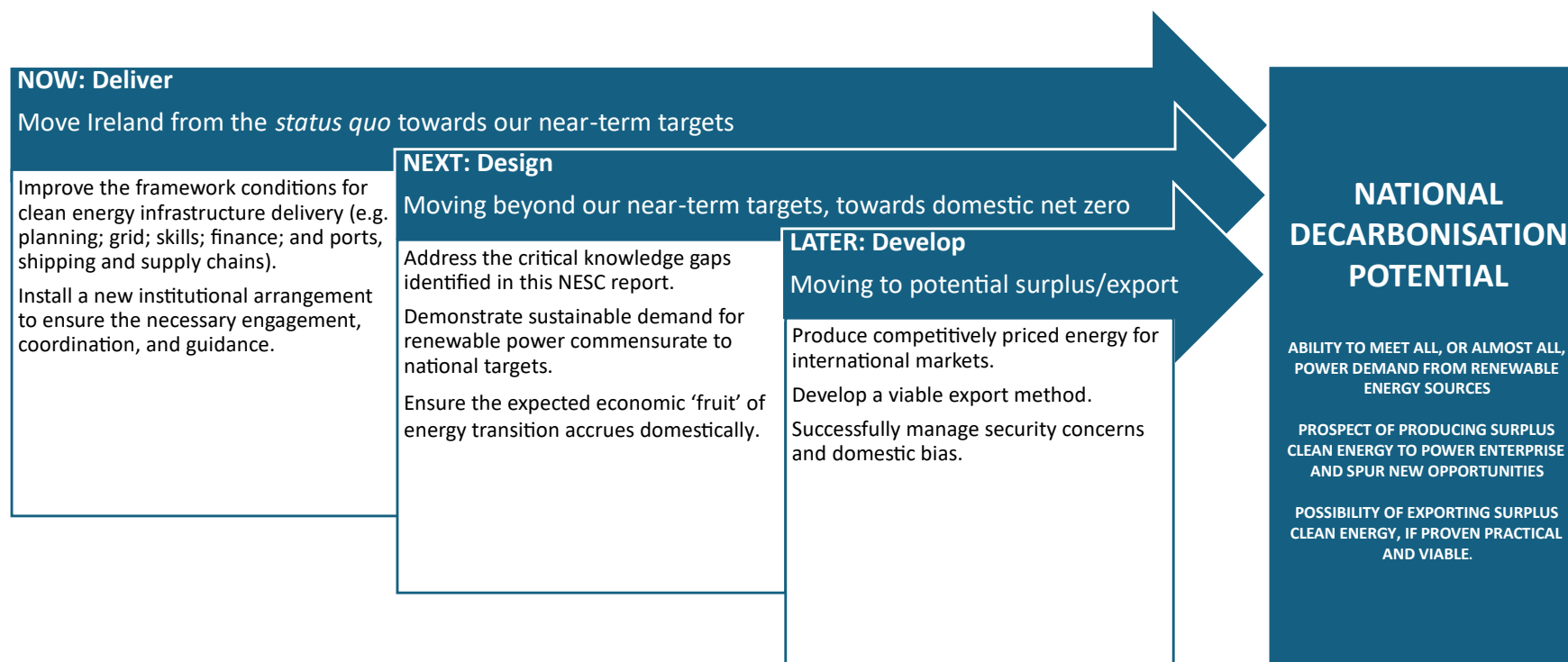
Therefore, in the chapters that follow, the Council presents eight recommended high-level **actions to be taken now, next and later**:

- **Now** – Actions to **deliver** progress in the near term where there is clarity: Moving Ireland from the status quo towards our near-term targets means acting now to improve the framework conditions for clean energy infrastructure delivery (e.g. planning and consents; grid; skills; finance; and ports, shipping and supply chains), and installing a new institutional arrangement to facilitate the necessary engagement, coordination and guidance (Chapter 6).
- **Next** – Actions to **design** the way forward in the medium term, though certainty is low: To move beyond our near-term targets and towards domestic net zero, the next set of actions must be to address the critical knowledge gaps identified by the Council in this report. Further, action is required to demonstrate sustainable demand for renewable power commensurate with national targets, and to ensure that the expected economic ‘fruit’ of energy transition accrues domestically (Chapter 7).
- **Later** – Actions to **develop** our understanding of the longer-term direction of travel when visibility is poor: There is the prospect of moving beyond domestic net zero to producing (and perhaps even exporting) surplus clean energy. If that proves to be practical and viable, action will be needed later to produce competitively priced energy for international markets, to develop a viable export method, and to successfully manage security concerns and domestic bias (Chapter 8).

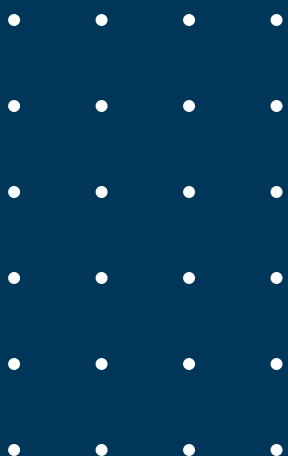
Despite the uncertainty surrounding the energy transition revealed by the Council, **we must not lose sight of Ireland’s significant decarbonisation potential**. This includes: the ability to meet all, or almost all, of our power demand from renewable energy sources (‘domestic net zero’); the prospect of producing surplus clean energy to power enterprise and spur new opportunities; and the possibility of exporting surplus clean energy, if proven practical and viable.

However, this potential will not be reached without a series of concerted actions, as set out below. To begin – to deliver progress in the near term where there is clarity – the actions to be taken now to move Ireland from the status quo towards our near-term targets are described in detail in the next chapter.

Figure 5.1: NESC's Recommended Actions to Reach Ireland's National Decarbonisation Potential



Chapter 6



**Transition in the Power
Sector:**
Actions to be Taken Now

6.1 Introduction

Ireland is currently set to miss its agreed carbon budget to 2030, and the delivery of the first staging post along the way to its overall ambition for renewable power – 5 GW of offshore wind generation by 2030 – is likely to be five years or more behind. There are immediate actions that require attention now. The Council believes that the first step to be urgently taken must be to move Ireland from the status quo towards our near-term targets. This involves acting now in two critical areas. First, is to improve the framework conditions for clean energy infrastructure delivery (e.g. planning and consents; grid; skills; finance; and ports, shipping and supply chains). Second, is to install a new institutional arrangement to facilitate the necessary engagement, coordination and guidance.

6.2 Improve the Framework Conditions

The enterprises relied upon to deliver Ireland's energy transition require the same supportive business environment as firms in general. The National Competitiveness and Productivity Council (NCPC) publishes an annual report on this business environment, guided by a framework of important elements, from macroeconomic stability to innovation (NCPC, 2024: 2).

The Council's analysis suggests that there are five specific factors – or framework conditions – *additional* to those listed by the NCPC that need to be acted on now to support the delivery of the State's ambition for the power sector. These are expanded upon below.

6.2.1 Framework Condition 1: Planning and Consents

Ireland's infrastructure stock is 25 per cent lower than average for a high-income European country, and electricity infrastructure is one of the four key areas with major infrastructure deficits (Conroy & Timoney, 2024).⁴⁰ All of the infrastructure required to deliver Ireland's ambitious targets for the energy transition (and to realise the export scenario) requires planning permission and associated consents.

Complex, slow and unpredictable planning processes have been identified as a key barrier to renewable energy deployment. Ireland's current planning and regulatory processes hinder investment and make the delivery of projects longer and more expensive. For onshore wind, Ireland has the longest permitting process in the EU, at nine years (European Commission, 2024d). No wind farm project was granted planning permission in 2023. According to Wind Energy Ireland (WEI), in the first six months of 2024, planning permission was granted for four wind farms (228 MW), whereas to achieve the 9 GW target for onshore wind energy by 2030, 860 MW would have been needed (WEI, 2024c). In quarter three of 2024, planning permission was granted to just one new onshore wind project.

Permission was granted in 2023 for capacity estimated to be approximately 13 per cent of the volume necessary to keep Ireland on track to meet Government targets. WEI data indicates that 30 projects totalling over 1.7 GW were awaiting decision at the end of Q2 2024, and that the average timeline for planning decisions is more than 90 weeks (WEI, 2024c). The current rate of permitting would, it is suggested, see Ireland achieve its 2030 wind energy targets at some point in 2044 (WEI, 2024b).

It should be recognised that the degree of complexity of consenting in the planning system relates in part to the scale, nature and location of the projects involved, including the fact that many require assessment for the purposes of EU environmental directives and have been subject to appeals or judicial review proceedings. These projects also often require a multiplicity of other consents outside of the planning process, and in particular, connection of these projects to the grid has been, until recently, restricted to a single application process every September (with a second application round now being introduced). Also, the *Planning and Development Act 2024* involves the introduction of mandatory consenting timelines for An Bord Pleanála (to become An Coimisiún Pleanála), in addition to the promotion of an enhanced plan-led approach to development.

⁴⁰ The other three areas are housing, health and transport.

Key actors in these areas – local authorities, An Bord Pleanála and the Maritime Area Regulatory Authority – must have the necessary expertise, resources and processes to address the challenges and seize the opportunities presented by the transition.

Reforming the planning and objection system could aid the delivery of clean-energy infrastructure. For example, the revised *National Planning Framework* presents an opportunity to provide a clear policy direction that will inform decision-making within the planning system, and thus greater certainty for stakeholders.

Ireland, as a signatory to the *Aarhus Convention*, has a highly participative planning system; the focus must be on providing a clear plan-led system that engages with all stakeholders from the outset, and streamlining and clarifying processes for engagement at all stages of the process as much as possible, noting also the need to comply with EU environmental directives.

Alongside greater resourcing of the planning system, one potential avenue for progress would be to reduce or remove any linear planning and consent decision processes and maximise the use of parallel processes. This approach can speed up delivery to such an extent that it has the potential to reduce wholesale electricity prices by 10 per cent and lower carbon emissions by 4 per cent (Longoria *et al.*, 2024).⁴¹

Overall, the Council believes it is important to examine *all* of the planning and regulatory steps required for clean-energy infrastructure delivery to ensure that policy initiatives address concerns. The planning system is just one element. The time and processes involved in grid connection, licence to generate, authorisation to construct, application for supports (e.g. the Renewable Electricity Support Scheme – RESS), and foreshore licensing and leasing are also worthy of attention to deliver efficiencies.

6.2.2 Framework Condition 2: Grid Infrastructure, Connection and SNSP Limits

The power transmission system plays a central role in the transition by enabling the integration of renewable power sources, while ensuring security and reliability of supply. The phrase ‘transition *is* transmission’ is commonly used. There is widespread acceptance that Ireland’s transmission grid has not been adequately strengthened and extended so as to be capable of meeting known requirements and future ambitions.

The requirement for significant investment in our electricity grid features in Ireland’s *National Risk Assessment* (Government of Ireland, 2024c: 31). Ireland has been identified as one of the European countries where plans for the development of the transmission grid are ‘slightly falling behind’. Research finds that our grid plan is 10–50 per cent behind where it needs to be for 2030 national targets (Aggreko, 2024). Existing renewable energy generation cannot all be used by the electricity system, due to limitations and constraints, or energy supply exceeding consumer demand. At the moment, up to 75 per cent of Ireland’s electricity generation can come from wind and solar at any one time – this is the System Non-Synchronous Penetration (SNSP) limit.

It has been estimated that the retail value of unused renewable wind energy since 2017 is over €1.8bn (Energy Cloud, 2024). Wind Energy Ireland estimates that over the first nine months of 2024, 14 per cent of wind energy production was lost because of challenges with the transmission grid (WEI, 2024d).

By 2030, a higher SNSP limit of 80 per cent is necessary under Government targets. Over the coming decade the grid must simultaneously carry much more power, cope with variable sources in remote locations, combine complex forms of generation (where renewable electricity is generated at a different frequency to the rest of the power on the grid), deliver interconnection, and manage a decade of grid upgrades (EirGrid & SONI, 2023a).

⁴¹ A Ministerial *Action Plan on Planning Resources* has been recently published to help ensure that sufficient resources and expertise are available (DHLGH, 2024).

Reflecting this, for 2025 over €1.4bn has been allocated for transmission investments associated with maintaining security of supply, investing in offshore, interconnection with Europe, and facilitating more renewables on the system (CRU, 2024a). This is up 38 per cent on 2024. In the most recent Budget, the Government also announced that the sale of the State's Allied Irish Bank (AIB) shares will provide for an initial direct equity injection of €750m to develop our electricity infrastructure and, in particular, to support offshore grid development. This is to expand grid capacity and send a positive signal for future investment decisions.

Overall, substantial grid investment and process improvements are necessary to facilitate renewable energy objectives, and any export opportunity. It is important that the distribution of planned grid improvements be aligned spatially with proposed development and growth areas, to ensure that a co-ordinated, plan-led approach to grid and development can be delivered.

6.2.3 Framework Condition 3: Labour and Skills Availability

If any country is to achieve its ambitious targets for the transition, climate policies will need to be accompanied by strong investments in skills policies (Borogoni *et al.*, 2023).

In 2021, the Expert Group on Future Skills Needs (EGFSN) published a report to support the delivery by 2030 of some of the key enabling actions in the Climate Action Plan, including the ambitions to boost onshore and offshore wind energy generation, and an increase in solar energy generation (EGFSN, 2021) – see Box 6.1.

In its analysis, the Irish Fiscal Advisory Council suggests that some 25,000 additional workers in construction alone are required to deliver the 'green transition', adding that they must be sourced in parallel to the sourcing of the 53,500 other construction workers needed for the delivery of necessary housing and transport projects (Conroy & Timoney, 2024).

Based on near-term projections, these workers must be found at a time of high or full employment. The seasonally adjusted unemployment rate is currently 4.3 per cent while the projected unemployment rates for 2025 and 2026 are 4.3 per cent and 4.4 per cent respectively (ESRI, 2024).

The view from the construction industry is that the required labour and skills will be available and, as has happened in the past, the sector would respond positively to greater certainty about the pipeline of viable projects broken down into multiyear blocks, as opposed to 10-year targets.

Box 6.1: Skills Needs for Transition in the Power Sector

The Expert Group on Future Skills Needs (EGFSN) found that 'achieving the allocation of skills required to attain the renewable energy targets is not without its challenges'. For example, in relation to the professional engineering occupations associated with renewable energy, they noted a shortage of skilled people with relevant experience, rather than necessarily a shortfall in the overall number of engineers entering the profession – although there may be shortfalls within some specific disciplines. This points to upskilling requirements in emerging and niche engineering occupations.

It also reported an overall shortage in construction occupations which may constrain activity in the renewable energy sector, while additional training to prepare for working in an offshore environment will be required.

The group made nine recommendations in relation to the energy sector especially, including for more coordinated planning for training and upskilling within the renewable energy sector.

6.2.4 Framework Condition 4: Financing, Routes to Market and Ability to Recover Cost

Ireland has been ranked as the fifth most attractive country in which to invest in renewable energy projects (EY, 2024).⁴² Those developers seeking to build, operate and maintain the renewable power infrastructure required to deliver our national targets must secure significant private finance. They will compete for finance and must have attractive routes to market for their power output, and a predictable ability to recover costs. The two primary routes to market are government-backed renewable electricity support schemes – the Renewable Electricity Support Scheme (RESS) or ORESS for offshore schemes – and corporate power purchase agreements (CPPAs).

Support under RESS is allocated by way of auctions. As illustrated in Table 6.1, Ireland has completed five RESS auctions, with two more underway or planned.⁴³ RESS auctions have been responsible for the successful delivery of the over 5 GW of renewable power on the system in Ireland today, so they can work.

In such auction systems there is an unavoidable tension or trade-off between (i) the developers' reasonable objective of securing a price for the energy provided that is *high enough* to ensure project viability and profitability, and (ii) the State's equally reasonable objective of setting a price for the energy provided that is *low enough* to ensure affordability for the consumer and protect overall national competitiveness.⁴⁴

For many years, the **cost** of renewables – and especially the levelised cost of energy (LCOE) – has been at the heart of policy debates (see Section 4.3 also). However, the **price** of renewable power has become an increasing concern (Christophers, 2024). Lower auction price caps serve the State but reduce the profitability and viability of projects under RESS contract, and lead to low-volume auctions which in turn hinder the achievement of targets for renewable power. Lower auction price caps harm the developers' and finance-providers' predictable ability to recover costs.

Although systems vary in a number of ways, there have been disappointing high-profile renewable power auctions in the EU, UK and US. An auction held in the UK in 2023 received no bids for new offshore wind farms; developers said the auction price cap was too low to make projects viable (Race, 2023; Williams, 2023). How inflation and indexation are managed appears to be a key concern there, alongside the price cap, contract duration and grid connection.

In the Netherlands, a four-site 4 GW offshore wind project auction was recently scaled back to a three-site 3 GW auction 'to reduce the financial risks for offshore wind farm developers' (Buljan, 2024).

⁴² The ranking is out of 40 economies, based on a GDP-normalised basis. Network gridlock and high capital costs are cited as consistent challenges. CPPAs continue to expand, with Ireland climbing one place to rank 16th in the CPPA Index. Battery energy storage systems are identified as critical to balance renewable energy development.

⁴³ It has been reported that auctions for an additional 14 GW of offshore wind are to be held by the end of this decade, which would be more than four times the volume contracted to date. See *The Business Post*, 23 November 2024 (Murray, 2024), referencing a tender planning document from the North Seas Energy Cooperation group (NSEC & European Commission, 2024).

⁴⁴ Speaking about the ORESS auction in 2023, then Minister for the Environment, Climate, Communications and Transport Eamon Ryan said: 'The competitive price secured — at an average of €86.05/MWh — is one of the lowest prices paid by an emerging offshore wind market in the world. This price will save Irish consumers hundreds of millions of euros a year in energy bills' (Corcoran, 2024).

Table 6.1: Summary of Ireland's Renewable Power Auctions

Auction	Date	Capacity Sought	Number of Bidders	Capacity Bid	Number of Winners	Average Price	Capacity Awarded	Capacity Not Procured	Projects Energised	Capacity Delivered to Date
RESS 1	September 2020	N/A	108 projects	1.56 GW	82 projects	All: €74.08/MWh Community: €104.15/MWh Solar: 72.92/MWh	Total: 1.28 GW Solar: 0.80 GW Onshore: 0.48 GW	Total: 0.28 GW Solar: 0.26 GW Onshore: 0.02 GW	34 of the 82 projects successful in the auction have energised (Not all projects successful in the auction took up the offer of support)	Total: 0.72 GW Solar: 0.28 GW Onshore: 0.48 GW
RESS 2	June 2022	N/A	130 projects	2.95 GW	80 projects	All: €97.87/MWh Community: 116.41/MWh	Total: 1.95 GW Solar: 1.53 GW Onshore: 0.41 GW	Total: 1 GW Solar: 0.97 GW Onshore: 0.03 GW	Not possible to project at present	Too early to state
RESS 3	October 2023	N/A	31 projects	0.89 GW	23 projects	All: €100.47/MWh	Total: 0.65 GW Solar: 0.50 GW Onshore: 0.15 GW	Total: 0.24 GW Solar: 0.22 GW Onshore: 0.02 GW	Not possible to project at present	Too early to state

Auction	Date	Capacity Sought	Number of Bidders	Capacity Bid	Number of Winners	Average Price	Capacity Awarded	Capacity Not Procured	Projects Energised	Capacity Delivered to Date
RESS 4	September 2024	N/A	43 projects	1.84 GW	27 projects	All: €96.85/MWh Solar: €104.76/MWh Wind: €90.47/MWh	Total: 1.33 GW Solar: 0.96 GW Onshore: 0.37 GW	Total: 0.51 GW Solar: 0.50 GW Onshore: 0.09 GW	Not possible to project at present	Too early to state
ORESS 1	June 2023	N/A	6 projects	4.2 GW	4 projects ⁴⁵	€86.05/MWh	3 GW	1.2 GW		N/A
ORESS <i>Tonn Nua</i>	2025	0.9 GW	N/A	N/A	N/A	N/A	N/A	N/A		N/A
ORESS <i>Lí Ban</i>	2026	1.1–1.5 GW								

Source: NESC Secretariat/DECC. It is not possible to state the number of projects that will energise ahead of the relevant Commercial Operation or Longstop date for every iteration of RESS. It is too early to state 'capacity delivered' for RESS 2-4. RESS 2 projects have up to end of 2026 to deliver, while RESS 3 and 4 are beyond that date.

⁴⁵ North Irish Sea Array (0.5 GW), Dublin Array (0.8 GW), Codling Wind Park (1.3 GW) and Sceirde Rocks (0.45 GW).

In the US too, auctions have failed to deliver the expected additional capacity. Developers there note that, while local opposition to renewable projects often makes the headlines, the projects come down to economics, with higher costs and lower prices working against offshore wind deployment. This has led to some developers even seeking better terms from governments with which they have already agreed contracts (Loneragan, 2024).

As shown in Table 6.1, the RESS 3 auction held in Ireland resulted in just 0.89 GW of renewable power being bid, a result that developers described as 'extremely disappointing' (WEI, 2023).

The price cap of €93.50 per MWh set for wind energy in the RESS 4 auction was criticised by developers, as no wind energy project could compete in the auction unless they were prepared to bid under the cap, and it is claimed that 'some projects immediately withdrew from the RESS process once the cap was announced, which reduced the volume of renewable energy available in the auction' (WEI, 2024a: 4).

According to the industry, the capacity procured in RESS 4 versus the procurement target 'adds to previous disappointment from auctions that went before it' and 'puts the Government's ambitious 2030 climate targets further out of reach', and: 'The reduction of the auction price cap for onshore wind results in few projects proving profitable under a RESS contract. As a result, this could prove an expensive, yet low volume auction' (Caden, 2024).

Finally, the level of capacity bid but not procured (e.g. the 0.5 GW of solar in RESS 4) raises questions as to what the primary objective should be – for example, maximising the amount of renewable capacity on the power system versus maximising affordability.

Box 6.2: Corporate Power Purchase Agreements

Corporate Power Purchase Agreements (CPPAs) are part of the energy market, providing demand for renewable power provision. CPPAs 'have a role to play in decarbonising the electricity sector. A CPPA is an arrangement whereby a company procures renewable electricity through a direct contractual agreement with a renewable electricity generator' (Government of Ireland, 2022a: 2).

CPPAs provide an alternative or additional route to market for developers of renewable power projects, alongside state support scheme auctions. As discussed, the price cap set in state auctions may not be attractive to some energy providers; rather than their renewable capacity not being developed, an agreement with a corporate purchaser can provide a viable route to market. At the same time, the purchasing firm gains access to clean, secure, reliable and relatively cost-effective renewable power. In parallel, the State can benefit from the addition of non-subsidised renewable energy that contributes to reaching national targets. Further, CPPAs can aid the development of, and test, the adequacy of the provision of inputs and services necessary for clean infrastructure delivery in Ireland generally.

The role of CPPAs in supporting the cost-effective delivery of renewable electricity targets was recognised in *Climate Action Plan 2019* which set a target of 15 per cent of electricity demand to be delivered by renewable energy CPPAs (Government of Ireland, 2019).

In 2022, following a public consultation and the preparation of a detailed consultancy report, the Government published the *Renewable Electricity Corporate Power Purchase Agreements Roadmap* (Government of Ireland, 2022a). This detailed preparatory work led

to an action plan to develop the market for CPPAs, including actions to align CPPAs with the lowest total costs for all electricity consumers, and with the development of the electricity network.⁴⁶

CPPAs are a feature of Ireland's energy market and in recent years a variety of companies have engaged with them, including large data companies (e.g. Meta, Amazon Web Services, Microsoft, and Google), manufacturing firms (e.g. Medtronic), and locally traded services (e.g. The Merrion Hotel), though CPPAs have become synonymous with data-centre development. Recent research finds that electricity demand from data centres far outstripped the additional renewable energy being procured through CPPAs between 2020 and 2023, and the proportion of CPPAs undertaken by data centres is itself unknown (Daly, 2024).

The feedback that the Council received during this research was that firms very much recognise the benefit of CPPAs and that companies are actively looking for opportunities. Companies report that the availability of CPPAs is considerably less than demanded, with data and life sciences operations in particular seeking CPPA opportunities.

Despite the popularity of CPPAs – and the benefits they can provide to developers, firms and the State – power system constraints have led to the introduction of new criteria for the connection of data centres. Also, for reasons that are unclear, the pursuance of the target set out in CAP 2019 seems to have fallen down the policy agenda, and the 2022 Roadmap is not being pursued.

Further, during the consultation phase of this research, the attractiveness of CPPAs in Ireland in a European context was queried given that the wholesale electricity price makes up a relatively low proportion of energy bills here (versus fixed network costs, imperfection charges, capacity charges, and the Public Service Obligation). While the wholesale price of electricity is the main driver of the final price of electricity, 'there are other costs which when combined can make up to 50 per cent of the bill for some users' (Ibec, 2024: 6). Ireland's policy should allow CPPAs and support schemes to co-exist. There is a risk that CPPAs reduce competition in auctions, while they must not simply be a means to avoid fixed costs, as that can increase the burden on those who do not or cannot engage in CPPAs.

Overall, there appears to be a trade-off to be resolved in climate, energy, enterprise and regulatory policy between the needs of the State (in terms of reaching decarbonisation targets in a sustainable manner), developers of renewable energy projects (in terms of viable routes to market) and enterprises (in terms of access to clean, secure, reliable and relatively cost-effective renewable electricity).

This is an issue which has arisen in economies across the world, including in the so-called 'data centre capital of the world' in Virginia, USA, where policymakers are working to manage 'three accelerating, co-dependent, conflicting trends': the rapidly increasing demand for data; the rapidly increasing demand for power to process that data; and the rapidly increasing infrastructure and societal acceptance constraints (Turner, 2024). (See also Section 7.3.)

⁴⁶ NESCC understands that in the interim the focus has shifted to shaping the policy environment for CPPAs through Action 13 of the *Future Framework Policy Statement for Offshore Renewable Energy* (Government of Ireland, 2024b). A project is underway to assess any supports and policy framework that may be required to maximise capacity from alternative routes to market (CPPAs). Desk studies and bilateral engagements are underway and a public consultation will be held. The project is due for completion by December 2025.

Overall, Ireland like many countries has placed responsibility for the deployment of the renewable energy infrastructure necessary to meet national targets on the private sector (developers and financiers), with wind energy and offshore in particular expected to deliver to the greatest extent.

The complex and unpredictable nature of the electricity markets can make RESS auctions (and CPPAs) a relatively attractive route to market for developers, but there is a danger that, because of the understandable desire of states to ensure that auctions deliver affordability for consumers and protect national competitiveness, for developers 'the price is wrong' (Christophers, 2024).

The problem is compounded by the other source of predictable prices, CPPAs, running into challenges (see Box 6.2). One of the potential remedies to the problem of poor project viability is electricity market reform (*ibid*).

Box 6.3: Electricity Market Reform⁴⁷

Over the past three decades, electricity markets have transitioned from a centralised and integrated system consisting largely of stable fossil-fuel-based generation, to unbundled, competitive markets with increasing shares of intermittent renewable generation. This shift will continue over the coming years, as national climate policies drive the decarbonisation of power systems. While the Single Electricity Market (SEM) is the wholesale electricity market for the island of Ireland, it uses market design features which are based on the EU Target Model and is part of an internal and integrated EU wholesale market. The SEM was redesigned in 2018 to harmonise the all-island and European wholesale electricity markets, facilitating the flow of energy across borders.

Following the invasion of Ukraine in 2022, the need for urgent reform of the wholesale electricity market gained increased prominence on the European and national political agenda. The price of electricity on the wholesale market is about 55–60 per cent of the cost of electricity for most consumers in Ireland, and that wholesale price is sensitive to the price of gas (Ireland Energy 2050, undated). Approximately 50 per cent of the electricity indigenously produced in Ireland comes from gas-fired generators; gas prices rose sharply after the Covid-19 pandemic, and climbed even further with the war in Ukraine.

The wholesale price of gas, which has been around €0.02/kWh over the past two decades, rose to over ten times this price in 2022, at €0.25/kWh. As a result, annual household bills effectively doubled from around €2,000 in 2021 to around €4,000 in 2022 (Foley *et al.*, 2024). The price of gas effectively sets the price of electricity because of the current design of the European wholesale electricity market, a system of marginal pricing where the price set is the price of the last producer from which electricity is bought (European Commission, 2024b). The last producer is likely to be a gas producer.

The decision of the Russian government to reduce the flow of gas into Europe and its consequences for electricity prices across the EU, including Ireland, revealed a weakness in the way the market is currently designed. The existing market design also poses a challenge for renewable energy generators in terms of providing sufficient revenues. For example, to ensure system adequacy, the market must procure sufficient capacity to cover expected peak demand (plus a margin). Renewable generators have limited ability to participate in the capacity market, as their availability is determined by the weather so they cannot guarantee generation at any hour of the year. Conventional generators, which are

⁴⁷ This section is informed in part by a forthcoming paper by Wade et al. commissioned by SEAI in consultation with NESC.

targeted to provide 20 per cent of energy or less by 2030, must provide 100 per cent of the capacity procured. Thus, the design of the capacity market is such that participation from variable renewable generators is negligible and likely to remain so, and capacity market payments are revenue that developers of renewable electricity are unlikely to be able to avail of. A further concern is that capacity markets result in increasing investment in gas generation, which is incompatible with necessary decarbonisation and fossil-fuel phase-out.

Renewable energy supports should not be considered independently of broader market design issues. Under the current market design, developers of renewable electricity are likely to depend on the state support schemes. As discussed above, the affordability and competitiveness concerns of the Government place downward pressure on revenues from state support auctions.

Overall, market redesign is necessary to avoid long-run subsidisation of the renewable power sector. As the SEM's market design is based on the EU, changes to the market arrangements on the island of Ireland will require co-operation at an EU level. A review of electricity markets is being conducted by the EU Commission before the end of 2026. In addition, the Electricity Market sections of the Trading and Cooperation Agreement between the UK and EU are up for review around the same time. As these reviews begin, Ireland would benefit from early engagement and a highly collaborative approach with like-minded and 'high-renewables' electricity markets.

It is worth noting that the power system operators state that 'while it has to be acknowledged that the EU needs to develop both a comprehensive and common approach to [market reform], the experience on the island of Ireland is that a flexible jurisdictional (local) approach is most effective, i.e. a one size fits all approach may not be the most efficient outcome' (EirGrid & SONI, 2023a: 155).

6.2.5 Framework Condition 5: Ports, Shipping, and Supply Chain Capacity

The wind and solar sectors, which are central to the energy transition, involve complex global supply chains, unique industrial processes, and critical minerals and infrastructure requirements. High demand in these sectors has led to the emergence of supply-chain bottlenecks (Hallinan, forthcoming). Ireland's supply chain for renewables is limited at present and it is recognised that it will not meet all of the needs of the renewable power sector. This means that the European and UK supply chain must play a strong role in helping to meet Ireland's needs (Carbon Trust & WEI, 2020; SEAI, 2024c).

In 2023, over 18 GW of new wind-power generation capacity was installed in Europe (Wind Europe, 2024), demonstrating supply-chain capacity across the continent. However, the European energy supply chain, of which Ireland is a relatively small element, is coming under increasing pressure from challenges in accessing raw materials and competition from international manufacturers.

Wind Europe has highlighted the three-to four-year waiting time for offshore wind foundations, and the shortage of cable and installation vessels. Increased competition for shipping vessels is expected, as new markets in Asia and North America open to offshore wind (Wind Europe, 2024). This is a global challenge. For example, in the US one developer ceased development of two large offshore wind projects (11 GW and 11.5 GW respectively) citing supply-chain constraints, particularly a vessel delay that disrupted project timing (Ørsted, 2023). In addition, Europe's ports, which are a vital part of both the onshore and offshore supply chain, are struggling to access the funding needed to meet capacity.

Regarding raw materials, European demand for lithium, which is crucial for the clean-energy transition, is expected to grow up to 18 times by 2030, and 60 times by 2050, but the EU mines only a small fraction of the lithium it consumes, and relies on China to process it (European Parliament, 2022). The Democratic Republic of Congo accounts for over 70 per cent of the global supply of cobalt, which is crucial for wind generators, and China in turn owns 70 per cent of Congo's mining industry.

China dominates the world supply of the group of 17 chemical elements widely used in high-technology and low-carbon products, with a 60 per cent global market share (*ibid*). In relation to shipping capacity, it is reported that, from January to October 2024, Chinese shipbuilders secured approximately 70 per cent of new ship orders worldwide (Rongqian *et al.*, 2024).

The supply-chain challenge facing Europe is considerable and, given Ireland's scale, location and stage of development, it will be greater still. In addition, there is currently no port in Ireland capable of accommodating offshore wind projects of the scale anticipated (WEI, 2022).⁴⁸ Significant areas of load-bearing space are required to enable assembly and other works to be undertaken. To give an example of the scale of the supply-chain and investment needs to be met in Ireland, the assumptions underpinning the 37 GW export scenario in the Government's assessment of co-benefits (BVG Associates, 2024b) include:

- Investment in all three suitable ports⁴⁹ for floating offshore wind construction or assembly, operational from the start of 2032. Two are dedicated construction ports and the third is dedicated to floating foundation assembly.
- The existing construction port in Northern Ireland, Belfast D1, will deliver fixed Irish projects, with an assumed maximum throughput capability of 100 turbines per year.
- A tower manufacturing facility is constructed that operates from the start of 2030.
- A synthetic rope and mooring line manufacturing facility is constructed that supplies from the start of 2035.
- Onshore and offshore interconnect cables and high-voltage electrical equipment are sourced from international suppliers.
- Individual facilities are future-proofed or incremental investments are made to maintain throughput numbers as turbines become larger over time.

These requirements do not include all of the wind and solar generation infrastructure, which is highly complex as well as of massive and increasing scale. In contrast to the international supply requirements for nearshore projects mentioned above, the *Policy Statement on the Framework for Phase Two Offshore Wind* includes the ambitious aim of supporting 'the long-term potential for a floating offshore wind industry, including **all elements of the necessary supply chain** required for an industry of this type, **in Ireland**' (Government of Ireland, 2023a: 18, emphasis added).

Ireland, despite its vast wind resource, is a relatively small market in global terms for the supplies and shipping needed to fulfil transition objectives.⁵⁰

⁴⁸ WEI has stated that Belfast Harbour's D1 facility is the only existing facility on the island of Ireland which can accommodate staging and marshalling of fixed-bottom projects of the scale anticipated.

⁴⁹ Cork, Moneypoint, and Shannon Foynes Island.

⁵⁰ The Port of Cork (Ringaskiddy) has been highlighted as having the potential to serve the wind energy sector. In July 2024, the port was awarded over €38 million under the EU Connecting Europe Facility for the construction of two quay berths at its deepwater site (Port of Cork, 2024). In October 2024, the port and the Ireland Strategic Investment Fund (ISIF) announced a partnership – including an €88.5 million investment by ISIF – to support the development of new port infrastructure to accelerate the deployment of Ireland's first offshore wind projects, on the east and south coast (ISIF, 2024).

Another consideration is the extent to which developers of renewable power projects in Ireland use sustainable supply chains. This is desirable but may not happen automatically and, as is the case in the UK, may require the introduction of a financial incentive in the auction process (UK Government, 2024).⁵¹

Overall, the industry has noted that, if and when much-needed port facilities are developed, local supply chains must be developed, particularly when considering floating wind; the identification of 'several suitable port infrastructure proposals around the coast could provide a significant level of regional development if the plans are realised' (WEI, 2022: 3).

Improving the Framework Conditions: Getting Started

- The increased resourcing of the planning system and new legislative context must deliver the promised results and be seen as just the latest steps in making Ireland's planning and consent processes clear, fast and predictable. Additional funding, resourcing and reform (including more parallel processing) may be required.
- All of the planning and regulatory steps required for clean energy infrastructure delivery must be examined to ensure that policy initiatives address concerns.
- Plans for, and investments in the transmission network must be commensurate with Ireland's ambitions for the power sector.
- A credible strategy for the provision of at least 25,000 additional workers to deliver the transition, mindful of labour market and skills constraints, must be available and actioned.
- The EU, the State, the private finance sector and industry must identify and respond credibly to Ireland's finance requirements for the energy transition. Adequate project financing must be accessible at the right cost, there must be viable options and routes to market (including CPPAs), and the auction system must provide developers with a predictable ability to recover costs and achieve viability and profitability.
- An ambitious but realistic response plan for ports, shipping and supply-chain capacity must be prepared and delivered.

6.3 Install a Formal Institutional Arrangement

This Council research deals with a complex policy challenge. Progressing it involved not just data analysis but a broad consultative approach and mechanism to engage with stakeholders and forge a more robust shared understanding of the challenges and potential way forward in terms of new policy actions.

During NESCC's policy workshop for this research project held in October 2024, it was said to be the first occasion on which those key actors had been gathered to discuss the key strategic issues around transition in the power sector.

The complexity of the energy transition, the range of actors, the need for better and ongoing data-gathering and analysis, and the centrality of societal engagement suggests the need for a new formal, effective institutional and governance arrangement.

⁵¹ The UK's Clean Industry Bonus allows bidders in offshore wind auctions to get extra revenue support if they choose to invest in more sustainable supply chains. The bonus is reported to be in the region of €32 million per GW.

A wide variety of stakeholders is involved – from state bodies, regulators and industry and representative bodies to service providers and policy experts, etc. Concluding this NESC research involved going beyond consultation and engagement to foster a shared understanding across multiple actors to provide a strong foundation for the Council's recommendations.

This indicates the need to put in place institutional arrangements and processes that will ensure and facilitate this type of ongoing engagement.

Progressing the actions recommended by the Council and linking evidence-gathering to strategic direction requires a formal institutional arrangement which connects all key actors, from the State and local authorities to the research community and market actors. The work of key actors to address the issues identified by the Council must not exist as islands.⁵² The objective is to facilitate a more productive relationship between all the relevant players.

While the market is crucial, the State must be the 'system architect' in the plan-led approach that provides the overarching strategy which can guide choices that will result in a successful transition (Baringa & Nesta, 2024). Crucially, the State should proactively inform the activity of actors, rather than only taking their activity as inputs (*ibid*).

It is important to recognise that, while reference is often made to 'the State' (including here), the State is not some monolith; rather it is a disaggregated entity where differences exist between – and often within – its constituent parts. This being the case, there is a critical role to be played by the centre of government in transition policy given its convening powers, coordination role and distance from sectoral interests (Kaur *et al.*, 2023).

Further, the State must be able to steer activity and ensure progress in a market where, at certain points, competition can be low, and where the State and developers/investors are each 'waiting' on the other to act. Also, the State must be assured that the power generation it supports will serve the Irish market.

This enables the State to define societal and economic needs (in terms of decarbonisation, cost-competitiveness, security, reliability and resilience) and the associated generation capacity. This provides the strategic context in which the market can provide for a competitive, reliable and sustainable energy system, fostering broader economic opportunities.

When societal objectives have been established, the State may rely on legislation to ensure they are reached. As noted earlier, there are competing forces in the energy sector, where demand for power far outstrips additional renewable energy supply, and spurring the development of new renewable capacity seems to rely on driving demand in advance. This brings into stark relief the question of how legislation, sectoral ceilings and generation targets affect decisions. For example:

- Although climate legislation requires public bodies to act in a manner consistent with national objectives, new connections to the power system – not only those for large energy users (LEUs)/data centres – can put the carbon budget for electricity at risk. Yet new connections facilitated by the CRU are essential in support of decarbonisation objectives, such as the electrification of heat and transport, as well as social and economic objectives, such as facilitating new housing and new enterprise activities (CRU, 2024c: 92 & 93).
- The High Court has recently found that An Bord Pleanála did not take account of its responsibilities under climate legislation to carry out its duties consistent with the need for climate action (O'Doherty, 2025). The judgment in that case made significant statements about the requirements of public bodies. These require careful consideration.

⁵² In relation to offshore wind energy, engagement is currently facilitated through an Offshore Wind Delivery Taskforce. It addresses some key issues, including planning (DHLGH and DECC), transmission grid (EirGrid), skills (DFHERIS), finance (DPENDR), ports (D/Transport), supply chain (DETE) and security concerns (D/Defence).

There appears to be an operational gap between obligations, and decisions and operations. Rather than legally binding targets or ceilings firmly shaping or influencing decisions, decision-makers must only, in so far as practicable, perform their functions in a manner consistent with the national plans, objectives and obligations.⁵³

In addition, while the State must live with uncertainty, it must also position itself to describe the planned energy transition to the greatest extent possible. A detailed model cannot be expected immediately (see Section 7.2). However, the State, in collaboration with key actors, must now define, agree and articulate the strategic path of the planned energy transition in more detail than is currently the case.

Overall, the consultation process for this NESC research suggests that **this new institutional arrangement must be sufficiently robust** to ensure it can fully perform this role.

Systemic risks can be underestimated if there is less than full understanding across the state system. The institutional arrangement itself must be capable of appreciating the complexities, opportunities and challenges – without depending entirely on actors' inputs – and of generating broadly based confidence in the proposed responses.

A new institutional arrangement can enable the State to provide much-needed strategic direction now in many areas highlighted here by the Council, including:

- a more clearly defined and articulated agreed strategic path for the planned energy transition;
- clear guidance on how the requirement in climate legislation that public bodies act in a manner consistent with national objectives such as carbon budgets, interacts with other policies relating to economic development, and shapes the decisions taken by public bodies;
- greater certainty on the trajectory for fossil-fuel infrastructure to better inform scenarios for renewables development;⁵⁴
- assessing and addressing any lack of competition in major energy infrastructure investment that leads to delays and/or higher costs;
- the approach for the planning of large-demand customers and associated infrastructure requirements (e.g. energy water, broadband, transport, etc), the associated costs, benefits and risks; and
- Ireland's early involvement in upcoming work at EU level on the new economic governance framework, reforms and priority investments, and market design, including discussions on the reforms and investments for the energy transition and strengthening economic resilience.

These are only a few examples. Additional strategic gaps to be addressed will no doubt emerge as, for example, the evidence-gathering exercise described in Chapter 7 progresses. Acting on these Council recommendations would also help address issues raised by a variety of key stakeholders (see Box 6.4).

Further, given the nature of the energy transition, evidence-gathering and policy must be linked to the key actors, and the national also be linked to the local. The Climate Action Plan rightly recognises the vital role of local authorities and Climate Action Regional Offices in supporting the transition by leading evidence-gathering and action at local level. This work needs to be developed and supported in the future, as do the important all-island dimensions (see Box 6.5).

⁵³ See Section 15 of the *Climate Action and Low Carbon Development Act* 2015 as amended by Section 17 of the 2021 Act.

⁵⁴ Reductions in gas demand are addressed as part of the Government's energy security review. See *Securing Ireland's Gas Supplies* (Government of Ireland, 2023d).

Box 6.4: Examples of Recent Calls for Further Strategic Direction

- The EPA has called for a national policy statement that articulates and drives the transition and provides a strategic, shared vision for how Ireland will adapt (EPA, 2024).
- The recent *Independent Review on the Security of Electricity Supply* recommended a clear statement of national policy regarding the future of the electricity market, including the details of the planned transition, the milestones and other parameters of a successful transition, and the roles, responsibilities and expected outcomes from all those involved in its delivery (McCarthy, 2023).
- The business community have stated that Ireland's struggles to ensure secure, affordable and sustainable energy are partially explained by the lack of a national energy and industrial strategy. They have called on the Government to address this gap as a strategic priority and bring renewed attention to energy competitiveness (Ibec, 2024).
- Experts have called for the development of a national electrification strategy which includes a plan for the use of surplus renewable energy production that best serves climate and societal goals, if and when any surplus arises (Daly, 2024).
- The SEAI has called for a 'pathway' for a decarbonised electricity system, setting out Ireland's long-term ambitions for technologies and their place within the wider energy system, and addressing security of energy supply, cost-effective energy for consumers, local jobs and economic benefits, climate and environmental benefits, and attracting foreign investment, to be updated every three years (SEAI, 2024c).
- Businesses groups have called for a strategic approach for those who seek to invest in offshore energy potential, including for the Maritime Area Regulatory Authority (MARA) to be the single point of contact that liaises with planners, agencies, departments and semi-state bodies to ensure that Ireland can decarbonise at the greatest pace (Chambers Ireland, 2022).
- The CRU has stated that a longer-term approach is required to provide clear investment signals, and has recommended that consideration be given to a national strategic approach for the planning of large-demand customers and associated infrastructure requirements (e.g. energy, water, broadband, transport, etc), the associated costs and benefits, and any potential risks arising from high volumes of similar demand customer types (CRU, 2024b).
- *Ireland's Climate Change Assessment Report* states that improved understanding of livelihood opportunities is required to support the transition, because knowledge of the national employment opportunities from technological and practice transitions is limited, and from wider transformations of structures and systems is essentially non-existent (EPA, 2023b).

Box 6.5: The All-Island Dimension

Since 2007 the electricity industry operates a single wholesale market across the island of Ireland. Both jurisdictions have ambitious climate-change and renewable energy targets, and both have identified security of energy supply and increased self-sufficiency as a priority. To achieve their ambitions, both jurisdictions need to increase greatly both renewable energy generation and storage capacity, to meet growing peak demand in the transition to more renewable sources.

NESC's research on the Shared Island highlighted opportunities for future strategic collaboration. This included exploration of renewable energy opportunities – both economic and environmental – associated with solar, offshore wind, wave and tidal energy, and anaerobic digestion (NESC, 2022). The Council's research recommended further investment in the built infrastructure of the all-island energy network, to ensure that the targets for the share of renewable electricity by 2030 could be achieved (*ibid*). All-island collaboration and cooperation can realise economies of scale on several fronts, and, if translated into easing costs for households, can assist in delivering a fair transition across the island of Ireland.

In the area of planning, local authorities, An Bord Pleanála and the Maritime Area Regulatory Authority (MARA) must have the right expertise, resources and processes to meet the challenges and opportunities the transition presents (see Section 6.2.1).

Also, energy communities are important social and economic actors to include in strategic policy development, bringing increased citizen participation to Ireland's energy transition. There is growing understanding across Europe that more locally oriented deployment of renewable energies is a more favourable approach to truly achieve a just transition (European Commission, 2023). Further, there is evidence that community-owned energy can remain more affordable for users during crisis periods (Baczynska, 2022).

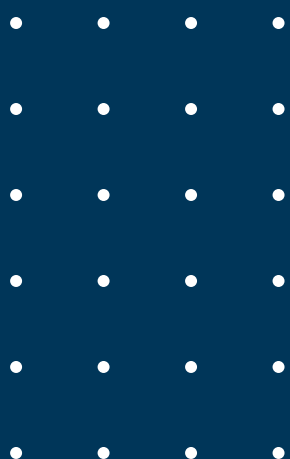
The issue of equity must be a central consideration in the policy approach. This is key with regard to issues such as demand management but also in terms of how additional costs are to be shared and borne by consumers.

Greater participation in decision-making can address the spatial dimension of the transition, enable local development, increase community ownership of the transition, and enhance public support (McCabe *et al.*, 2020). Place-based approaches to a just energy transition can include co-creation initiatives to identify and implement change (Moore-Cherry *et al.*, 2022). The new institutional arrangement recommended by the Council should include mechanisms to gather and reflect the wide variety of perspectives and interests in this policy area, while providing leadership.⁵⁵ The detailed stakeholder engagement processes undertaken by bodies such as EirGrid and the CRU can be instructive, and engagement should be appropriately broad.

This NESC research points to a number of strategic cross-government and public-private coordination issues. The broad-ranging impacts of the energy transition will require cohesive action, ensuring that key actors get and stay on the same page. The Council believes that **a new formal institutional arrangement to support the necessary engagement, coordination and strategic guidance is now essential.**

⁵⁵ This includes ensuring that the views of any impacted communities are considered. It will be necessary to dedicate resources to engagement to ensure concerns are heard, to support public buy-in, and to prevent misinformation.

Chapter 7



**Transition in the Power
Sector:**
Actions to be Taken Next

7.1 Introduction

While the first step must be to act now to move Ireland from the status quo via the recommendations in Chapter 6, other priority actions must be taken next to design the way forward in the medium term, although certainty is low. Ambition for the energy transition must be maintained and be given life by working hard to move beyond our near-term targets, towards domestic net zero. This involves acting next in three important areas. First, is to address the critical knowledge gaps identified by the Council in this report. Second, is to demonstrate sustainable demand for renewable power commensurate with national targets. Third, is to ensure that the expected economic ‘fruit’ of energy transition accrues domestically.

7.2 Address Critical Knowledge Gaps

To move from the status quo to near-term targets and towards domestic net zero, the State must have the capacity to harness frontline knowledge as well as the evidence from the research community – and from elsewhere – to revise plans and actions accordingly (Sabel & Jordan, 2015). Building this capacity is how the fog of uncertainty will be successfully navigated and is central to the ‘now, next and later’ approach proposed here by the Council (see Chapter 5).

As noted earlier, the State must live with uncertainty yet must act now to provide a more clearly defined and articulated agreed strategic path for the planned energy transition (see Section 6.3). Next, it must position itself to describe the planned transition in the power sector in the greatest detail possible, accepting that this plan will need to be adjusted as progress is made.

The Council has identified 10 key research gaps in this regard. To begin with, action is needed on the following:

- i. A detailed **model for capacity expansion** for Ireland. The model should set out the logical, evidence-based staging posts and other parameters of a successful transition; the progress to be completed by those staging posts; and the roles, responsibilities and expected outcomes from all those with responsibility for delivering the various elements of the shared plan. Rather than starting with an end-goal target for capacity (e.g. 37 GW of offshore wind), the model should detail the path, from existing renewable power generation capacity to an agreed mid-point on the way to domestic net zero, and if viable and valuable, on to surplus production. Adjustments can be expected along the way.
- ii. Assessment of the specific energy **capacity required to achieve domestic net zero, and when this is to be achieved**, whereby Ireland’s power demand is met via renewable sources, to the maximum that is feasible, and where greenhouse-gas emissions are balanced or exceeded by the removal of greenhouse gases.
- iii. Detailed consideration of the **optimal use of any surplus energy**, including (but not limited to) creating and serving new industrial opportunities in advanced manufacturing and in traditional sectors which require significant quantities of power, and the potential export of energy.
- iv. A **single, internally consistent and coherent forecast** of power generation, demand, interconnection, reliability and capacity adequacy.⁵⁶
- v. A detailed, evidence-based **profile of expected energy supply reliability** across the transition timeline.

⁵⁶ Note that DECC has initiated a *System Security Post-2030* study with the IEA, with key inputs from EirGrid to examine energy system security through the transition. Also, *Energy Security in Ireland to 2030* (Government of Ireland, 2023b) includes a requirement to integrate the forecasting framework for the electricity and gas sectors, and to establish an independent expert panel to review forecast modelling.

- vi. Examination of **whether Loss of Load Expectation (LOLE) remains an appropriate metric** for capacity adequacy in Ireland. Informed by recent work in the UK, further develop the theoretical framework for a new metric (or combination of metrics) of reliability.
- vii. Widely accepted, standardised **technology cost comparison metrics** and data to better inform policy considerations and action.
- viii. Irish data comparing the levelised cost of renewable power versus conventional energy sources, and a **new measure to capture the full system costs of delivering power to consumers**, the cost of ensuring the reliability of intermittent renewable sources, energy storage and backup costs, and other important costs not captured by the LCOE measure.
- ix. A single source of **verified data on planning and regulatory process efficiency**, accepted by industry and authorities, to inform policymaking.
- x. Research which provides clarity and certainty on **the path of expected full system costs and related competitiveness impacts** over the short, medium and long term.

The evidence and the process by which it is gathered are important. The output of research must be transparent, clear and accessible, and it should support dialogue and engagement among key actors in the new formal institutional arrangements.

The Council also highlights the importance of evidence-gathering being designed to inform both policy (energy, enterprise, skills, investment, regulation, planning, etc) *and* communications, starting with a willingness to acknowledge where certainty is absent, and state where uncertainty must be either accepted or addressed.

To mitigate uncertainty, the new institutional arrangement called for in Section 6.3 should identify and name outstanding evidence and data gaps as a guide to Ireland's research community, including in the higher-education sector, to maximise their contribution to policymaking. It is important to recognise the vast scope of research work already underway, and the crucial contribution the academic and other research communities are making today. They must be equipped, ready and able to do more. Bodies such as the Climate Change Advisory Council and the Just Transition Commission can also play a role in identifying and addressing knowledge gaps.

Overall, Ireland's energy transition is a long-term, capital-intensive endeavour which will have complex and uncertain effects on economic resilience. **The Council's analysis highlights potential limitations in long-term economic planning.** Anticipating and managing such strategic issues requires (elusive) certainty around the details, timeline and impacts in the near to medium term, paired with capacity to plan for the long-term impacts and the demonstrable ability to deliver progress. Similar challenges persist in other policy areas (e.g. housing, infrastructure, healthcare, and other services).

The Council believes that the policy system may benefit from fresh consideration of ways Ireland could improve its long-term planning, provision and delivery capacity. NESC is currently considering its potential contribution to work in this area.

7.3 Demonstrate Sustainable Demand for Renewable Power

Giving life to Ireland's ambition for the energy transition means moving beyond our near-term targets, towards domestic net zero. This involves acting next to demonstrate sustainable demand for renewable power commensurate with our challenging national targets.

As outlined in Chapter 2, peak electricity demand in Ireland is likely to reach between 12 and 16 GW in the medium to longer term, assuming there is good progress on decarbonising heat and transport in accordance with our legally binding commitments.⁵⁷ That level of demand should be met via renewable power generation and interconnection by 2040, though the State currently has targets that would see generation capacity greatly exceed that level (e.g. 37 GW of offshore wind capacity by 2050).

The project developers consulted during this research pointed to the necessity for stable, predictable long-term demand (and prices) for its renewable output, for projects to be considered, let alone financed and progressed.

The rationale for generating sufficient clean power such that Ireland has an economy and society where energy demand is met by renewable sources and greenhouse-gas emissions are balanced or exceeded by the removal of greenhouse gases (i.e. domestic net zero) is self-evident. The rationale for going beyond domestic decarbonisation is less clear and is perhaps insufficiently clear given the high costs involved (see Chapter 4).

The State's strategy seeks to address this by pointing out that the rationale for going beyond net zero and delivering the 37 GW export scenario is the economic co-benefit described in Chapter 2, which in turn depends on, among other things, extensive domestic demand and increasing large energy user (LEU) and data-centre infrastructure (Government of Ireland, 2024b: 84).

The economic analysis underpinning that strategy states that, if Ireland wishes to pursue an ambitious 37 GW export scenario, the Government should explore measures to attract inward investment by such energy-intensive industries to boost electricity demand (BVG Associates, 2024b: 35). These industries include data centres and (to support hydrogen production using surplus offshore wind power) developing 'Green Energy Industrial Parks', sustainable aviation fuel (SAF) production, ammonia production for fertiliser, methanol production for maritime fuel, and clean steel production. The above approach appears to plan to grow energy demand as a step towards promoting capacity delivery and to meeting targets for renewable power generation, with a view to realising the potential economic benefits of surplus energy use and export.

Certainty in the pipeline of demand should spur increased generation capacity, greater investment in supporting physical and human capital, and new enterprise opportunities. However, there is a risk of the 37 GW export scenario and necessary associated new demand becoming an end in themselves, as opposed to the energy transition being planned to respond to environmental, energy, economic, competitiveness and societal needs in the first instance.⁵⁸

Recent research has highlighted how electricity demand from data centres in Ireland has increased rapidly since 2015, compared to other sectors, and that, by 2030, data-centre demand could surpass that of the country's entire industrial sector (Daly, 2024).

⁵⁷ For example, in accordance with EU requirements for Nearly Zero Energy Buildings, approximately 252,500 new houses will be powered by electrical heating by 2030. In addition, the Climate Action Plan has committed to install 400,000 heat pumps in existing houses by 2030. That will mean approx. 700,000 dwellings in total will rely on electrical heating by 2030. This requires development of the network, reliability of supply and timely delivery of energy infrastructure to facilitate the delivery of new housing.

⁵⁸ It is notable that industrial policy as articulated in the Enterprise White Paper is to target opportunities for decarbonised manufacturing and ICT services that catalyses development of renewable energy, flexibility and storage, and does not imply a demand-first energy export scenario.

That research also states that all additional wind energy since 2017 has been absorbed by data centres, negating fossil-fuel reductions. It points to a reliance by some data centres on on-site natural gas. That analysis concludes that a robust national strategy is needed to align economic growth with climate commitments, prioritising renewable energy deployment.

Further, a dependence on increasing LEU and data-centre infrastructure to provide the rationale for pursuing the 37 GW export scenario seems questionable given current and foreseeable constraints – constraints which have led to the introduction of new criteria for the connection of data centres to the power system.⁵⁹

That approach would contrast in emphasis with the approach to new demand connections as set out in the *National Energy Demand Strategy* (CRU, 2024b). That CRU strategy positions new demand as providing a potential route to increase flexibility, rather than providing a demand for new generation capacity.

The Climate Action Plan also positions LEUs as making a higher proportional contribution to the flexibility target (*ibid.* 19). The focus is on building flexibility contributions from LEUs seeking to connect, rather than connecting LEUs in order to foster renewable energy supply. The challenge to a demand-first energy export scenario is captured succinctly in the SEAI's recent publication:

[If] total electricity demand increases ahead of the roll-out of renewable generation capacity it will lead to higher emissions. This will make it extremely challenging for the electricity sector to meet its national greenhouse gas emissions reduction obligations. In the context of our legally binding national and international climate and energy obligations, the negative consequences versus the benefits of allowing new large electricity users, such as data centres, to establish in Ireland needs to be considered. If the scale and pace of renewable energy growth cannot exceed that of electricity demand, as was the case in 2023, then renewables are just abating further increases in emissions rather than delivering the absolute reductions in greenhouse gas emissions required (SEAI, 2024b: 25 & 27).

Yet, as detailed earlier, there appears to be an operational gap between legal obligations, and decisions and operations. Rather than legally binding targets or ceilings firmly shaping or influencing decisions, decision-makers must only, in so far as practicable, perform their functions in a manner consistent with them. Strategic guidance for all relevant public bodies on this issue is one of the areas recommended by the Council for attention by the new formal institutional arrangement described in Section 6.3.

Overall, surplus renewable power will be vital to the decarbonisation of industry, but **the Council has identified a conundrum – if not an outright contradiction – inherent in the current 'drive demand to drive supply' approach.** The State's ambition for renewable power, to realise the greatest economic co-benefits and to be a competitive exporter of energy, appears to rely on ensuring massive levels of energy demand. But, if growth in demand precedes and exceeds renewables development, on top of that needed to decarbonise existing demand, then the State's climate objectives risk being undermined. The current approach creates the risk of misdirecting enterprise, energy, investment and climate policy.^{60 61}

⁵⁹ The Commission for the Regulation of Utilities (CRU) introduced in November 2021 new assessment criteria on the connection of data centres to the electricity system. These criteria include a requirement for data centres to have back-up dispatchable generation facilities on-site, and consideration of the location of the application. The direction introduced new assessment criteria for the system operators to consider and apply in the processing of applications. The CRU is currently reviewing its LEUs connection policy.

⁶⁰ The National Risk Assessment states that 'failure to reconcile increasing demand, decarbonisation and our climate and energy commitments, with associated investment requirements, and the need to ensure a secure and sustainable energy supply, remains a risk' (Government of Ireland, 2024c: 31).

⁶¹ A new electrification strategy has been recommended to address issues in this area (Daly, 2024).

Demonstrating Sustainable Demand: Getting Started

- Time and policy resources should be allocated to resolve the conundrum (or contradiction, even) inherent in the current approach to demonstrating sustainable demand for renewable power.
- Detailed analysis of the optimal use of any surplus energy should be undertaken, including (but not limited to) creating and serving new industrial opportunities in advanced manufacturing and in traditional sectors which require large quantities of power, and the potential export of energy.
- If the State's ambition for renewable power (and for the delivery of economic co-benefits) relies on ensuring massive levels of energy demand in advance, a widely accepted and practical way of doing so that is in line with the State's climate commitments and objectives is needed – if indeed it is possible.
- The starting point should be planning for renewable capacity in a way that responds to environmental, energy, economic and social needs.

7.4 Ensure the Expected 'Fruit' of Energy Transition Accrues Domestically

Maintaining ambition and support for the transition in Ireland's power sector involves acting next to ensure that the expected economic 'fruit' accrues domestically. Chapter 1 summarised a selection of assessments of the enterprise opportunities that are forecasted to arise from the energy transition. These co-benefits include new employment, increased tax take, significant gross value added (GVA), sizeable payrolls, massive investments, and additional local authority contributions (see Appendix).

These are the expected economic fruit of transition in the power sector (beyond the environmental and related benefits). The domestic activity and employment expected from delivering onshore wind and solar infrastructure is likely to be greater than that accruing from the delivery of offshore wind capacity.

The Government's economic analysis underpinning the 37 GW export scenario agrees a proportion of local content in order to assess the expected *domestic* economic benefits (as opposed to those benefits that might accrue abroad to, say, foreign investors and their shareholders, to international suppliers, and to workers from abroad who work on renewable power projects and locate here temporarily) (BVG Associates, 2024b: 8).

For example, during the expansion of offshore renewable generation capacity, the analysis assumes that Ireland has a high share of project development and operation and maintenance activities. Opportunities should arise from construction at port facilities, and in the manufacture of towers and synthetic cables. Irish companies are also expected to service new demand in areas such as geophysical and geodata surveying; controls and instrumentation; electrical and marine engineering; haulage transportation; repairs; and insurance (Government of Ireland, 2024e: 25 & 26).

Equally, there is a recognition that not all the activity, investment, sales and jobs will be in Ireland (e.g. interconnection cables and high voltage electrical equipment are expected to come from international suppliers; cable installation is expected to be undertaken by international firms, with limited Irish involvement).

The publication of the *Powering Prosperity* strategy is a welcome development in this context, as it sets out a series of actions to build capacity and capability in the Irish supply chain, specifically in relation to offshore wind energy (*ibid*).

As expanded on in Section 6.2.5, the supply chain for the broad energy transition is currently limited in Ireland and it is accepted that Irish suppliers will not meet all of the needs of the renewable energy sector, so European and UK suppliers must play a significant role in Ireland's transition (Carbon Trust & WEI, 2020; SEAI, 2024c).

Ireland's membership of the EU and World Trade Organization has been highlighted as limiting the ability to promote supply-chain growth through favouring local content (SEAI, 2024c: 118).

Further, high or full employment in Ireland may mitigate the full realisation of new job opportunities described in the assessments summarised in Chapter 1 and/or lead to job and sector switching, rather than net gains.

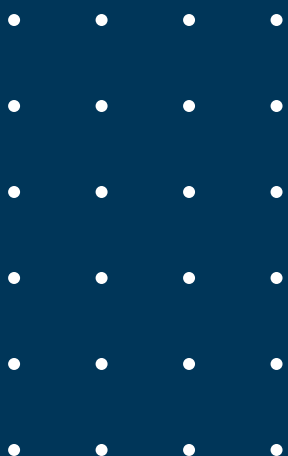
It is also worth noting that a singular focus on 'green jobs' created by the energy transition would risk missing the impacts of 'greening' existing employment across many sectors. The evolution of many jobs to deliver the transition (engineering, consultancy, electricians, manufacturing, digital services, circular products, etc) may significantly outpace the creation of 'new' roles. This should improve resilience and sustain employment across many sectors, and it requires an equal policy appreciation.

Overall, the Council believes that concerted, strategic action must be taken to ensure that the expected economic co-benefits of the energy transition (and from potential energy exporting) accrue across Ireland, including evidence-based policies, funding and other initiatives to maximise the involvement of enterprises and workers.

Ensuring Domestic Accrual: Getting Started

- Provide a unified, robust quantification of the enterprise opportunities arising from the achievement of stated targets across technologies, with intuitive metrics, and with reference to instructive international examples.
- Expand the approach set out in the *Powering Prosperity* strategy to ensure that the expected economic 'fruit' of energy transition accrues domestically and regionally across Ireland (not just those co-benefits related to offshore wind generation).
- Working within EU and WTO rules, Ireland should task the enterprise development agencies and any other relevant bodies to devise and implement a dedicated approach to maximising the supply chain, investment, employment activity involved in the broad energy transition – i.e. wind, solar, hydrogen generation/production, transmission, distribution, interconnection, shipping, operation/maintenance/decommissioning, and related goods and services.

Chapter 8



**Transition in the Power
Sector:**
Actions to be Taken Later

8.1 Introduction

Chapters 6 and 7 detailed the actions to be taken *now* to move Ireland from the status quo towards our near-term targets, and to be taken *next* to move beyond those targets towards domestic net zero. This is not necessarily the limit of Ireland's ambition. Actions should be taken *later* to develop our understanding of the longer-term direction of travel and, though visibility is poor, move Ireland towards our desired future.

As described in Chapter 5, Ireland's decarbonisation potential includes the prospect of producing surplus clean energy to power enterprise and spur new opportunities, and the possibility of exporting surplus clean energy, if proven practical and viable.

Regarding the production of surplus clean energy to power enterprise and spur new opportunities, the Council (in Section 7.2) called for detailed analysis of the optimal use of any surplus energy, including creating and serving new industrial opportunities in advanced manufacturing and in traditional sectors which require significant quantities of power.

The Council also recommends careful consideration of the potential to export surplus clean energy. If that proves to be practical and viable, action will be needed later to produce competitively priced energy for international markets, to develop a viable export method, and to successfully manage security concerns and domestic bias.

8.2 Produce Competitively Priced Energy for International Markets

Ireland's East-West interconnection allows for international trade to-and-from the UK mainland (outside the all-island market). In 2023, Ireland imported 8.3 times more electricity than it exported (SEAI, 2024a). From 2026, the Celtic Interconnector should allow for international trade to and from the European mainland via France.

The generation of surplus renewable power is just one of the necessary elements of an export model for Ireland; that power must be produced at a price that is competitive on international energy markets.⁶² At present, Ireland's electricity prices are the highest in Europe and, as discussed in Chapter 4, may increase in the medium term.

Any assumption that Ireland will be able to price surplus renewable electricity competitively needs to be tested, both in terms of the price of Ireland's surplus power (primarily from offshore wind) relative to that of other countries, and relative to other technologies in the international market (e.g. wind, solar, nuclear, etc). It is also important to note that potential importing countries are not standing still and are themselves rolling out ambitious renewable energy infrastructure plans.

For example, in terms of new offshore wind capacity in key markets for Ireland (SEAI, 2024c: 83 & 84):

- The UK is targeting up to 50 GW installed by the end of 2030, including up to 5 GW of floating offshore wind.
- France is targeting 18 GW installed by the end of 2035, and 40 GW by the end of 2050.
- Denmark is targeting between 12.5 and 17.5 GW installed by the end of 2032, and 22 GW by the end of 2040.
- Germany is targeting 30 GW installed by the end of 2030, 40 to 50 GW by the end of 2035, and 70 GW by the end of 2050.

⁶² Ireland's largest existing energy exports are fuel-oil and gasoline, produced by the refining of imported crude oil at the Whitegate refinery in Co. Cork (SEAI, 2024a).

- The Netherlands is targeting 21 GW installed by the end of 2031, 50 GW by the end of 2040, and 70 GW by the end of 2050.

The generation of competitively priced surplus energy is a key consideration for successful policy for cross-border electricity trade, as is physical interconnection (see Section 8.4). In addition, market arrangements need to be efficient, i.e. the flows should go from a market with a low price to a market with a high price during a trading period. At present, due to changes since Brexit, there has been an increase in the level of *flows against price difference* between the Single Electricity Market (SEM) and the market in Great Britain (GB). As a result, there have been instances where, even during times of high wind, the interconnectors between SEM and GB may continue to import electricity into SEM from GB.⁶³

One development that might inform an understanding of the competitiveness of Ireland's surplus renewable electricity prices is the upcoming analysis which follows the recent 'cap and floor' approval for two new interconnectors.⁶⁴

Producing Competitively Priced Energy: Getting Started

- Undertake a market and sectoral assessment of the investment readiness of Ireland's transition sectors (perhaps based on the Scottish example provided in Section 4.4), to reveal key interdependencies, barriers and opportunities for urgent action by the Government and stakeholders.
- Provide clarity on how Ireland will produce and be able to price surplus renewable electricity competitively, both in terms of the price relative to that of other countries, and relative to other technologies in the international market.

8.3 Successfully Manage Security Concerns and Domestic Bias

In addition to generating surplus renewable energy at a price that is competitive on international energy markets, Ireland's export potential must overcome security concerns and domestic bias in importing markets.

Both phenomena have been heightened by the invasion of Ukraine in February 2022, the explosions that severely damaged the Nord Stream 1 and 2 natural gas pipelines in the Baltic Sea in September 2022, and the severing of undersea cables in the Baltic Sea in November 2024.

After it invaded Ukraine in 2022, Russia cut gas supplies to Europe, 'plunging the region into an energy crisis' (IEA, 2024b). This focussed attention across Europe, including in Ireland, on the location and diversity of energy sources.

Cyberattacks, such as the 2021 ransomware attack on Colonial Pipeline in the US, are also contributing to security concerns around energy infrastructure. And while the sabotage of the Nord Stream pipelines had limited immediate impact on the supply of energy, it heightened concerns over the vulnerability of energy sources, and added to a bias towards domestically sourced power. Imports of gas oil, and coal are also exposed to security and geopolitical risks.

⁶³ EirGrid has recently completed a study comparing the different market arrangements since Brexit.

⁶⁴ *MaresConnect* will link Ireland to Wales via a 190 km subsea cable and deliver 0.75 GW of additional electricity capacity; *LirlC* will link Scotland with Northern Ireland via a 142 km subsea cable and deliver 0.7 GW of additional electricity capacity.

In a recent example of how security concerns are affecting the deployment of clean energy infrastructure, Sweden rejected offers totalling 32 GW from offshore wind farms on its own coast in the Baltic Sea, stating that '... with war in our immediate area, the defense interest must weigh heavily when judgments like this are made' (Memija, 2024b).

A recent international conference on offshore energy was told by the Dutch Ministry of Defence that states 'have to add more energy capacity and be more independent in energy production while protecting the energy assets we already have at the same time' (Memija, 2024a).

Following the severing of two undersea cables in the Baltic Sea, the foreign ministers of Finland and Germany issued a statement which said that 'European security is not only under threat from Russia's war of aggression against Ukraine, but also from hybrid warfare by malicious actors. Safeguarding our shared critical infrastructure is vital to our security and the resilience of our societies' (FFO, 2024).

Further, the producers of energy in potential destination markets for Ireland will argue that their output is more secure and generates significant enterprise opportunities for their own economies and societies.

Overall, security concerns and domestic bias in importing countries regarding power supply via interconnectors may limit Ireland's export potential, even if that exported power were somehow cheaper.⁶⁵

Managing Security Concerns: Getting Started

- Set out Ireland's national plan to successfully manage the security concerns and domestic bias of potential importing states. Ireland should consider the actions it could and would take. For example, Ireland's diplomatic and international engagement apparatus (e.g. embassy network, IDA Ireland, etc) could provide a two-way communication pathway to gather country-specific concerns and communicate back Ireland's response.

8.4 Develop a Viable Export Method

Surplus energy can be exported off an island via three methods: (i) as electrons across electrical interconnectors, (ii) as hydrogen gas through pipelines, or (iii) as hydrogen liquid on ships. In addition to exporting hydrogen directly, hydrogen carriers such as ammonia and methanol can be used. The Government's targets for offshore wind generation are multiples of what Ireland will need in terms of meeting its own power demand, so hydrogen must play an important role in providing a route to market. In relation to electrical interconnectors:

- Ireland's all-island single energy market currently has electricity interconnection with Great Britain (GB) through the **500 MW East-West Interconnector (EWIC)**⁶⁶ and the **500 MW Moyle** interconnector.
- In January 2025 a new link to GB will be in place via the **500 MW Greenlink** interconnector.
- A first link to France across the **700 MW Celtic Interconnector** is under construction and due to be in place by 2027.

⁶⁵ The Government policy in relation to energy security is set out in the *Energy Security in Ireland to 2030* report, published in November 2023. Further analysis is ongoing.

⁶⁶ Brexit has affected interconnector flows between Ireland, the rest of the EU and the UK.

- There are plans at the early stages of development for two further links to GB through the **750 MW** MaresConnect and **700 MW** LirIC interconnectors.

This **3,650 MW** total of existing and planned interconnection is in the context of 12 GW (or 12,000 MW) being required to realise the 37 GW export scenario (BVG Associates, 2024b: 6). Regarding hydrogen transportation, existing natural-gas pipeline infrastructure can be repurposed, subject to careful transition management for consumers. One of Ireland's two gas interconnectors to the UK could be converted for 100 per cent hydrogen transport by 2040 (EHB, 2024).⁶⁷

Much technical and regulatory work is needed before these methods can be fully deployed for larger-scale energy export, and far greater capacity – over 8 GW – is likely needed.

Further, the current approach to interconnection under the Trans-European Networks for Energy (TEN-E) regulation is largely bilateral – i.e. between energy partner states. A more regional approach in the design of the electricity transmission system and interconnection relating to cost-benefit sharing is evolving. This is of key importance to countries such as Ireland and Denmark, with high generation potential but small domestic markets.

During consultation, NESC heard the view that the conversion of the existing gas interconnectors (initially IC1, which has a hydrogen capacity of 6 GW) can provide a safe, efficient and affordable route to import and export hydrogen. If offshore wind capacity scales up significantly and beyond Ireland's demand, it is argued, the second gas interconnector (IC2, which could have a hydrogen capacity of 12 GW) could be converted. Energy, in the form of hydrogen, could then be exported at scale into the UK and into to new pan-European hydrogen transport infrastructure (the 'Hydrogen Backbone') to markets such as Germany, using existing state assets.

While the physical infrastructure to enable export is being developed, so must the associated policy, regulation and market assessments – which do not appear to have been developed or modelled.

The *Offshore Renewable Energy (ORE) Technology Roadmap* 'does not examine the development of wider enabling technologies such as interconnection, hydrogen, e-fuels, battery storage and other grid flexibility technologies' (SEAI, 2024c: 3). Regarding hydrogen, the SEAI has highlighted that there is 'little regulatory framework currently in place to govern production, usage, transportation and storage of hydrogen (SEAI, 2024c: 110).

Work is ongoing to outline a pipeline of projects out to 2040 including a technical resource assessment of fixed and floating offshore wind in Irish waters. This assessment will inform future Designated Maritime Area Plan (DMAP) development and help identify key enablers of ORE projects (e.g. transmission grid, other offtake, supply chain, ports, etc). This process involves direct engagement with stakeholders across interest groups.

There appears to be a lacuna at present that undermines current targets, as well as the promise of enhanced economic resilience that is to accompany them. This also leaves important policy interactions unexplored – for example, the impact of the mandatory provision of preferential grid connection for interconnectors on the development of offshore wind capacity (SEAI, 2024c).⁶⁸

⁶⁷ The importation of hydrogen might also occur (through repurposed, existing pipelines or via new hydrogen pipelines) to support intermittent renewable power generation, and for use in the heat, transport and industrial sectors.

⁶⁸ *Electricity Regulation (EC) No 714/2009* requires that interconnectors be treated preferentially by EirGrid over other generation or demand grid connections.

Overall, the Council's consultation and analysis suggests a lack of clarity on a viable method of export of energy from Ireland. This is consistent with recent SEAI research (SEAI, 2024c: 87). There is an absence of detail specifically for energy export, including interconnection and hydrogen, which in turn are key enablers for large-scale offshore wind deployment. This is a particular weakness as Ireland's domestic demand is likely to remain limited relative to the State's ambitious generation capacity targets.

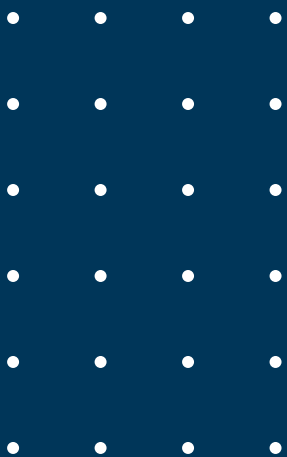
Developing a Viable Export Method: Getting Started

- Outline the viable export method that Ireland will use for any potential energy exports. A plan for delivering a viable export method is needed, whether it is through interconnectors, pipelines or shipping – or a combination of all three. The result must be a credible and competitive national framework of infrastructure and related regulation for international trade in energy to and from Ireland.

Chapter 9



Conclusion



Last year was the warmest on record globally. The average global temperature was 1.6°C above the pre-industrial average. It was the first calendar year with a global average temperature exceeding 1.5°C above the pre-industrial level (Copernicus, 2025).

Globally, emissions from fossil fuels are projected to have increased in 2024 (Global Carbon Budget, 2024). The continued emission of harmful greenhouse gases (GHGs) will lead to increasing global warming, and will intensify multiple and concurrent hazards (IPCC, 2023). Alternatively, if there are deep, rapid and sustained reductions in emissions, we can expect a discernible slowdown in global warming within around two decades, and discernible changes in our environment within a few years (IPCC, 2023).

Central to Ireland's response are our ambitious targets for renewable power generation. The positive impact on the environment of achieving these targets is indisputable. The cost of inaction would be unbearable. Further, there is an expectation that achieving our targets for the energy transition will create substantial co-benefits – such as 'green jobs', investment and the possibility of Ireland becoming an energy exporter – and bolster economic resilience through more reliable and lower-cost energy supplies.

In Ireland, delays in delivering greater levels of renewable generation capacity challenge the achievement of our national transition targets for the power sector and threaten the delivery of associated enterprise and economic resilience co-benefits.

The Council believes that Ireland's plans and targets for transition in the power sector must be credible and deliverable, as well as ambitious – such that societal confidence in and support for the transition overall are sustained.

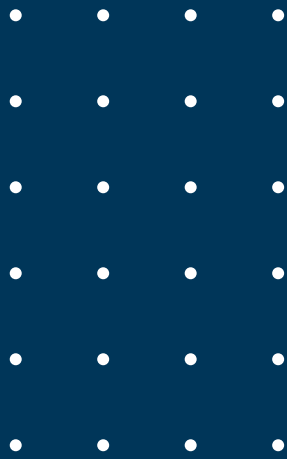
The Council's analysis highlights a fragmented approach to assessing economic resilience outcomes during the transition, unclear impacts on supply reliability and cost competitiveness, and an incomplete energy export model. The Council believes that Ireland's power sector transition is proceeding into 'fog', with limited visibility and strategic alignment, where key stakeholders are disconnected and uncertain about the path forward. These findings were reached on foot of an extensive literature and policy review, data analysis, and wide-ranging consultation with over forty key stakeholders in this policy area.

The Council therefore suggests that a renewed focus is warranted on the strategic, structural elements of the energy system that can make the transition happen. The power sector presents numerous opportunities, with new developments emerging frequently. Having ambitious targets to steer progress can help. However, these opportunities and innovations will only be realised when a market effectively connects consumers who are willing and able to pay with developers who are able to supply, via viable projects. This is a key element in creating a cost-competitive, secure, reliable and decarbonised power system – one which contributes to Ireland's economic resilience.

The Council's conclusions must not lead to policy paralysis; rather they demand a systematic, evidence-based response. To make sure the transition happens and is successful, there is a strong case – supported by stakeholders in this policy area – for more targeted work. Rather than new policy, legislation or targets, **the imperative is for work that addresses the strategic issues identified in this NESC report.**

Therefore, **the Council recommends actions to be taken now, next and later to reinforce Ireland's energy transition and economic resilience, and to help us reach our national decarbonisation potential.**

Overall, the Council believes there is an urgent need to address the strategic gaps identified in this report in a way that reinforces both the energy transition and economic resilience, while moving Ireland forward. NESC's recommended actions represent an agenda for the policy system to work through immediately to make transition in Ireland's power sector more likely, and more likely to be successful.



Appendix

Assessment Summary

Summary of Quantitative Estimates of Economic Impact from the Delivery of Renewable Power Infrastructure⁶⁹

Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
1 'Offshore renewable energy export potential for Ireland' (BVG Associates, 2024b)	2024	- Fixed offshore wind - Floating offshore wind - Hydrogen production, storage, and transmission - Interconnection	37 GW 10 GW fixed 27 GW floating - Well-connected scenario 12 GW interconnection	Out to 2060	GVA ⁷⁰ • €69bn • Peak at €2.4bn in 2049	Employment • 820,000 FTE⁷¹ years⁷² • Peak at 31,000 in 2049	Tax take ⁷³ • €16bn out to 2050 • Peak at €1bn in 2049
2 'Building our Potential' (BVG Associates, 2024a)	2024	- Offshore wind - Development and project management - Manufacturing - Installation - Operations, maintenance, and service	- Government capacity targets met - Government actively addresses skills shortages and attempts to increase local content in Ireland	- Up to 2030 - Up to 2040		Employment • 30,400 FTE years up to 2030, or 4,200 FTE in an average year to 2030 • 146,700 FTE years, or 8,600 FTE in an average year to 2040	

⁶⁹ Some totals rounded.

⁷⁰ Gross value added (GVA) is the aggregate of labour costs and operational profits.

⁷¹ Full-time equivalent (FTE) is a unit to measure employment. One FTE year is the equivalent of one person working full-time for one year, or two people working for six months. For seasonal roles therefore, filling one FTE year will require multiple employees.

⁷² FTE years: 43 per cent = floating offshore wind; 39 per cent = hydrogen; 13 per cent = fixed offshore wind; 5 per cent = interconnection.

⁷³ 'Tax take' includes corporation tax, income tax, social insurance and VAT.

Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
3 'The NDP in 2023' (Barrett & Curtis, 2024)	2024	- Onshore wind - Offshore wind - Solar	- Moving from 4.4 GW to 9 GW total onshore wind capacity by 2030 - Direct employment only - Meeting the target of at least 5 GW offshore wind - Installation activities only - Installation of an additional 7.32 GW of solar capacity - Construction activities for buildings and civil engineering works	Up to 2030		Employment <i>Onshore wind</i> 2,103 expected jobs annually - At least 5,152 full-time equivalent (FTE) construction workers out to 2030 - Expected mean of 14,720 workers out to 2030 <i>Offshore wind</i> 1,469 expected jobs annually 10,280 FTE out to 2030 <i>Solar PV</i> 4,392 expected jobs annually 30,744 FTE out to 2030	

	Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
4	'Act Now – Accelerating onshore renewable energy in Ireland' (KPMG, 2023)	2023	Onshore wind	9 GW of onshore wind energy by 2030 (= additional 4.5 GW?)	To 2030⁷⁴	GVA €550m additional GVA for the Irish economy if Government target is reached ~€2.7bn potential GVA arising from the capital activities required to meet Climate Action Plan targets by 2030	Employment 7,020 potential jobs throughout the sector and its supply chain	Other €1.5bn of total industrial - output across operating and capital activities €305m total payments in incomes to workers across the supply chain if Government target is reached ~€100m potential of contribution to local authority rates

⁷⁴ The report states: 'The forecasts for 2030 are likely to be conservative as the Government has since revised the target for onshore wind generation capacity to 9,000 MW which will require an increased level of investment' (p. 14).

Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
5 'Harnessing Our Potential' – Leahy et al./Carbon Trust for GreenTech Skillnet, managed by Irish Wind Energy Association (Carbon Trust & WEI, 2020)	2020	- Offshore wind - Supply chain study - Phases: - Planning and development - Procurement - Manufacturing - Transport and logistics - Installation and connection - Operation and maintenance - Decommissioning	3.5 GW of offshore wind energy by 2030 - CAP2019 context/targets	By 2030		Employment 21,000+ jobs (15,700,000 person days) during the life cycle of 3.5 GW projects⁷⁵ - Of these: - Planning and development = 210 jobs - Procurement = 130 jobs - Manufacturing = 16,900 jobs - Transport and logistics = 60 jobs - Installation and connection = 2,100 jobs - Operation and maintenance = 675 jobs - Decommissioning = 1,300 jobs <i>between 2050 – 2055</i>	Investment €17.9bn 'lifetime spend' to deliver 3.5 GW of offshore wind energy by 2030 - Of that, €7.7bn is by 2025 (1.5 GW) and €10.2bn is by 2030 (2 GW) €42bn in fixed and floating offshore wind energy <i>post 2030</i>

Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
6 'Blueprint for offshore wind in Ireland 2020-2050: A Research Synthesis' (Cummins & McKeogh, 2020)	2020	- Offshore wind - Supply chain (multiple activities in DEVEX, CAPEX – over 50% of overall cost relates to capital expenditure, OPEX, and DECEX.	6.5–7.3 GW of domestic offshore wind - Three port clusters as catalysts for jobs and enterprise in the Irish Sea (e.g. Rosslare), the Celtic Sea (e.g. Cork Harbour) and the Atlantic coast (e.g. Shannon Foynes and Killybegs)	2020–2029	GVA • €1.98–€2.2bn • €845–€948m in GVA in 2030 •	Employment • 12,012–13,491 direct and indirect jobs (equivalent to 29,702–33,558 person years of employment)⁷⁶	
7 'Growth of Onshore to Offshore Wind – Atlantic Region Wind Energy & Supply-Chain Feasibility Study' (Dublin Offshore, 2022)	2022	Onshore and offshore wind	- Atlantic: Northwest, West, and Midwest regions (from Donegal to Limerick) - Republic of Ireland 'Rapid' build-out scenario	Out to 2037	GVA • Atlantic • €2.87bn • ROI • €15.7bn	Employment • Atlantic • 44,320 FTE (9,460 = onshore; 34,860 = offshore) • ROI • 202,080 FTE (41,390 = onshore; 160,690 = offshore)	

Study	Year	Technology/Activity	Scenario	Year(s) of Outturn	Estimate 1	Estimate 2	Estimate 3
8 'Ireland's Sustainable Energy Supply Chain Opportunity' (SEAI, 2014)	2014	• Energy efficiency-related construction • Onshore wind energy • Electricity transmission grid • (Renewable heat technologies) • (Biomass CHP, AD, and heat generation) • (Small-scale generation technologies) •	• Estimate new business as a result of the anticipated investment in the sustainable energy-related products and services needed to meet Ireland's renewable energy and energy efficiency targets for 2020.	• 2020	Market size (average €/year to 2020) • €335 – 550m in onshore wind energy • €335 – 420m for the electricity transmission grid	Operations and • maintenance (€/year to 2020) • €55 – 70m in onshore wind energy • €45 – 70m for the electricity transmission grid •	Capital • expenditure (€/year to 2020) • €335 – 550m in onshore wind energy • €335 – 420m for electricity transmission grid

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