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Davy Decarbonization

Corporate Finance

Investing in Tomorrow: Shaping a Net-Zero Future

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Key Messages

The energy transition is underway and will require extensive cooperation among all stakeholders –government, consumers, corporates and investors. The investment required to achieve the 2030 and 2050 targets are substantial. This paper aims to set out the quantum and scale of investment, the likely source of the capital and the investment opportunities that are arising from the transition.

Tackling climate change has strong **political saliency** and **public support**. The Irish government has put in place a **supportive** and **enduring** policy and legislative framework, underpinned by international, EU and domestic law to coordinate action and **investment**.

The policy and legislative framework is a **work-in-progress**. The determination of Sector Emissions Ceilings has yet to be completed and further measures identified to address the emissions reduction targets. In addition, progress towards the targets remains slow. Accordingly, we expect **greater intensification** of ambition and measures in upcoming policy development and an across-the board-increase in the **urgency of execution**.

The **National Development Plan (NDP)** and the **Climate Action Plan** both set out actions to be taken by 2030 with regard to spending on the part of the state, industry and citizens. The Davy view of the spending required is €129 billion by 2030 or €18.5 billion (6.8% of GNI*) per year, decreasing to €12.5 billion (4.6% of GNI*) per year from 2030 to 2050. The incremental investment (to 2030) compared to business-as-usual is €7.8 billion per year (2.9% of GNI*). These are lower bound estimates. International norms suggest this is of the order of 5% of Gross National Product (GNP).

The Davy view is that **state spending** will be €18 billion to 2030, funded by the Exchequer in the ordinary manner. This is a lower bound as it does not include many of the investments outlined in the **NDP**, which sets out a capital programme of €165 billion – of which tens of billions could reasonably be attributed to climate action.

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The Davy view is that **private spending** will be €110 billion to 2030, funded by €97 billion of debt (and/or savings) and €13 billion of equity. Private spending includes consumer spending of €57 billion on electric vehicles (EVs) and home retrofitting.

There are well-known and considerable inhibitors to investment in Ireland, including: **planning, permitting** and **public acceptance** of infrastructure, notably the electricity grid; **skills** and **labour shortages**; and global **supply chain blockages**. Moreover, due to higher cost-of-capital, inflation and supply chain challenges, the equity markets are hesitant to invest and therefore a re-assessment and re-alignment of public support are needed.

Table 1: Investment Requirement for the Energy Transition in Ireland to 2030

Sector	Davy Estimate					Incremental Investment					
	Total €bn	Public €bn	Private €bn	Debt €bn	Equity €bn	Per Annum 24-30 €bn	%GNI*	GFCF22 €bn	%GNI*	Incremental Investment €bn	%GNI*
Electricity	€43		€43	€32	€11	€6.1	2.3%	€1.6	0.6%	€3.1	1.1%
Transport	€43	€4	€39	€39		€6.1	2.3%	€3.2	1.2%	€1.5	0.6%
Buildings Residential	€23	€13	€10	€10		€3.3	1.2%	€7.0	2.6%	€1.6	0.6%
Buildings Commercial	€13		€13	€12	€1.3	€1.9	0.7%	€16.7	6.1%	€1.0	0.4%
Industry	€3		€3	€3	€0.3	€0.43	0.2%			€0.3	0.1%
Agriculture	€4.3	€1.7	€2.6	€2.3	€0.3	€0.6	0.2%	€1.3	0.5%	€0.3	0.1%
Total	**€129**	**€18**	**€110**	**€97**	**€12.9**	**€18.5**	**6.8%**	**€29.8**	**10.9%**	**€7.8**	**2.9%**

Source: Davy Estimates[1]

1 Modified GNI or (GNI*) for 2022 has been reported at €273billion and is used throughout this report for comparison reasons

Introduction

The energy transition to address climate change is a significant and essential undertaking for all of society. It will require extensive cooperation among stakeholders: **government** will provide a policy and legislative framework, financial supports/subsidies and undertake the corresponding public spending; **entrepreneurs** and **companies** will innovate and transition their businesses to low-carbon models; **consumers** will modify and change their behaviours; and **investors** (from all parts of the capital structure) will provide funding across all sectors of the economy and parts of the value chain (from development through to operating assets).

This transition is already underway, and it involves a significant transformation of the economy, industrial system, society and way-of-life. It will necessitate a large quantum of investment. Ireland is not alone in making this transition, and the competition for capital and resources will be intense. From a macro-economic perspective, the Irish economy is well positioned to support and fund this transition. This should provide comfort to investors that their investments will not only be secure but should generate attractive returns.

The purpose of this paper is to catalogue the **investment opportunities** that are arising from this energy transition; to set out the **quantum;** to classify that as either **public** or **private** spending; and to consider how it could be funded.

The energy transition is being impelled by action (including investment) that is expected to take place in large measure further to the policy and legislative framework. Accordingly, a study of the framework is necessary to **reveal and extract** the investment opportunities that it intends to provide. Furthermore, the framework itself is of interest to investors who will be keen to understand how it currently **supports** investment and its trends and **endurance**.

Accordingly, in the first part of this White Paper we examine the policy and legislative framework and the constraints to investment in the Irish economy. We review international literature to establish a norm for the quantum of investment (i.e. 'top down') followed by a sector-by-sector discussion ('bottom-up'). We then examine the current perspective of funding markets. The final section explores the quantum, the different types of capital required and the likely source of this investment.

Policy and Legislative Framework

The policy and legislative framework **(Framework)** is a key enabler of the energy transition and gives rise to an opportunity set of investment. Investors, companies and the financial services industry are very interested in this framework as it affects sentiment in general and in two specific regards: (i) whether the Framework or individual components are investable (or not) and individual project business cases are justified; (ii) once an investment is made, whether the Framework will endure and the benefits be reasonably realised.

This overview of the Framework examines its grounds, evolution and, in light of the foreseen challenges, envisages what development trend is plausible or likely..

International Policy Context

A whole-of-society and industrial transformation is already well underway as the transition to net-zero emissions by 2050 continues. Much of the policy and regulatory framework has been or is being constructed. The political and popular saliency of environmental stewardship, biodiversity loss, global warming and climate change has come to the fore and intensified over the past three decades. There are numerous international agreements addressing these subjects and, for our purpose, specifically on reducing greenhouse gas emissions to limit global temperature rise. These include treaties such as the *United Nations Framework Convention on Climate Change* (1994) and the associated *Kyoto Protocol* (2005), the *Paris Agreement* (2016) and associated decisions such as the *Glasgow Climate Pact* (2021). The *Paris Agreement* is legally binding and has been ratified by 193 states and the European Union.

The UN-sponsored discussions are informed and complemented by the reports and work of the **Intergovernmental Panel on Climate Change (IPCC)**, which assesses the science related to climate change. The *Paris Agreement* sets out the goal of containing the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. Moreover, in the course of the negotiations on the *Paris Agreement*, the IPCC was invited to address the subject of 1.5°C and, accordingly in 2018, published a Special Report[2] which found that limiting global warming to 1.5°C would require:

> *"Rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide would need to fall by about 45 percent from 2010 levels by 2030, reaching **'net zero' around 2050**" (emphasis added).*

Since that publication and consistent with their obligations under the *Paris Agreement*, many countries, regions, cities and companies have adopted net-zero standards of various strengths: some as policy statements, others legally binding and others as declarations.

Climate change and biodiversity loss are interlinked: 15% of global greenhouse gas emissions result from nature loss and deforestation caused mainly by activities involving animal husbandry, mining, palm oil, rubber, soy and timber. As the connection between climate crises and biodiversity loss becomes more apparent, international policy and regulation for countries and corporates to halt nature degradation is growing. Often viewed as nature's equivalent to the *Paris Agreement*, the **Kunming-Montreal Global Biodiversity Framework (GBF)** aims to halt and reverse nature loss while safeguarding biodiversity globally. The EU Restoration Law supports meeting the EU's international commitments under GBF. It impacts forest, agriculture, marine, waterways and urban spaces with binding legal targets by 2030. The EU Deforestation

[2] The IPCC (an independent body under the World Meteorological Organization) publishes Assessment Reports (on climate change, its causes, potential impacts, and response options); Special Reports (assessment of a specific issue); and Methodology Reports (guidelines for the preparation of greenhouse gas inventories).

Regulation, passed in May 2023, mandates all EU commodities and products to be deforestation free by 2030 with full traceability back to the forest. The premise for these policies is that by supporting the recovery of nature, we invest in a more productive future that aligns with achieving the EU's climate and biodiversity objectives. The investment returns from every €1 invested are estimated to bring a return of at least €8 in benefits.

The **UN Environment Programme** publishes annual reports (aka 'gap' reports) assessing the difference between where greenhouse gas emissions are predicted to be in 2030 and where they should be to meet the temperature targets. The 13th edition (2022) of the report finds that even if current pledges are implemented, the temperature rise is estimated to be 2.4-2.8°C; to achieve 1.5°C, emissions must be reduced by a further 45% by 2030. This has pointed to the need for ever more urgent action and responsibility, especially on the part of the developed world.

EU Policy Context

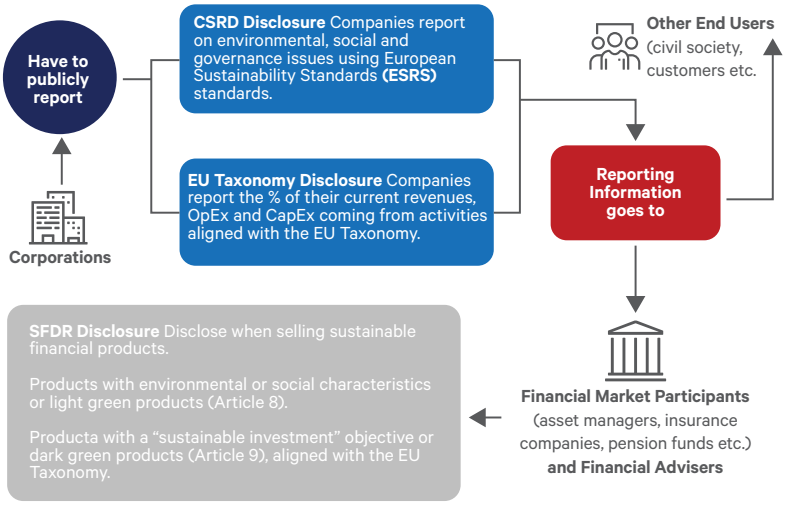
The EU and its member states have long been leaders and vigorous participants in climate diplomacy, and there exists an extensive corpus of policy and legislation in this field. Notably, France and the UK (both in 2019) were among the first countries to give a legal strength net-zero pledge by 2050 followed by the European Union (the *European Green Deal/European Climate Law* (2021)) and joined by Ireland (the *Climate Action and Low Carbon Development (Amendment)* Act 2021). This has settled the aim and end point of the transition for those countries.

In 2018, the European Commission published the EU *Sustainable Finance Action Plan*. This plan sets out a wide-ranging strategy to further connect finance with sustainability through ten defined actions divided into three overarching categories: reorienting capital flows towards a more sustainable economy, mainstreaming sustainability into risk management and fostering transparency and long-termism in financial markets.

Central to the EU *Sustainable Finance Action Plan*, the EU *Taxonomy* is a science-based classification system that provides a standard for determining whether an economic activity can be considered environmentally sustainable. The framework provided by the EU *Taxonomy* regulation assesses companies and funds against criteria focused on six key environmental objectives. The EU *Taxonomy* introduced the concept of 'Do No Significant Harm' – in order for an activity to be classified as environmentally sustainable, it must do no significant harm to the remaining environmental objectives.

The figure below illustrates the disclosure requirements within the *Sustainable Finance Action Plan* framework. Recent changes to the *Market in Financial Instruments Directive II* include sustainability preferences for investors that are expected to further drive capital towards sustainable investments.[3]

Figure 1: EU Sustainable Finance Action Plan Framework



Source: EU Commission

[3] This is further explained in the Davy White Paper "Future Proofing Financial Reporting For Sustainability"

The *Sustainable Finance Disclosure Regulation* **(SFDR)** requires in-scope financial market participants to disclose information related to sustainable investments and the risks associated with sustainability. The primary objective of SFDR is to promote transparency in sustainability and ensure that companies can finance sustainable growth. The regulation includes disclosure requirements that apply to both businesses and products to standardise sustainability reporting and prevent 'greenwashing'. SFDR categorises investment funds into three categories of sustainability based on the product's sustainability objectives[4].

The *Corporate Sustainability Reporting Directive* **(CSRD)** is now in force. It modernises and strengthens the rules about the Environmental, Social and Governance **(ESG)** information that companies must report. A broader set of large companies, as well as listed Small Medium Enterprises **(SMEs)**, will be legally mandated to report annually on sustainability. CSRD ensures investors and other stakeholders will have access to the necessary information to evaluate investment risks that may result from climate change and other sustainability concerns. This will foster a culture of transparency regarding the impact of companies on the environment and people. The first companies will have to apply the new rules in financial year 2024 for reports to be published in 2025. Entities in scope of CSRD will be required to comply with detailed sustainability reporting standards – the European Sustainability Reporting Standards **(ESRS)**. The ESRS comprises 12 standards covering ESG matters and represents over 80 new non-financial data points on which corporates will need to begin gathering data for reporting and assurance. Requirements on climate change, biodiversity loss and other sustainability priorities are prescribed in the ESRS, with accountability required in annual reporting on all regulatory and material ESG impacts.

CSRD will also require companies falling within scope to formulate and disclose transition plans. These must include the implementation of actions and related financial and investment plans aimed at ensuring that their business models and strategy are in line with the transition to a sustainable economy and reducing global warming to 1.5°C, in accordance with the *Paris Agreement*.

An immediate EU focus is to complete the policy and legislative framework for 2030; accordingly, the first legislative phase of the *Green Deal* is a vast policy compendium known as *Fit-for-55*, referring to 55% emissions reduction by 2030 compared to 1990 levels. The political settlement on this target (i.e. 55%) reifies the progressive evolution of ever-increasingly ambitious climate policy in the EU encouraged by the 'ratcheting up' expected under the *Paris Agreement*. The first target set was for a 20% emissions reduction in the *2020 package* (proposed 2008); a 40% reduction by 2030 was set out in the *Clean Energy Package* (proposed 2016); following political negotiations, this has now been settled at 55%[5].

The Fit-for-55 package is extensive in scope and gives rise to a wide range of expectations on individual member states and, of particular interest, to country level targets/expectations for emissions reductions, energy efficiency, renewable energy, vehicle standards and more. The various instruments addressing these topics have been enhanced, made more ambitious, recast, supplemented, expanded and deepened. For example, the Renewables Energy Directive has evolved in this manner and is now in version III (RED-III).

The Fit-for-55 package has also been complemented by various other instruments, including *EU Strategy for Energy System Integration, EU Solar Energy Strategy, EU Hydrogen Strategy* and a *Hydrogen and Decarbonised Gas Markets Package*. Finally, greater emphasis and policy ambition have been brought by *REPowerEU* following the invasion of Ukraine (also covered in the Davy White Paper *Identifying the Opportunities in an Accelerated Energy Transition*). The key instruments are set out in Table 2.

[4] This is further explained in the Davy Horizons guide What the EU's Sustainable Financial Disclosure Regulation (SFDR) means for PLCs (davy.ie)

[5] The EU Emissions Trading System is also a good example: it was first set up in 2005 and has its parameters and coverage progressively increased and is now in Phase IV (2021-2030).

In brief, the evolution of policy over the past 30 years or more can be understood to have broadened in coverage from an early focus (mid-90s) on emissions reduction from point sources (i.e. industrial facilities) to encompass the entire energy system (including distributed heat and transport) and lately the whole of society. The early thrust of policy was to encourage energy efficiency and renewable energy, and this has endured with various iterations of Directives. A construct emerged (c.2005) known as the emissions/security/cost trilemma and resulted in greater integration with economic policy[6]. Throughout this development, the policy has become increasingly voluminous, ambitious and ever more detailed and technical while progressively addressing consequential topics. The Fit-for-55 package includes 20 pieces of EU legislation.

Table 2: Key EU Targets in the Fit-for-55 Package: The Fit-for-55/Green Deal/REPowerEU packages contain a wide and extensive range of policy instruments and targets.

	Target	Instrument	Note
Emissions Reduction	55% reduction over 1990	▪ Emission Trading System ▪ Effort Sharing Regulation ▪ LULUCF Regulation	Ireland's target for the non-ETS sector is 42% (versus 2005 baseline)
Renewable Energy	42.5% of energy consumption	▪ Renewable Energy Directive	
Energy Efficiency	9% reduction by 2030 c/f BAU	▪ Energy Efficiency Directive ▪ Energy Performance of Buildings Regulation	
Vehicle Emission Standards	Path to zero emissions by 2035 (intermediate targets 2030)	▪ Emissions Performance Standards for Cars/Light Vehicles ▪ Ban on Internal Combustion Engines in 2035	

Source: European Commission

[6] At about the same time (from the mid-90s onward), in the economic sphere, EU policy was focusing on opening competition in the electricity and gas sectors (well covered in former Davy White Paper Identifying the Opportunities in an Accelerated Energy Transition) and as time progressed this was progressively joined coherently with this environmental sphere.

Irish Policy Context

"Electricity generation is just one of the important dimensions of an overall energy policy. It is, of course, crucial to our economic development but it is also inextricably bound up with other energy questions such as security of supply of fossil fuels, general energy conservation and the development of indigenous resources."
- Desmond O'Malley TD, Minister for Industry, Commerce and Energy: Forward to Energy Ireland White Paper, July 1978

As discussed above, the construction of the Framework is now well advanced and been underway for a considerable period of time (decades). For example, the Kyoto Protocol was ratified by Ireland in 2002 and implemented in 2005; a White Paper on Energy was published in 2007[7] and again in 2015[8] (post the Great Financial Crisis); whereas the original version of Climate Action and Low Carbon Development Act was enacted in 2015.

Moreover, climate change has taken a renewed and significant prominence and emphasis in recent years, and there is now strong political and popular support for the impending actions. The transition can be thought of as an extensive formal and informal 'public private partnership'. In this partnership, government has two contributions: (a) to put in place the necessary institutional, policy and legislative framework and (b) to make the necessary public investments and spending. The private sector and citizens' contribution is to change behaviour and take actions guided by the Framework, including making the necessary investments.

There has been a significant uptick in activity in recent years, especially from about 2017 onwards. The following are notable examples:

- **Strong political and popular support** – this has been evident for several years at the polls and also in the widely reported and well supported Citizens Assembly (2017); commitments made in the *Programme-for-Government* (2020); and a (renamed) Joint Oireachtas Committee on Environment and Climate Action.

- **Legally binding** – statutory targets are in place to meet net-zero emissions by 2050, and legally binding Carbon Budgets (addressing 51% emissions reductions on 2018 levels by 2030) based on *Sectoral Emissions Ceilings* are in place, which are informed and underpinned by three editions of a progressive and ambitious *Climate Action Plan*[9].

- **Institutional arrangements** – there is a revamped, consolidated and better resourced Department of the Environment, Climate Change and Communications **(DECC)** that in this government shares a Minister with the Department of Transport containing the Office of Zero Emissions Vehicles **(ZEVI)**; a Climate Action Unit in the Department of Taoiseach; Climate Action Regional Offices; Climate Change Advisory Council; and a newly established Marine Area Regulatory Authority, all complementing the existing agencies.

- **'Flagship' publications** – there have been many government 'flagship' publications, notably Project Ireland 2040, combining the *National Planning Framework* (now supplemented with the *National Marine Planning Framework*) and the **NDP**; and the *National Adaptation Framework*. Adaptation will also require investment, but this is out of the scope of this White Paper.

- **Grants, fiscal and taxation measures** – there are a range of grants available for retrofitting homes and the purchase of EVs and various taxation measures, including zero VAT rating on solar panels, and accelerated capital allowances for energy efficiency equipment.

[7]The White Paper on Energy preceding this was published in 1978 Energy Ireland where issues such as nuclear power and the supply shock of the Arab Oil Embargo (1973) were then front of mind.
[8]The introductory section of this White Paper sets out well the policy context at that time and the issues that arose since the last White Paper (2007) and the outlook then expected to 2030.
9 There have been three editions of the Climate Action Plan. Notably, the first edition (CAP-I) was produced by the previous government – meaning that support for this Plan and its maintenance has transcended governments. The various editions of the plan will be referred to in this White Paper as CAP-I, CAP-II or CAP-III (current version) where relevant.

- **Long-term government commitments** – the new institutions (above), the long-term statutory net-zero target and the Carbon Budgets/Sectoral Emissions Ceilings are all striking examples of the current government seeking to establish long-term intentions for itself and for future governments. Other examples include embedding climate change in the National Strategic Outcomes of the NDP; incorporating the shadow price of carbon into the *Public Spending Code*; a political and legal commitment (*Finance Act (2020)*) to an increase in the carbon tax (by way of a ladder to reach €100/tonne by 2030); adopting the *OECD Green Budgeting Framework*; and using hypothecation of carbon tax revenues[10] and extra budgetary funds[11].

- **Targets** – in addition to statutory targets, there are a wide range of other targets set out consistently in the annual editions of the **Climate Action Plan**. Notably, in some particular policy domains, long-term contracts (e.g. the Renewable Energy Support Scheme **(RESS)** are provided for investor certainty.

- **Work in progress –** work continues on many important aspects, notably planning and development; the first revision to the *National Planning Framework*; a *long-term strategy for greenhouse gas emissions reductions* and *energy storage policy* among others.

10 The commitment to progressively increase carbon taxes bodes well for enticing the desired behavioural change (e.g. encouraging the switch from fossil fuels to say heat pumps), and the aims of hypothecation are towards climate action and 'just transition' – seeking to make the tax more progressive and the transition more just.
11 There are three non-Exchequer funds of relevance: the Environment Fund, Energy Efficiency National Fund and the Climate Action Fund.

The National Development Plan

Ireland's NDP outlines the government's investment plan over the 2021-2030 period. Originally, the NDP addressed an EU requirement on member states to set out how (the then) 'Community' Cohesion Fund disbursements would be spent; the Irish NDP broadened that and included the national capital expenditure programme. The capital spending of each is provided below:

- National Development Plan (2021-2030) - €165 billion
- National Development Plan (2018-2027) - €116 billion
- Capital Plan, Building on Recovery (2016-2021) - €42 billion
- Infrastructure and Capital Plan (2012-2016) - €17 billion
- National Development Plan, Transforming Ireland (2007-2013) - €184 billion
- National Development Plan (2000-2006) - £41 billion
- National Development Plan (1994-1999) - £20.2 billion (27.6 ecu)
- National Development plan (1989-1993) - £9.6 billion

The current version covering the period 2021-2030 is organised around 'themes', specifically ten **National Strategic Outcomes (NSOs)**, and sets out associated expenditure ceilings totalling €165 billion.

Embedding climate change in the NDP has been particularly noticeable in recent editions and is now well integrated in the current edition. Each NSO incorporates the sustainability agenda – most notably NSO8, which is in fact '**Transition to a Climate-Neutral and Climate Resilient Society**' – and therefore complements and overlaps the initiatives set out in the Climate Action Plan. For example, the NDP discusses the earmarking of €5 billion for improvements in residential energy efficiency and €1.5 billion to target the decarbonization of the agriculture sector along with a discussion of renewable electricity targets, energy efficiency/retrofitting the National Smart Metering programme and enhanced electricity interconnection.

There is, however, no breakout or itemisation of the proportion of public capital expenditure that can be attributed to climate action, but the departmental breakdown (for 2021-2025) is set out in Table 4.2 (of that Plan). Helpfully, the previous edition (NDP 2018-2027 in Table 3.2) sets out the capital expenditure associated with each NSO. It can be seen that NSO4 (Sustainable Mobility) is €8.6 billion, NSO8 is €21.8 billion and NSO9 (Sustainable Water) is €8.9 billion. It is therefore safe to conclude that a significant proportion (of the order tens of billions) can be regarded as attributable to climate action.

For completeness, government is also committed to international climate finance reaching €225 million per year by 2025. In addition, it is interesting to note that the institutional, governance and delivery mechanisms have also evolved and become more aligned. For example, the publication of White Papers has now transformed into the publication of periodic Climate Action Plans with increased coherence, consistency and granularity. Lately, in CAP-III, an alignment with the Carbon Budgets has been made.

In conclusion, there has been strong political and bureaucratic investment in the policy Framework. It is grounded in international and EU law; it is extensive in range, scope and depth; and, importantly, it has been on a continual progressive evolutionary **trend** of greater intensity and ambition.

Constraints

There are a number of well-known and considerable challenges to investment in the energy transition sector in Ireland, namely **planning** and **permitting, electric grid availability** and **supply chains**. It is worth noting in passing that there are many other constraints or dependencies that will affect the pace of the transition including market design, technological innovation and the emergence of new business models.

Planning and Permitting

The issues and blockages that have arisen from public acceptance and planning/permitting of energy infrastructure are well known. This is not confined to Ireland, and the EU has tentatively advanced policy and legislation in this area. A recent paper by the **Electricity Association of Ireland** sets out the current situation: in 2022 it took on average 58 weeks for a decision on a planning appeal and 76 weeks for a Strategic Infrastructure Development case. A presentation by the **Department of Housing, Local Government and Heritage** to the Wind Energy Ireland conference sets out the extent to which energy projects remain in planning. The Climate Change Advisory Council, in a letter to the heads of government, presents statistics that go back to 1990 on planning for solar and wind farms – showing an increasing backlog.

Government is responding to this challenge. A temporary EU Regulation (laying down *a framework to accelerate the deployment of renewable energy*) was adopted that includes decision time limits, the creation of a presumption of overriding public interest[12]. These provisions are to be put on an enduring basis when the RED-III Directive is enacted. REPowerEU included a concept of Renewable 'Go-To' areas (not unlike the 'Developer led' option advanced by EirGrid in *Shaping our Electricity Future*), now being commonly referred to as 'plan-led'.

The *Planning and Development Bill (2023)* is making its passage through the Oireachtas and addresses several reforms, including restructuring of (the renamed) **An Coimisiún Pleanála**; changes to the thresholds and procedures for Judicial Reviews; timelines and financial consequence associated with case processing; a concept of imperative reasons for overriding public interest; and an emphasis on a plan-led approach combined with new ministerial guidance. Resources are also being addressed, with up to 59 additional posts being promised to the (reformed) Coimisiún.

Government has also approved the establishment of a dedicated Planning and Environment division of the High Court.

While these reforms are welcome, they will take time to enact and implement and they address only the legal aspects; the cultural and societal issues also remain to be solved (perhaps in the spirit of the 'public private partnership'). This is beyond the scope of this White Paper and deals with such matters as the just transition, localism, citizens' support and community gain.

Electricity Grid Availability

The availability of, and access[13] to, the electricity grid is a continual topic of concern for developers in Ireland and in many other countries. As a generalisation, the grid was developed over the past decades as a linear delivery mechanism to transfer bulk power from relatively few point sources. However, the energy transition involves numerous geographically distributed sources and requires fundamental transformation of the power system. EirGrid has demonstrated leadership in this regard and set out various road maps regarding how the electricity grid will transform: *Grid-25* was published in 2008 and, more recently, *Shaping our Electricity Future* (2021 and 2023). Nonetheless, there remains considerable opposition in Irish society to grid development, and in some cases transmission is now being placed under the ground.

12 This was well covered in a former Davy White Paper 'Irish Solar's Time to Shine'.
13 Access is complicated and administered by EirGrid and ESB Networks; originally known as Group Processing Approach (since 2004) and currently (since 2020) Enduring Connection Process.

The scale of grid investment needed both onshore and offshore (and associated landfalls) is unprecedented (see below). This is well recognised internationally and, for example, discussed in the recent report by the UK's Electricity Networks Commissioner. It is a particularly pronounced risk in light of the fact that the electricity sector is to be the 'backbone' of the transition to grow by over twofold. For example, in EirGrid's document *Network Deliver Portfolio – Guidance Document (October 2022),* 348 projects are contemplated and 'Powering up Dublin' is also underway. Urgent progress is needed on successfully implementing these projects.

Human Resources and Skills

The situation regarding Ireland's labour market constraints is also well known, and there is notable commentary by the **Department of Finance** in its Summer Economic Statement (2023):

"Mounting labour shortages in certain sectors, particularly construction, represent a particular risk for increasing wage pressures."

In the electricity sector there is a well-known and acute shortage of some skills (e.g. power engineers). This issue is involved and relates to demographics, immigration policy and skills development (trades, higher and further education) and will take time to adjust to a new normal.

Supply Chains

Global supply chains remain disrupted in the aftermath of the pandemic, and major geopolitical competition and tensions are continuing with 'de-coupling', de-risking and 're-shoring'. Access to minerals, notably in the field of batteries for EVs, is a well-recognised issue. Industrial policy is re-emerging with the US Inflation Reduction Act and the EU Net Zero Industry Act. Manufacturers' order books are jammed and there are long lead times for many items including turbines, cables, power electronics, etc. Companies report having to pay substantial down payments and/or pre-order equipment. There are also acute shortages of some specialised plant, for example vessels needed for the installation of offshore wind turbines. This is a complex area related to global supply chains, manufacturing capacity and related issues with the multilateral framework of global order.

These constraints represent a significant risk to achieving the 2030 targets within the remaining six years.

Critique Framework, Constraints, and Investor Confidence

This policy domain has become vast and a formal evaluation[14] and is out of the scope of this White Paper. However, what is of interest for the present purpose is the relationship between the Framework (a work-in-progress) and the investment contemplated to achieve its objectives.

The overarching targets are the carbon budgets to address an overall emissions reduction of 51% by 2030 on 2018 levels (Table 3). The budget provides for national emissions of (no more than) 495MT of CO_2 equivalent over two budgetary periods (2021/5 and 2026/2030).

Table 3: Ireland's Carbon Budgets: The total budget is 495 MT of CO_2 equivalent over two 5-year budgetary periods to 2030.

Budget Period	2021 - 2025	2026 - 2030	2031 – 2035 (provisional)
$MtCO_2$ eq.	295	200	151
Average annual reduction	4.8%	8.3%	3.5%

Source: Climate Action Plan

Completeness of the Framework

There has undoubtably been creditable progress made in the construction of this Framework with a strong uptick in activity from 2017 onwards; indeed, a recent progress report by the **Department of the Taoiseach** on completeness of the actions set out in the CAP-III assesses this at 75%. However, the Framework remains incomplete in two regards.

- The Sectoral Emission Ceiling for the Land Use Land Use Change and Forestry **(LULUCF)** sector has yet to be determined pending the completion of the Land Use Review. This is a pronounced gap and raises uncertainties about whether the ceilings and/or budgets for the other sectors may need future revision.
- The construct of the budget includes a provision for **unallocated savings** of 26 MT (5.25%) which are to be allocated to measures ahead of the second carbon budget. This also gives rise to uncertainties that the already identified measures may also need revision.

14 An evaluation of a policy framework would ordinarily examine at a minimum necessity (is public intervention needed?), appropriateness (are the right instruments, e.g. taxes or regulations, etc being employed?), effectiveness (are the desired objects being achieved?) and efficiency – all in light of intended and unintended consequences. The Irish government recommends that Programming Logic Models (inputs, activities, outputs results and impacts) should be used.

This means that the Framework is not precisely calibrated for the desired emissions reduction targets; this was set out clearly by the Chair of the Climate Change Advisory Council in the Council's annual review:

"Government still has not identified how carbon budgets are to be allocated to sectors with uncertainties relating to the LULUCF sectoral emissions ceiling and the unallocated savings for the second carbon budget period. The Council is extremely concerned that this clarity may arrive too late to provide the necessary signals to all sectors of their obligations over the period to 2030 and beyond. If we are to achieve our targets this needs to be clarified urgently to enable sectors to prepare their approach to ensure they comply with their targets in the future."

This matter is also subject to a Judicial Review taken by Friends of the Irish Environment.

Progress

There are also concerns about the efficacy (i.e. the relationship between the output and the outcomes sought) of the Framework. Interestingly, **Met Éireann** published a study on climate averages for 1991-2020 and found that Ireland has become warmer and wetter in the last 30 years and that average yearly air temperature is now 9.8°C (1991-2020), an increase of 0.7°C. Although this points to the global climate condition, it is nonetheless interesting.

The **Environmental Protection Agency**'s publication on *Ireland's Greenhouse Gas Emissions Projections* found that:

"Ireland is not on track to meet the 51 per cent emissions reduction target (by 2030 compared to 2018) based on these projections which include most 2023 Climate Action Plan measures. Further measures still need to be identified and implemented to achieve this goal.....The first two carbon budgets (2021-2030) will not be met, and by a significant margin."

Furthermore, the Chair of the **Climate Change Advisory Council** variously noted:

"While I welcome the reduction in greenhouse gas emissions of 1.9% [2022 compared to 2021] and the progress made across sectors, at the mid-point of the first five-year carbon budget we are not on track to achieve our emissions targets. [parentheses added]....Ireland will not meet the targets set in the first and second carbon budget periods unless urgent action is taken immediately, and emissions begin to fall much more rapidly."

The Council goes further and makes sector-by-sector recommendations as part of its 2023 annual review. The clear conclusion is that more measures, actions and initiatives are urgently required. Overall, from an investor perspective, the following observations can now be made.

- **Supportive, enduring policy** – in general, the movement to address climate change is both supportive and enduring (not least international treaty obligations obtain), and the EU and Irish government have already put in place an extensive policy and legislative framework. It is also a work-in-progress and will likely require adjustment and augmentation for the foreseeable future. It is also worth noting that certain individual policy elements (for example the RESS) are underpinned by long-term contacts. A key issue that will emerge for investors is to see a clear connection between policy and on-the ground action, i.e. that an 'implementation disconnect' does not gain root and that a wider universe of investors are enabled to participate.

- **Greater intensity and ambition** – although acknowledging that the Framework needs time to operate and achieve its objects, there are nevertheless serious indications that progress is slow (2025 and the end of first budget period is now in view). This is likely to mean a response (perhaps in the upcoming CAP-IV) along the lines of greater intensification of policy and/or new measures being identified. The Climate Change Council has provided helpful recommendations in this regard. It is also worth bearing in mind that this is a long-term programme, and it may be that achievement of certain targets will take longer, i.e. be achieved over the course of the 2030s, which itself is a milestone to 2050 (indeed, in the recent State of the Union speech, 2040 targets were mooted).

- **Troublesome constraints** – the constraints are troublesome and are impeding investment. Government action – specifically planning reform – is underway. Along with this, the geopolitical, supply chain and demographic issues will take time to resolve and adapt to a 'new normal'.

Overall Investment Quantum

The required quantum of investment has been the subject of several international studies. Global energy investments currently stand at c.US$2 trillion per year or 2.5% of global GDP. The **International Energy Agency** estimates that this will rise to $5 trillion (2.5x) or 4.5% of GDP each year to 2050; the **International Renewable Energy Agency** estimates the requirement at US$5.7 trillion per year until 2030; and **Bloomberg New Energy Finance** estimates average investment requirements to be between US$3.1 trillion and US$5.8 trillion per year until 2050. The **European Commission** (in a staff working document) estimated that the average annual investment will be of the order of €1,040 billion (or 6.6% of EU GDP). From this sample, a norm is that the investment to GDP ratio is in the region of 5% of GDP.

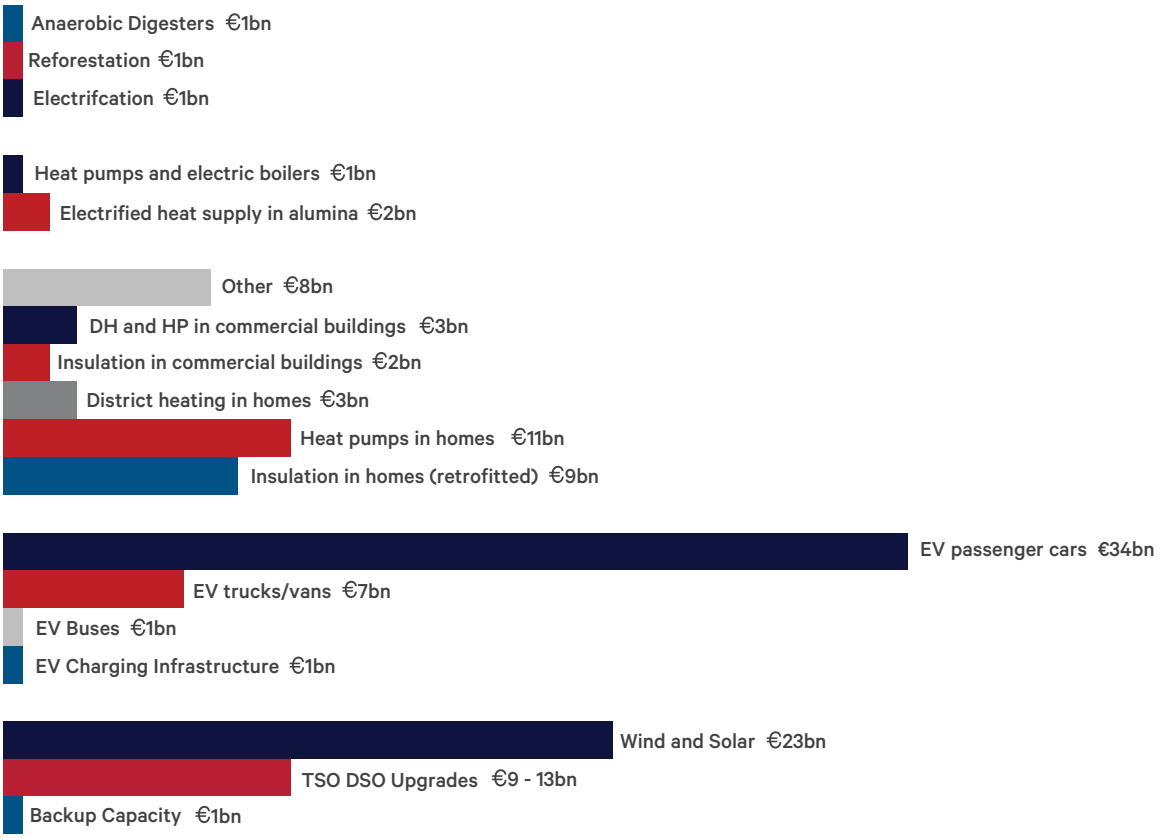
Present to 2030 Period

CAP-III has provided a preliminary analysis of the quantum of investment required to meet the sectoral ceilings on emissions. Analytical capacity is being developed by the **Department of Expenditure and Reform** and the **Economic and Social Research Institute (ESRI)** over the next 18 months.

DECC's preliminary analysis suggests that a total of €119 billion of incremental and re-directed capital investment in low-carbon technologies and infrastructure through 2022-2030 is needed to achieve the target of reducing emissions by 51% by 2030. This largely comprises transport (€43 billion), electricity (€35 billion) and buildings (€36 billion). Significant contributors within these sectors include EV) passenger cars (€34 billion) and wind and solar renewables (€23 billion). This is set out in Table 4 and represents an annual investment of c. €17 billion per year or (5.9% of GNI*[15]).

15 Modified GNI (or GNI*) for 2022 has been reported at €273 billion and is used throughout this report for comparison purposes.

Table 4: Preliminary Analysis of Investment needed to mobilise key technologies, along with incremental investment by sector.



	Electricity	Transport	Buildings Residential	Buildings Commercial	Industry	Agriculture
Total Investment in Sector	€35bn	€43bn	€23bn	€11bn	€3bn	€3bn
Share of Which in Incremental	50%	25%	50%	53%	63%	50%

Source: Climate Action Plan

The Department's estimates imply that circa €50 billion would be incremental investment through the 2022-2030 period. For example, only 25% of additional spending on EV passenger cars is assumed to be incremental. The bulk of incremental investment for electricity will come from the private sector, supported by user fees and levies.

The NDP envisages public capital spending of €165 billion out to 2030, raising public investment to 5% of gross national income – above the EU average of 3%. This investment is intended to support climate targets in areas such as renewable electricity generation, retrofitting building and public transport infrastructure. There is no breakdown available as to what portion of this €165 billion can be attributed to climate change; however, as outlined above, this could be of the order of tens of billions.

Past research by the **UCC/MaREI** and, more specifically for the agriculture sector, by **Teagasc** points to similar conclusions (Table 5). They estimate the required additional investment to achieve a 51% reduction in emissions across all sectors. This implies an extra €4 billion of expenditure, or 2% of gross national income. In the case of transport, two-thirds to three quarters relates to passenger transport, primarily cars. In the base case, there is assumed to be no substantial deployment of EVs.

Table 5: Average Annual Investment, 2026-2030, base year prices

Sector	Baseline annual investment	Additional annual investment to achieve 51% cut in emissions
Transport	€4.1bn	€0.8bn
Supply	€0.1bn	€0.2bn
Services	€0.9bn	€0.2bn
Residential	€1.3bn	€1.6bn
Power	€2.3bn	€0.8bn
Industry	€0bn	€0.5bn
Total	**€8.7bn**	**€4.1bn**

Source: UCC/MaREi modelling

In the household sector, an additional €1.6 billion (0.59% of GNI*) of spending per annum is estimated. This estimate appears consistent with retrofitting costs of €40,000-50,000 for each of the targeted 500,000 dwellings.

With the exceptions discussed above, carbon budgets have now been established for each of the main sectors of the economy. These budgets are consistent with the targets set in the Climate Action Plan III. In what follows we review each sector, its targets and the measures identified to achieve these targets. We also assess the investment required and provide a critique. The overall targets for each sector extracted from the Climate Action Plan are summarised in Table 6 below.

Table 6: Sectoral Emission Ceilings: Note the ceiling for the LULUCF sector has not yet been determined (shown as "N/A") and unallocated emissions are shown at 26 MT.

Sector	2018 Baseline ($MtCO_2$ eq.)	Sectoral Emission Ceilings for each 5 - year carbon budget period ($MtCO_2$ eq.)		Emissions in final year of 2021 - 2025 carbon budget period) ($MtCO_2$ eq.)	Reduction in Emissions in final year of 2021 - 2025 carbon budget period compared to 2018 baseline	Emissions in final year of 2026 - 2030 carbon budget period) ($MtCO_2$ eq.)	Reduction in Emissions in final year of 2026 - 2030 carbon budget period compared to 2018 baseline
Sector	2018	2021 - 2025*	2026 - 2030*	2025*	2025	2030	2030
Electricity	10	40	20	6	~40%	3	~75%
Transport	12	54	37	10	~20%	6	~50%
Built Environment - Residential	7	29	23	5	~20%	4	~40%
Built Environment - Commercial	2	7	5	1	~20%	1	~45%
Industry	7	30	24	6	~20%	4	~35%
Agriculture	23	106	96	20	~10%	17.25	~25%
LULUCF	5	N/A	N/A	N/A	N/A	N/A	N/A
Other (F - Gases, Waste & Petroleum refining	2	9	8	2	~25%	1	~50%
Total	**68**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Legally Binding Carbon Budgets and 2030		295	200			34%	51%
Annual unallocated Emission Savings in 2030			5.25				
Unallocated Savings 2026 - 2030			26				

Source: Climate Action Plan

The 2030-2050 Period

Although most of the research material addresses the time period to 2030, there is some material addressing 2050. In the State of the Union address, the President of the European Commission stated that targets for 2040 will now be developed. Nevertheless, we get a glimpse of the transition from 2030 to 2050 in the following publications.

In April 2023, the government published a consultation on *Ireland's Long-term Strategy on Greenhouse Gas Emissions Reduction*. This indicates that a further €200-250 billion of investment will be required from 2030-2050. This is an average annualised investment of €10-12.5 billion (c.4.1% GNI*) per year. This is likely understated as investments in hydrogen (green hydrogen becoming commercially available then, according to the Irish Academy of Engineers) are set to take place.

The period is also addressed in the *Policy Statement on the Framework for Phase Two Offshore Wind*, where a longer-term vision for offshore wind targeting 20GW of offshore production by 2040 and at least 37GW by 2050 is mentioned. Moreover, The *Programme for Government* spoke of 30GW of offshore wind; the *Joint Statement on the North Seas Energy Cooperation* (2022) attributes 7GW for Ireland by 2030, 15-20GW by 2040 and 37GW by 2050. In the Ostend Declaration, it is stated that Ireland will establish at least 4.5GW offshore wind by 2030 and 20GW by 2050. Finally, the **DNV** report that accompanied the Policy Statement on Interconnection also has some very interesting scenarios for 2030, 2040 and 2050.

An interesting study published by **MaREI** (Table 7) contains a 2050 scenario, which shows the electricity generation sector growing by c.3 times from 2019 to 2050 (i.e. electrification) and the combined production from wind and solar amounting to c. 96% (decarbonisation).

Table 7: Scenario of Solar/Wind in Ireland's 2050 Net Zero Energy Power System: The total primary energy requirement grows from c. 30 TWh in 2019 to 122 TWh in 2050 (Our Climate Neutral Future. This study contemplates storage of approximately 3 GWs in 2050.

	TWh	GW	2019
Wind	77	21	≈ 10 TWh
Solar	4	4	≈ N/A
Total (Wind/Solar)	*81*	*25*	
Electricity	84	37	30 TWh
Wind/Solar Share of Electricity	*96%*	*66%*	
Primary Energy	122		157 TWh
Electricity Share of Primary Energy	69%		19%

Source MaREI, Wind Energy Ireland; Davy Research

Electricity Sector Analysis to 2030

EU Policy

The EU policy covering this sector was discussed above, and it is important to note that electrification will be at the centre of the energy transition.

Irish Policy, Targets and Investment Requirement

This sector accounted for an approximately 14% share (10MT baseline in 2018) of greenhouse gases in 2021 and is targeted to decrease by 75% by 2030, as per the carbon budget (3MT in 2030). The key measures are to increase the share of renewable electricity to 80% by 2030, with targets of 9GW of onshore wind, 5GW of offshore wind (and an additional increment to manufacture hydrogen) and 8GW of solar. The carbon budget for the sector, along with the key measures and investment identified, is set out in Table 8. The mid-range investment requirement is identified in CAP-III at €35 billion, of which €18 billion (50%) is incremental to business-as-usual.

Table 8: Key Targets and Investment Requirement for the Electricity Sector

Sectoral Carbon Budget 2021 to 2025 $MtCO_2$ eq.	Cumulative Emission to 2021	Remaining Sectoral Carbon Budget 2022 to 2025 $MtCO_2$ eq.	Sectoral Carbon Budget 2026 to 2030 $MtCO_2$ eq.
40	9.98	30.02	20

	Onshore Wind	Offshore Wind	Solar PV	Biomethane	TSO/DSO Upgrades	Backup Capacity
2025 KPI	5.9GW	0.015GW	0.96GW	0.7TWh	-	-
2030 KPI	8GW	5GW	2GW	1.4TWh	-	-
Investment Required	€23bn				€9-13bn	€1bn
Incremental Investment	50%					

Source: Climate Action Plan

Achieving the above will be challenging as the sector is growing and Moneypoint Power Station is transitioning to oil-firing (to be run as a last resort).

Analysis and Commentary

CAP-III has identified a sector investment of the order of €35 billion (by 2030). EirGrid's publication *Shaping our Electricity Future* v1.1 mentions an investment requirement (originally set out in Shaping V1.0, published November 2021) of €40-50 billion (by 2030) in the power generation sector alone. This investment addressed the then 70% RES-E target; in order to reach the now 80% target, the level of investment will need to rise.

In previous Davy White Papers *Irish Solar's Time to Shine* and *Energy Storage Unlocking Renewable Energy's Full Potential*, the total addressable markets for solar and storage are covered. These estimates, together with further research around onshore and offshore wind, are set out in Table 9 below totalling €28 billion.

Table 9: Targets, Investment and Funding of (Power Generation) Electricity Technologies

Technology	Gap-to-Target	Investment	Equity	Debt
Onshore Wind	4GW	€5bn	€1bn	€4bn
Offshore Wind	5GW	€15bn	€5bn	€10bn
Solar	6GW	€4bn	€1bn	€3bn
Batteries	2GW	€4bn	€3bn	€1bn
Total	**17GW**	**€28bn**	**€10bn**	**€18bn**

Source: Davy analysis

In addition to the above, investment is needed in the back-up capacity[16] (to be used when intermittent renewables are unavailable); this is estimated at €1 billion. This brings the total of the power generation sector estimate to €29 billion. Applying norms for financing of these technologies, we estimate that this €29 billion would be funded by €10 billion equity and €19 billion debt (the back-up capacity assumed funded by debt).

EirGrid and ESB Networks are currently operating under a regulated price control regime (known as price review #5 or PR5) covering the years 2021-25 and jointly have a total allowed capital spend of €4 billion. In its *Networks for Net Zero* publication, ESB Networks sets out a total investment of €10 billion to 2030, which covers on-land transmission and distribution networks. Allowing for spend (pro rata) already incurred in PR5, this implies a spend to 2030 of approximately €8 billion. For information, EirGrid in *Shaping (ibid)* identifies a transmission spend of €3.4 billion. This estimate of on-land networks likely understates this given the pressures on the grid due to electrification, digitisation and anticipatory investment. Furthermore, many assets are already (or soon will reach) end of life and need substantial capital investment for refurbishment or replacement.

EirGrid is developing an interconnector with France (the Celtic Interconnector) that has an estimated budget of €1.6 billion; in accordance with a Franco-Irish joint regulatory decision, EirGrid will have responsibility for an estimated spend of €1 billion (€988 million). Furthermore, EirGrid has responsibility for developing the offshore transmission grid, and CRU has estimated this to be in the order of €3.9 billion for Phase I of the *Offshore Renewable Energy Programme*. This represents a total EirGrid spend of c.€5 billion. This is corroborated in the recent CRU paper *Offshore Revenue Recovery Model – EirGrid*, where it anticipates a regulated asset base of €5 billion by 2030 (up from €40 million at the end of 2025).

Further interconnection with GB and the continent is contemplated in *Shaping (ibid)* (which addresses 2030), in the *National Policy Statement on Electricity Interconnection (2023)* and in the technical paper by **DNV** (which addresses 2030, 2040 and 2050). Ireland and the UK have recently entered a MoU that also addresses interconnection. Our balance-of-view[17] is that by 2030, **Greenlink** (due in 2024) and **MaresConnect** (both to GB) should be included in the estimates at an additional €1+ billion (which is private equity). Beyond 2030, capital spend on interconnectors will likely increase – indeed, a bold vision is set out in *Supergrid- Super Solution*.

16 We note that DECC has a security-of-supply review underway; a Temporary Emergency Generation programme is also being implemented; planning permission has recently been refused for a LNG facility at Shannon by New Fortress Energy.
17 EirGrid and DNV agree that Celtic and Greenlink should be assumed completed by 2030, whereas EirGrid assumes a second link to France; DNV assumes a second GB connection (presumably MaresConnect) with capex of €687 million. For the avoidance of doubt, both EirGrid and DNV agree that LirIC between NI and Scotland should be included.

In summary, the investment for transmission and distribution is €14 billion: (a) €8 billion on-land (mainly by ESB Networks); (b) €3.9 billion by EirGrid on the off-shore grid; (c) €1 billion by EirGrid (on Celtic); and (d) €1 billion by Greenlink/MaresConnect on interconnection. Given that the bulk of this investment is by state-owned entities, this will be funded by debt (€15 billion) with the balance by private equity of €1 billion. This is further discussed below.

Taking the above, the Davy estimate for incremental capital expenditure for the electricity sector is of the order of €43 billion – of which all is private and funded by €32 billion in debt and €11 billion in equity (Table 10). This investment is further discussed below and is put in context by comparison to business-as-usual investment for the sector.

The key actions for this sector (which will be at the centre of the transition) are to continue to integrate the wind/solar resources while ensuring security of supply and to invest in the grid infrastructure.

Table 10: Davy view of the Investment Required in the Electricity Sector to 2030

	Climate Action Plan III						Davy Estimate				
	Low	Mid	High	Increment		Total	Total	Public	Private	Debt	Equity
Electricity				50%	€18bn	€35bn	€43bn		€43bn	€32bn	€11bn
Wind and Solar		€23bn						€24bn	€24bn	€17bn	€7bn
TSO / DSP Upgrades	€9bn	€11bn	€13bn						€14bn	€13bn	€1bn
Back Up Capacity		€1bn							€1bn	€1bn	
Storage									€4bn	€1bn	€3bn

Source: Source: Climate Action Plan; Davy analysis.

Investment opportunities in the Electricity sector

There has been a high level of activity in this sector in recent years, mixed with the departures of **Equinor** and **Shell** and strong disagreement over the pace of the now eventual introduction of a plan-led process in Phase II of the Offshore Renewable Energy programme. We continue to see opportunities emerging from this sector:

- The onshore wind sector is dominated by large domestic and international players. **Greencoat Renewables** is the largest operator of wind assets, and state-owned companies **ESB**, **Bord na Móna** and **FuturEnergy** (a joint venture between **ESB** and **Coillte**) have significant shares. **SSE**, **Statkraft** and **Energia** also have established positions in this relatively mature market.

- The offshore sector is still at a relatively early stage of development with 3.1GW of contracts awarded in the recent Offshore Renewable Energy Support Scheme auction. The successful candidates in this process included an **EDF/Fred Olsen** joint venture, **SSE**, **RWE** and a joint venture involving **Macquarie's Green Investment Group**.

There is a significant pipeline of projects being developed in the Irish and Celtic seas by a range of companies including **ESB**, **OceanWind** (joint venture **Bord na Mona** and **Engie/EDP**), **Mainstream** and **Simply Blue Energy**. The key to developing a successful offshore sector in Ireland is ensuring appropriate supply chains are in situ. Some companies are developing supply chain solutions that are being deployed around the world and will eventually be adopted in the Irish market. These include survey vessels by **Mainport** and **Green Rebel** and the innovative unmanned solution developed by **XOcean**, crew transfer vessels by **Farra Marine** and cable technology solutions by **Subsea Microplies**. Finally, there is a significant opportunity for floating offshore wind in the Atlantic waters – all to meet the 37GW by 2050 target.

Port infrastructure is also critical to the development of the sector and there are a number of proposals to develop adequate port facilities along the east (Dublin and Rosslare), south (Cork) and west (Foynes) coasts. An interesting recent announcment has been made by **Drogheda Port Company** in connection with the development of a new deepwater port at Bremore, Co. Meath

- Solar is less mature, with the recent auction delivering almost 800MW of new projects. There are developers in the Irish market that have successfully developed capacity in recent years. Between them, **Terra Solar**, **BNRG**, **Elgin Energy**, **Amarenco** and **Highfield Energy** have developed over 2.2GW of solar capacity in the Irish market and have significant pipelines to come.

- Energy storage is a critical enabler of accommodating higher quantities of variable power on the grid. In the short duration market, **Lumcloon Energy** is developing and operating battery farms while **Gore Street Capital** and **Gresham House** have built a portfolio of operating assets. As the proportion of renewables continues to increase, the need for long duration storage will also rise. **Corre Energy** is developing a pipeline of grid-scale storage assets across Europe and North America based on compressed air technology. In the longer term, Green hydrogen could emerge as a storage method – **dCarbonX** is developing a solution in this space.

- Significant investment in the grid will also be required to facilitate the 80% renewables target, with **EirGrid** and **ESB Networks** tasked with developing and implementing an ambitious investment programme. Private equity is emerging in the interconnection area and elsewhere. Concurrently, innovative demand-side management/grid services companies have emerged including **GridBeyond**, **Viotas** and **Electroroute**, with the latter now owned by **Mitsubishi**. Dublin-based **Cenergise** has developed an energy trading platform for commercial and industrial companies. **SuperNode** is developing a high voltage DC solution to provide more efficient transmission of electricity across long distances that will be an important enabler of interconnection and meshed grids.

Over time, we see the potential for the development of a domestic, renewables-based independent/integrated power producer (IPP) combining wind (onshore and offshore), solar, storage, demand-side and other grid services including national and/or international interconnections. Most of the components are in place but could soon take the next step and aggregate to form a fully-fledged renewables-based energy utility.

Summary: Electricity Sector

- **Baseline (2018)** – 10 MT emissions with a 14% share (2021).
- **Object (2030)** – 3 MT being 75% reduction on baseline (rounding excepted).
- **Measures** – Off-Shore Wind (5 GW), On-Shore Wind (4 GW), Solar (6 GW), Storage (2 GW), Backup Capacity and Grid.
- **Investment** – €43 billion or €6.1 billion per annum or 2.3% of GNI*.
- **Incremental Investment** – €3.1 billion per annum or 1.1% of GNI*.
- **Funding** – €32 billion debt and €9 billion equity.

Built Environment and Industrial Sectors Sector Analysis to 2030

The built environment (including residential and commercial/public) and industrial sectors, as present in the CAP, are combined and considered collectively below.

EU Policy

Across the EU, buildings are responsible for approximately 40% of total energy consumption and 36% of greenhouse gas emissions. The key policy instruments are: the *Energy Efficiency Directive*, the *Energy Performance of Buildings Directive* (covered above) and the *Renovation Wave for Europe*.

The latter seeks to double the rate of renovation, tackle energy poverty (which coincides with the worst-performing buildings), public buildings and social infrastructure, and decarbonise heating and cooling. In order to achieve the overall 55% emission reduction target by 2030, greenhouse gas emissions from buildings must be reduced by 60% and final energy consumption by 14%.

Irish Policy, Budgets, Targets and Investment Requirement

In Ireland, the built environment accounts for approximately 12%[18] of emissions (2021) and is addressed by a variety of instruments, studies and plans, including the *National Energy Efficiency Action Plan* (now replaced by the National Energy and Climate Plan[19]), the *Energy Efficiency Obligation*, the *National Heat Study*, the *National Retrofit Plan* and a range of grants and supports. These emissions must be reduced by over 40% (residential) and 45% (commercial) on a 2018 baseline per the carbon budget. The carbon budget for the sector, along with the key measures and investment identified, is set out in Table 11.

Table 11: Carbon Budgets, Key Targets and Investment Requirement for the Buildings Sector

Sector	Sectoral Carbon Budget 2021 to 2025 $MtCO_2$ eq.	Cumulative Emission to 2021	Remaining Sectoral Carbon Budget 2022 to 2025 $MtCO_2$ eq.	Sectoral Carbon Budget 2026 to 2030 $MtCO_2$ eq.
Residential	29	7	22	23
Commercial / Public	7	1.5	5.5	5

	Buildings Residential	Buildings Commercial
2025 KPI	▪ 120,000 retrofitted homes ▪ 45,000 new heat pumps in residential buildings ▪ 170,000 new homes with heat pumps ▪ 0.7TWh of district heat supplied ▪ 0.4TWh consumption of zero-emission gas ▪ No fossil fuel boilers to be established in new Irish homes beyond 2023 ▪ Energy demand reduction in line with high persistent price effectt	▪ Savings of 375 Kt Carbon Dioxide in ▪ commercial and public buildings ▪ 25,000 buildings with heat pumps ▪ District heating demand of ~0.1TWh ▪ Zero-emission gas demand 0.22TWh
2030 KPI	▪ 495,000 retrofitted homes ▪ 400,000 new heat pumps in residential buildings ▪ 290,000 new homes with heat pumps ▪ 2.5TWh of district heat supplied ▪ 0.7TWh consumption of zero-emission gas ▪ No fossil fuel boilers to be established in new Irish homes beyond 2023 ▪ Energy demand reduction in line with high persistent price effect	▪ Savings of 735 Kt Carbon Dioxide in ▪ commercial and public buildings ▪ 55,000 buildings with heat pumps ▪ District heating demand of ~0.2TWh ▪ Zero-emission gas demand 0.4TWh

	Insulation in homes (retrofitted)	Heat pumps in homes	District heating in homes	Insulation in commercial buildings	DH and HP in commercial buildings	Other
Investment Required	€11bn	€9bn	€3bn	€2bn	€3bn	€8bn
Incremental Investment	50%			53%		

Source: Climate Action Plan

18 The definition of the built environment sector in Ireland is different to that used by the UN/EU and hence the 12% and 36% emission share figures are not directly comparable.
19 The Governance Regulation in the Clean Energy Package reformed the arrangements for reporting by member states from individual plans to an omnibus plan known as the National Climate and Energy Plan (see Bibliography).

The combined investment in the residential and commercial/public sectors set out in CAP-III is €3 billion, of which €2 billion is incremental.

The industrial sector accounted for approximately 10% of emissions in 2021. This must reduce by 35% (per the carbon budget) by 2030 compared to 2018 by means of a reduction in the use of fossil fuels in heating, increased electrification, energy efficiency and use of low carbon materials. Carbon abatement in industry requires improvements in energy efficiency; greater electrification of low-to-medium temperature heating; increased supply and use of biomethane and green hydrogen. Given the growth in demand for cement (e.g. in housing), the cement industry may require a carbon capture and storage solution[20]. Uptake of these opportunities can be accelerated through policies that facilitate business investment in low carbon processes, providing appropriate support and reviewing regulatory conditions. The carbon budget for the sector, along with the key measures and investment identified, is set out in Table 12 below.

Table 12: Targets and Investment Requirement for the Industry Sector

Sectoral Carbon Budget 2021 to 2025 $MtCO_2$ eq.	Cumulative Emission to 2021	Remaining Sectoral Carbon Budget 2022 to 2025 $MtCO_2$ eq.	Sectoral Carbon Budget 2026 to 2030 $MtCO_2$ eq.
30	7.1	22.9	24

	Industry	
2025 KPI	■ 50-55% share of carbon neutral heating in total fuel demand ■ Demand for construction materials remains flat ~20% vs. ■ 'do nothing' scenario ■ ~1.2TWh consumption of zero-emission gas ■ 3% reduction in energy demand	
2030 KPI	■ 70-75% share of carbon neutral heating in total fuel demand ■ Demand for construction materials remains flat ~30% vs. ■ 'do nothing' scenario ■ ~2TWh consumption of zero-emission gas ■ 10% reduction in industry energy demand	
	Electrified heat supply in alumina	**Heat pumps and electric boilers**
Investment Required	€2bn	€1bn
Incremental Investment	63%	

Source: Climate Action Plan

The investment in the industry sector set out in CAP-III is €36 billion, of which €18 billion is incremental to business-as-usual.

In these two combined sectors, these targets are to be achieved by reducing the use of all fossil fuels (peat, coal, oil and natural gas) to heat buildings, along with an increase in retrofit activity. Buildings will need to switch to heat pumps or district heating by 2050. All new buildings will become emissions free from the outset by way of progressive regulation to introduce zero energy buildings together with banning use of fossil fuels and adopting electric heat pumps, renewable gas and district heating. The challenge will then be to raise the energy performance of the existing building stock; the *National Retrofit Plan* estimates that 500,000 buildings will be refurbished with grant assistance by 2030.

20 The cement industry requires high temperature heat and hence fuels of a high calorific value. The industry is subject to the ETS price; the Fit-for-55 package contains a proposal to address carbon leakage known as the Carbon Border Adjustment Tax; and the treatment of the UK (now a third country) is uncertain. All these factors will combine to influence the economics of domestic cement production, trade flows and hence the extent of emissions and, accordingly, the sizing of carbon capture and storage facilities that may be required.

Analysis and Commentary

Capital expenditure contemplated in CAP-III in the built environment and industrial sectors is of the order of €39 billion, with a proportion of this to be grant assisted. Exchequer funding of €8 billion to 2030 has been earmarked in the NDP and a further €5 billion from the carbon tax funds for a total of €13 billion in public funds.

The **Strategic Banking Corporation of Ireland** is in the process of developing with the **European Investment Bank** a loan guarantee scheme to provide householders with a competitive funding offer so as to increase the rate of retrofit activity. A report by the **Banking & Payments Federation of Ireland** recommends financial supports to make retrofits more affordable including tax incentives, a low-cost finance scheme and increased grants and subsidies for ancillary costs such as Building Energy Rating certification.

The *National Retrofit Plan* estimates the cost to a homeowner of retrofitting to be as much as €66k with grant levels varying but typically of the order of 50%. This can be understood in light of the fact that average annual gas and electricity bills are approximately €4,000[21], upon which potential savings could be made (the IMF reports that the amortisation time is 11.6 years). This would imply a total capital expenditure on 500,000 homes of the order of €33 billion, with a proportion grant aided. This will be consumer spending funded by a combination of savings and debt. By this reckoning, the CAP-III capital expenditure estimate – at a mid-range of €23 billion – is broadly consistent; however, inflation adjustments are necessary.

In the commercial and industrial sector, there are a large range of supports available and well set out by the Department of Enterprise Trade and Employment.

Investment opportunities in the Built Environment sector

We foresee many investment opportunities emerging from this sector including the following:

- Solutions that make new buildings more energy efficient and retrofitting of existing stock. Wall and window insulation are among the main methods of achieving this, as is installation of electric heat pumps to replace fossil fuels. **Kingspan** is the leading provider of wall and roof insulation into the residential and commercial construction sector. **Grant Ireland**, **Dalkin** and **Mitsubishi** are leading suppliers of domestic heat pump solutions.

- Solutions (e.g. smart thermostats) that drive smarter consumption of energy in buildings focused primarily on spatial heat (60% of domestic energy consumption). There are a growing number of providers in this space, including Irish companies like **Climote** and **Hub Controls.**

- Smart solutions are also being adapted to provide demand-side management solutions for the grid. Examples include **Climote**, which has developed a solution to dynamically use electricity at off-peak periods to heat domestic water tanks. **Ohme** is providing a similar solution for domestic and commercial EV infrastructure.

- District heating is emerging as a solution for the reuse of waste heat from industrial and data centres to provide energy to domestic and commercial customers. This technology is well established in Northern Europe, with the first pilot project up and running in Tallaght, West Dublin. The recent District Heating Steering Group report outlined capital required of €2.7-4 billion to reach a target of 2.7TWh of district heating, which is consistent with the CAP-III estimate of €3 billion in Table 13. The Codema *Dublin Region Energy Masterplan* estimates the cost of district heating at €7.7 billion by 2050.

21 In 2022/3 due to very high imported commodity prices, household bills were reported at €5,400 (net of government €600 credit which was in addition to an excise tax reduction on petrol/diesel).

- Reusing or recycling building materials is also an important means of reducing emissions from the built environment. **CRH**, which is the largest road construction company in the US, is already reusing 25% of waste asphalt in its product mix with plans to increase this to 40% over time. Similarly, **CRH** continues to look at ways of using building materials such as concrete as a carbon sink.

The key action for this sector is to increase the rate-of-retrofitting. The Davy estimates for these combined sectors are summarised in Table 13.

Table 13: Davy view of the Investment Required in the Build Environment and Industrial Sectors to 2030: The rate of retrofitting will likely need to be increased; no estimate is made of possible installation of carbon capture and storage in the cement sector. Consumer spending is of the order of €39 billion. This requires inflation adjustment.

Sector Initiative	Climate Action Plan III				Davy Estimate			
	Mid	Increment		Total	Public	Private	Debt	Equity
Buildings Residential		50%	€12bn	€23bn	€13bn	€10bn	€10bn	
Insulation in homes (retrofitted)	€11bn							
Heat Pumps in homes	€9bn							
District Heating in homes	€3bn							
Buildings Commercial		53%	€7bn	€13bn		€13bn	€12bn	€1.3bn
Insulation (Sp) in commercial buildings	€2bn							
DH and HP in commercial buildings	€3bn							
Other	€8bn							
Industry		63%	€2bn	€3bn		€3bn	€3bn	€0.3bn
Electrified heat supply in alumina	€2bn							
Heat pumps and electric boilers	€1bn							

Source CAP-III; Davy analysis

Summary: Built Environment and Industry Sector

- **Baseline (2018)** – Built Environment 9 MT emissions with a 12% share (2021) and Industry 7 MT with a 10% share (2021).
- **Object (2030)** – 5 MT being 40-45% reduction on baseline (rounding excepted) for Built Environment and 4 MT for Industry being a 35% reduction on the baseline.
- **Measures** – Energy Efficiency, Retrofitting, Electrification, move away from Fossil Fuels, new building materials and perhaps Carbon Capture and Storage.
- **Investment** – €39 billion or €5.6 billion per annum or 2.0% of GNI*.
- **Incremental Investment** - €2.9 billion per annum or 1.1% of GNI*.
- **Funding** - €13 billion public; €26 billion private being €24 billion debt and €1.6 billion equity (rounding excepted).

Transport Sector Analysis to 2030

This section discusses territorial emissions. Out of scope are emissions from aviation (where work is underway by the **International Civil Aviation Organization** on the Carbon Offsetting and Reduction Scheme for International Aviation); Sustainable Aviation Fuel; and the work underway by the **International Maritime Organisation** on emissions from ships.

EU Sectoral Policy

Transport-related emissions currently account for approximately 25% of the EU's total greenhouse gas emissions and are targeted for reductions of 90% by 2050.

The Fit-for-55 package includes an *Alternative Fuels Infrastructure Regulation*, which sets targets for deploying electric charge point infrastructure and alternative fuel networks including hydrogen refuelling. Furthermore, the Commission adopted a *Sustainable and Smart Mobility Package* (2020) with the aim of making the European transport system sustainable, smart and resilient (e.g. a 2030 30 million EV target).

This was elaborated by a *Package of Measures for Efficient and Green Mobility* (2021) covering: updates to the regulation on the *Trans-European Transport Networks*[22] **(TEN-T)** and the Directive on *Intelligent Transport Systems;* a new urban mobility framework; and an action plan to boost long-distance and cross-border passenger rail.

The overall strategy for decarbonisation of transport is a combination of demand management/reduction, shifting use (away from private vehicles towards public transport) and improvements in the journey experience (e.g. a move to EVs or integrated ticketing, etc.).

Irish Policy, Targets and Investment Requirement

The transport sector in Ireland accounts for approximately 16% of emissions (2021), and this is required to be reduced by 50% by 2030 (on 2018 levels). To this end, an 'avoid', 'shift' and 'improve' framework has been adopted. A study was carried out by the OECD **International Transport Forum** that simulated transport requirements for the Greater Dublin Area and showed that the area's mobility could be delivered with only 2% of the current number of private vehicles (by means of ride sharing and reconfiguration of public transport).

The *National Investment Framework for Transport in Ireland (*2021) ensures that investment is aligned with the *National Planning Framework* and supports delivery of the NDP's National Strategic Outcomes. In addition, both an *Electric Vehicle Charging Infrastructure Strategy,* setting out a roadmap for the roll-out of the infrastructure, and a *National Sustainability Mobility Policy* have been adopted.

In connection with the roll-out of EV charging infrastructure, it is worth noting that the (recast) Directive on *Common Rules for the internal Market for Electricity* (specifically Article 33) created the presumption that this will, by default, be undertaken by non-regulated/private sector. Specifically, the electric Distribution System Operators will not undertake this activity unless there is an established market failure. This is a key policy prescription to enable the kick start of private investment in charging infrastructure.

22 Trans-European Transport Network is an EU-wide network of railways, roads, waterways, shipping routes, ports and airports and Ireland is now part of two corridors: the North Sea-Mediterranean and Atlantic corridors. The Core network should be completed by 2030, the extended Core by 2040 and the comprehensive network by 2050. Notably, the Port of Galway has now been added to the Core network.

The carbon budget for the sector, along with the measures for EVs and investment identified in CAP-III, is set out in Table 14. Fleet electrification and the continuing use of biofuels (increasing the blend to E10 for petrol and B20 for diesel) will provide the majority of the abatement.

Table 14: Key Targets and Investment Requirement for the Transport Sector

Sectoral Carbon Budget 2021 to 2025 $MtCO_2$ eq.	Cumulative Emission to 2021	Remaining Sectoral Carbon Budget 2022 to 2025 $MtCO_2$ eq.	Sectoral Carbon Budget 2026 to 2030 $MtCO_2$ eq.
54	10.9	43.1	37

	Transport
2025 KPI	■ 75,000 passenger EVs ■ 20,000 commercial EV vans and 700 EV heavy goods vehicles ■ 125,000 additional sustainable journeys ■ 300 EV buses and expanding electrified rail services ■ Bioethanol blend vol% E10 ■ Biodiesel blend vol% B12
2030 KPI	■ 20% share EV of total passenger car fleet ■ 100% share EV of total new registrations of private car fleet ■ 645,000 private EVs ■ 20% EV share of total LGV fleet ■ 95,000 commercial EVs ■ 3,500 low emission HGVs ■ 30% EV share of new HGV registration ■ 1,500 EV buses and expanding electrified rail services ■ Bioethanol blend vol% E10 ■ Biodiesel blend vol% B20

	EV passenger cars	EV trucks / vans	EV buses	EV charging infrastructure
Investment Required	€34bn	€7bn	€1bn	€1bn
Incremental Investment	25%			

Source: Climate Action Plan

Transport is a much wider policy sphere than set out in the CAP. The NDP estimates €35 billion in investment in transport to 2030 with €15 billion allocated to the **National Transport Authority (NTA)** (of which €8 billion is earmarked for **Transport Infrastructure Ireland**); flagship projects include BusConnect, DART+ programme (to be delivered by 2030) and Metrolink (in the 2030s). The attribution of this investment to the transition to net-zero is not available; nevertheless, it is clear that (with the exception of public-private partnership arrangements) it will be government spending financed by the Exchequer in the ordinary way.

The *All-Island Strategic Rail Review* was recently jointly commissioned by the Department of Transport and the Department for Infrastructure in Northern Ireland and is currently under public consultation. It contemplates a rail capital programme of €31.8 billion, most of which is to be spent post 2030.

Analysis and Commentary

The 50% reduction in emissions from the transport sector is set to be achieved through a combination of demand reduction, a modal shift to public transport/active travel and electrification of and use of biofuels in vehicles – domestic and commercial. Biofuels and green hydrogen are expected to play a role in displacing fossil fuels in HGVs; **Gas Networks Ireland** and **Circle K** are already offering BioCNG. Interestingly **ElectroRoute** recently announced it will provide biomethane services to **DHL** fleet who have entered an arrangement with **Stream Bioenergy.** Hydrogen may play a role in heavy transport, and trials are underway at **Dublin Bus** and **Irish Rail** (retrofit of locomotives). **Irish Rail** have announced a new strategy to reduce their emission by 51% by 2030

CAP-III sets out costed targets for fleet electrification (€43 billion), including EV charging infrastructure (€1 billion). It also includes measures to increase the bioethanol and biodiesel blends. This is in the wider context of an extensive transport policy framework involving a spending programme in the order of €35 billion and an announced ban on sales of internal combustion engines (by 2035), all in the timeframe up to 2030. Public investment will include a wide range of areas including active travel (€360m/year), urban and rural road and light and heavy rail infrastructure (Connecting Ireland) and improvements in integrated ticketing or tickets for young people, etc.

The target of 940,000 EVs comprises 845,000 passenger vehicles and 95,000 light goods vehicles, originally set out in CAP-II (up from 500,000 in CAP-I). When this target was originally set, it equated to approximately 30% of the expected 2030 fleet size. SEAI estimates that there is currently about 70,000 EVs and therefore the gap-to-target is 775,000 vehicles. ZEVI states that approximately 40,000 electric vehicles have availed of grants since 2011, a slow uptake. However, it must be borne in mind that there have been significant improvements in battery technology (hence vehicle range) and infrastructure, along with changing consumer tastes, all of which now bode well for increased public adoption of EVs. Also notable is that consumers are being faced with the cost of retrofitting their homes.

The **Society of the Irish Motor Industry (SIMI)** estimates that new vehicle registrations will run at approximately 100,000-120,000 vehicles per annum. Its statistics for April 2023 show that EV registrations had a share of 20%. Moreover, a SIMI-commissioned report by Arup and economist Jim Power (*Reducing light fleet carbon emissions to achieve Irish Government targets*) contains scenarios of EV adoption, illustrating the ambition and challenge of the targets. They also point out the global supply chain challenges, the small Irish market for right hand drive vehicles and poor availability of used EVs. The issues with battery manufacturing have also been well discussed in the Davy White Paper *Energy Storage: Unlocking Renewable Power's Full Potential*.

Taking the estimates as given, the vast majority of the spending will be consumer spending and SME spending on fleets, financed by bank loans, Personal Contract Plans and/or savings. To illustrate this, given an assumed purchase price of €40k per vehicle and the government grant of €3,500, this equates to an approximately 10:1 ratio of private/public spending. Overall, this implies approximate private funding of €39 billion and public funding of roughly €4 billion. This estimate does not include the cost of accelerated capital allowances and Vehicle Registration Tax rebates for EVs that are in place. The Department of Finance has published an interesting paper on the *Potential fiscal impacts of the transition to a lower carbon economy in Ireland* covering lost taxation revenue from fossil fuels. For completeness, there is currently no scrappage scheme for older vehicles that could otherwise assist with turning over the fleet.

In relation to charging infrastructure, the NDP has allocated €100 million[23] (to 2025) and funding has also been made available (to **ESB eCars**) by the extra budgetary fund (the Climate Action Fund). Overall, this would therefore imply public capital of the order of €100 million and private capital of some €900 million.

23 There are various grants available: the SEAI funding covers home and apartment charging, and ZEVI will be funding the shared island sports club infrastructure scheme, a 'just transition' community facilities charging scheme and possibly a scheme to accelerate infrastructure provision on the motorway and primary road network and certain destination points.

In conclusion, of the €43 billion on electrification, approximately €39 billion is private capital (consumer spending) and €4 billion is public capital (mainly grants). The wider spending on transport policy set out in the NDP of €35 billion by 2030 will be public spending; the attribution to climate policy is not known[24]. The key actions for this sector are to reduce demand, roll out the EV charging infrastructure and continue to encourage the uptake of EVs. The Davy view is summarised in Table 15.

Table 15: Davy view of the Investment Required in the Transport Sector to 2030: Consumer spending in this sector is €42 billion. The estimate does not include the capital required for hydrogen re-fuelling stations.

	Climate Action Plan III						Davy Estimate				
	Low	Mid	High	Increment		Total	Total	Public	Private	Debt	Equity
Transport				25%	€11bn	€43bn	€43bn	€4bn	€39bn	€39bn	
EV passenger cars		€34bn					€42bn	€4bn	€38bn		
EV trucks/ vans		€7bn									
EV buses		€1bn									
EV charging infrastructure		€1bn					€1bn	€0bn	€1bn		

Source: Climate Action Plan; Davy analysis

Investment Opportunities in the Transport Sector

- The EV target will require a significant investment in EV charging infrastructure. A number of players have emerged in this area, including **ESB eCars**, **EasyGo** and **GoEve** in public infrastructure while **Ohme** is gaining traction in the domestic sector with its demand-side management functionality. Other companies like Jolt have combined charging infrastructure with battery storage to provide rapid charge services.

- Galway-based company **Xerotech** is developing battery systems for transport and commercial markets. **SiDrive** is an EU Horizons Fund-backed start-up in Limerick that is developing next-generation Li-ion battery solutions.

- **Ecovolve** has developed a range of electric machines, including dump trucks which will replace heavier fossil-fuel variants.

- Traditional fuel distributors like **DCC**, **Applegreen** and **Circle-K** are evolving their refuelling infrastructure to reflect the growing adoption of EVs.

- Longer term, green hydrogen fuel cells are seen as a potential replacement for fossil fuels in HGVs. **Element2** is developing a hydrogen-based refuelling infrastructure in the UK and Ireland. **Galway Hydrogen Hub (GH2)** is a pilot project that aims to fuel commercial transport vehicles in Galway from domestically-produced green hydrogen. The consortium consists of seven members - **University of Galway**, the **Port of Galway**, **CIÉ Group** and **Bus Éireann**, **Aran Islands Ferries**, **Lasta Mara Teo**, **Aer Arann Islands**, and **SSE Renewables**. More generally, the Alternative Fuels Infrastructure Regulation will ultimately require hydrogen refuelling stations to be installed at various locations.

24 The Minister's Foreword to the Electric Vehicle Charging Infrastructure Strategy 2022-2025 states the following 'The National Development Plan dedicates €1bn towards decarbonisation of transport in the period up to 2030'.

- Vehicle sharing is already in place with companies like **DriveYou**, **GoCar** and **YUKO** active as is bicycle sharing (**Dublin Bikes, ESB**). More generally, Mobility-as-a-Service **(MaaS)** and **ride sharing** is an emerging area and there have been recent favourable changes to legislation. There is opportunity for companies providing micro mobility hardware (e.g. scooters) and software applications for integrated journeys (e.g. applications that via an API links Taxi/Ride hailing APPs, the NTA's integrated ticketing and MaaS service providers and others). Collaboration with the owner management companies of multi-unit developments (or other building managers) may also be fruitful – especially given the ever-tightening numbers of allowed vehicle spaces.

Summary: Transport Sector

- **Baseline (2018)** – 12 MT emissions with a 16% share (2021).
- **Object (2030)** – 6 MT being 50% reduction on baseline.
- **Measures** – 'Avoid-Shift-Improve', fleet electrification, EV charging infrastructure, biofuels and public transport investment.
- **Investment** – €4.3 billion or €6.1 billion per annum or 2.3% of GNI*.
- **Incremental Investment** - €1.6 billion per annum or 0.6% of GNI*.
- **Funding** - €4 billion of public spending; €39 billion debt (consumer spending).

Agriculture Sector Analysis to 2030

EU and Irish Policy Backdrop

Across the EU, the food and agriculture sector accounted for 10.3% of emissions in 2021, significantly below that of Ireland at 34%. This naturally poses challenges for Ireland. The sector falls under the *Effort Sharing Regulation*, which requires all member states to make best efforts to reach their individual targets. As part of the EU *Green Deal*, the overall policy for the sector is contained in *Farm to Fork*, which identifies a number of key areas to address including the use of nitrogen fertilizers, organic farming and biomethane as a renewable energy source.

The 2021 reform of the Common Agriculture Policy contains a commitment to developing 'a smart, sustainable competitive, resilient and diversified agricultural sector' while contributing to the *European Green Deal*. Under the revised *Common Agriculture Policy*, each member state is obliged to submit a strategic plan outlining its key measures, including climate impact. Under the latest version, Ireland is set to receive EU funding of almost €7.5 billion over the 2021-2030 period. When combined with national funding, this implies a total of almost €10 billion, including over €1.5 billion dedicated to environmental and climate-based measures funded from the hypothecated carbon taxes.

Irish Policy, Targets and Investment Requirement

The sector emitted 23.34MT of CO_2 equivalent in 2022 (a slight decrease from 2021) and previously was on an increasing trend, driven by a combination of the expansion in the dairy herd, post the abolition of the quota system in 2016, and growing food output.

The target is to reduce emissions from the sector by 25% by 2030 with an interim target of a 10% reduction by 2025 (relative to 2018 levels of 23.39MT). This equates to a reduction of 5.75MT by 2030. Emissions from agriculture have two key drivers – livestock numbers and fertiliser use. Biogenic methane from livestock accounts for the greatest share (65% of the total agriculture emissions) and nitrous oxide accounts for 30% of the total; approximately 40% of these emissions are associated with chemical nitrogen fertilisers. The means through which both these factors will be addressed has been set out in the CAP-III and is summarised in Table 16 below.

Table 16: Key targets and investment requirement for the agriculture sector

Sectoral Carbon Budget 2021 to 2025 $MtCO_2$ eq.	Cumulative Emission to 2021	Remaining Sectoral Carbon Budget 2022 to 2025 $MtCO_2$ eq.	Sectoral Carbon Budget 2026 to 2030 $MtCO_2$ eq.
106	23.09	82.91	96

Target	2021-2025 reduction	2026-2030 reduction	Total reduction	Percent of target
Reducing chemical nitrogen to 300k tonnes	0.4-0.45	0.1-0.2	0.5-0.65	10%
Increased use of protected urea	0.35-0.45	0.08-0.12	0.43-0.57	9%
Reduce cattle growing time	0.28	0.55	0.73	13%
Improved animal breeding	0.0	0.3-0.5	0.3-0.5	7%
Organic farming (75k ha to 450k ha)	0.1	0.2	0.3	5%
Pasture-based feed additive	0.0	0.6	0.6	10%
Biomethane (5.7TWh by 2030)	1.3	0.2	1.5	26%
Other including improved animal feeding, extended feeding, etc	0.4	0.7	1.1	19%
Total	2.8-3.0	2.7-3.1	5.5-6.1	100%
Percent of 2030 target	49-52%	47-53%		

	Agriculture
2025 KPI	▪ Maximum usage of 330,000 tonnes Chemical N on land ▪ 24-25 months average finishing age of beef cattle ▪ Production of up to 1TWh of Biomethane ▪ Construction of up to 20 AD plants ▪ 250,000 ha of organic farming ▪ 360,000 land dedicated to tillage
2030 KPI	▪ Maximum usage of 300,000 tonnes Chemical N on land ▪ 22-23 months average finishing age of beef cattle ▪ Production of up to 5TWh of Biomethane ▪ Construction of up to 200 AD plants ▪ 450,000 ha of organic farming ▪ 400,000 land dedicated to tillage

	Electrification	Reforestation	Anaerobic Digestion
Investment Required	€1bn	€1bn	€1bn
Incremental Investment	50%		

Source: Climate Action Plan

The investment requirement is identified in CAP-III at €3 billion, of which €1.5 billion (50%) is incremental to business-as-usual

Analysis and Commentary

Many of these targets above require behavioural changes by farmers, and it is therefore difficult to quantify the investment required[25]. These behavioural changes may also require government policy or supports. However, there are two areas that can be estimated, both of which are consistent with the EU Farm to Fork strategy.

- the development of a biomethane solution using a range of feedstocks including animal slurry, forage (silage, grass and other crops), food waste and commercial biodegradable materials. These materials are processed in an Anaerobic Digestor, which releases biogas that can be upgraded to biomethane. The residual material, called digestate, can be used as a fertiliser that can replace chemical-based versions, thus helping to reduce nitrous oxide emissions.

- an increase in organic farming, which accounts for 5% of the target.

The development of a biomethane capability through anaerobic digestion **(AD)** is the identified largest contributor to the target and is discussed in *Food Vision 2030* and *Ag Climatise*. This will also help to decarbonise the gas grid and in turn contribute to the decarbonisation of the industrial and built environment and transport sectors (above). There has been notable work carried out by GNI, including a RFI (Request for Information) from biomethane producers and possible future initiatives on procuring biomethane to cover the GNI shrinkage gas. The resulting report, 'Biomethane Energy Report' states:

"An indigenous biomethane industry would not only support the reduction of emissions of the agricultural sector, but it would also provide significant opportunities for rural communities, facilitate sustainable circular economies and significantly enhance security of energy supply."

Policy in the form of a *National Biomethane Strategy* and the introduction of a *Renewable Heat Obligation* is pending. The target equates to the production of 1TWh of biomethane by 2025 and 5.7TWh by 2030 from an estimated 200 plants. We estimate this will require investment of approximately €1.6 billion over the period.

Table 17: Key Targets and Investment Requirement for AD Plants

Year	Production (TWh)	Implied Anaerobic Digestion Capacity (MW)	Estimated € / MW (m)	Investment (€m)
2025	1.0	114	2.5	285
2030	5.7	651	2.5	1625

Source: Climate Action Plan; Davy analysis

The AD industry has been slow to develop given the lack of government supports. We believe the industry needs long-term pricing contracts, similar to those provided in the electricity sector to wind and solar under the *Renewable Energy Support Schemes*.

A biomethane price of approximately 9.0c/kWh[26] is required to realise an investment return (IRR) of 12%. Assuming current but volatile natural gas prices of 3.5c/kWh, this implies support of 5.5c/kWh or an annual cost of over €300 million. This appears expensive as it implies a co st of almost €190 per tonne of carbon abated compared to the current carbon tax of €48.50 per tonne (although on a trajectory to €100 per tonne by 2030). This could also be viewed as a levy of 0.5c/kWh based on the 55TWh of gas consumption.

25 Fitzgerald makes an estimate in "The Macroeconomic Implications of Carbon Budgets for Ireland John FitzGerald, Second Draft, 14th September 2021" (See Bibliography).
26 For reference, the auction clearing price for offshore wind was 8.6 c/kWh.

In our view, with a secure long-term offtake agreement, the AD plants could secure 70-80% (€1,100-1,300 million) debt funding and attract corresponding equity investment of €300-500m.

Finally, government has committed to introducing a *Renewable Heat Obligation* **(RHO)** (currently in consultation) scheme in 2024. Under this scheme, distributors of heating fuel would be obliged to ensure that a minimum proportion of the fuel they distribute is from renewable sources. While the detail on the scheme is awaited, it is likely to include a penalty on any distributor who fails to meet the target and these proceeds could then be used to support the production of biomethane.

In conclusion, we estimate sector investment of the order of €1.6 billion to 2030, with the majority of this funded by the private sector. For completeness, €3 million of state funding for research into integrated anaerobic digestion and green biorefining demonstration has been announced.

The *Organic Farming Scheme* offers drystock farmers €300/ha for the first two years post conversion and €250/ha thereafter. Assuming a target of 375k ha increase in the area being farmed organically, this implies a cost of over €100 million per annum (or €300/tonne of CO_2 abated) or €0.7 billion of public money to 2030. Under the *Common Agriculture Policy*, a total of €256 million is dedicated to achieving the target area of land under organic production. This is public expenditure. A key action for this sector is the development of a long-term support scheme/framework for biogas. Our overall view is summarised in Table 18.

Table 18: Davy view of the investment required in the agriculture sector to 2030

Sector Initiative	Climate Action Plan III						Davy Estimate				
	Low	Mid	High	Increment		Total	Total	Public	Private	Debt	Equity
Agriculture				50%	€2bn	€3bn	€4.3bn	€1.7bn	€2.6bn	€2.3bn	€0.3bn
Electrification		€1bn					€1.0bn		€1.0bn	€1.0bn	
Reforestation		€1bn					€1.0bn	€1.0bn			
Anaerobic Digestion		€1bn					€1.6bn		€1.6bn	€1.3bn	€0.3bn
Organic Farming							€0.7bn	€0.7bn			

Source: CAP-III; Davy analysis

Investment opportunities in the Agriculture sector

Despite this sector accounting for over one-third of total emissions, the investment opportunities to date have been limited.

- While the prospects and potential for AD are significant, only a few companies have managed to develop profitable operating models in the absence of government supports. These include **Green Generation** in Kildare and **Glenmore** in Donegal, both of which are injecting (and trucking) biomethane into the grid, and **Ormonde Organics** in Waterford. **Huntstown Bioenergy** is close to re-opening its plant in North Dublin. A number of plants are in planning or under construction, including **Evergreen Agricultural Enterprises** in Kildare and **GreenGas** in Limerick.

- **BHSL** has a food-to-waste business that is focused on generating energy from poultry litter using a different technology based on pyrolysis.

Summary: Agriculture Sector

- **Baseline (2018)** – 23 MT emissions with a 33% share (2021).
- **Object (2030)** – 17.25 MT being 25% reduction on baseline (rounding accepted).
- **Measures** – Behavioural change, Anaerobic Digestion, Biogas/Biomethane, Reforestation, Organic Farming
- **Investment** – €4.3 billion or €0.6 billion per annum or 0.2% of GNI*.
- **Incremental Investment** - €0.3 billion per annum or 0.1% of GNI*.
- **Funding** - €1.7 billion public spending; €2.6 billion private with €2.3 billion debt and €0.3 billion equity.

Equity Markets' Perspective

In the electricity sector, the capital expenditure associated with the power generation capacity build out is estimated to be €28 billion (Table 9) from private sources, which equates to an average annual investment requirement of approximately €4.0 billion out to 2030.

However, like many other countries, Ireland's ever-increasing ambition is challenged by a more difficult economic backdrop. Given its capital-intensive growth characteristics, the energy transition sector is particularly exposed to several economy-wide headwinds at present, including a **materially higher cost of capital, increasing construction costs and supply chain challenges** alongside other industry-specific issues mentioned above.

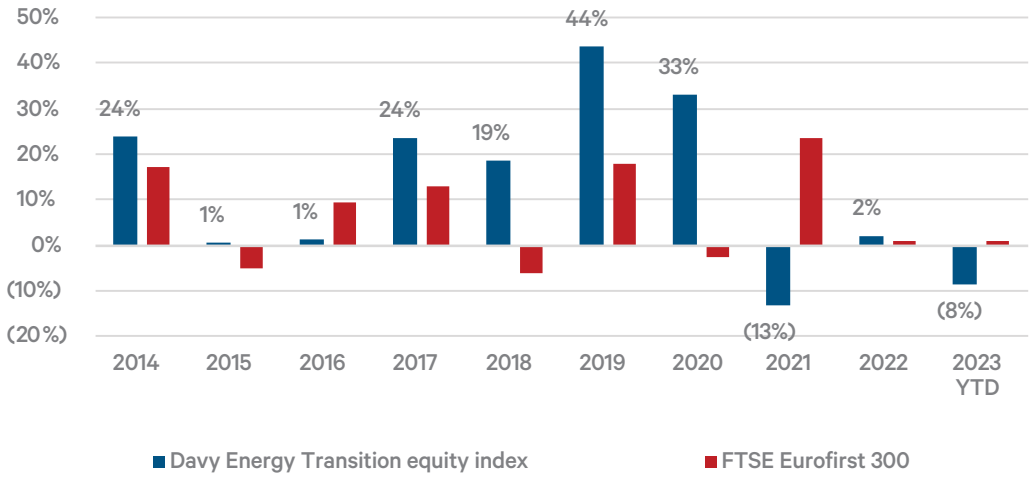
The sector returns outlook has become uncertain as a result. It is this, rather than ambitious policy and targets, that is currently framing the investment debate.

Sector Performance – Returns and Valuation

Historically, the publicly listed energy transition sector outperformed the broader European equity market in six of the seven years from 2014 to 2020. For the period in aggregate, the sector delivered total shareholder returns, as measured by our **Davy Energy Transition Equity Index**, of almost 240%. On a comparable basis, the broader market delivered shareholder returns of approximately 45%.

However, the sector's performance has come under pressure more recently. From the end of 2020 to August 2023, sector total returns were -20% compared to +27% for the broader European market – reflecting a worse, and still uncertain, returns opportunity for investors. This is shown in Figure 2.

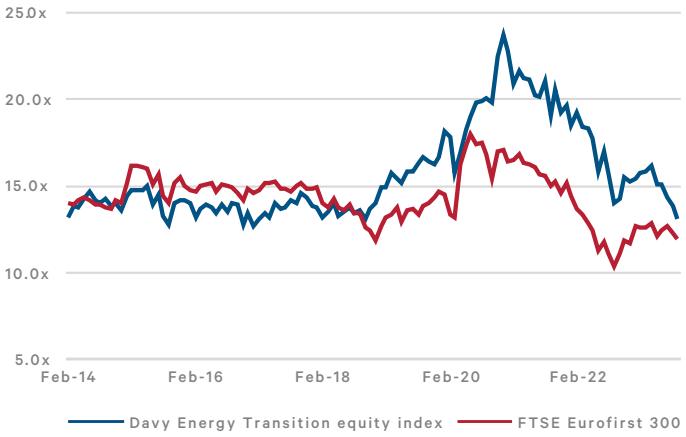
Figure 2: Davy Energy Transition Equity Index annual total returns performance relative to broader European market



Source: Davy Research; FactSet

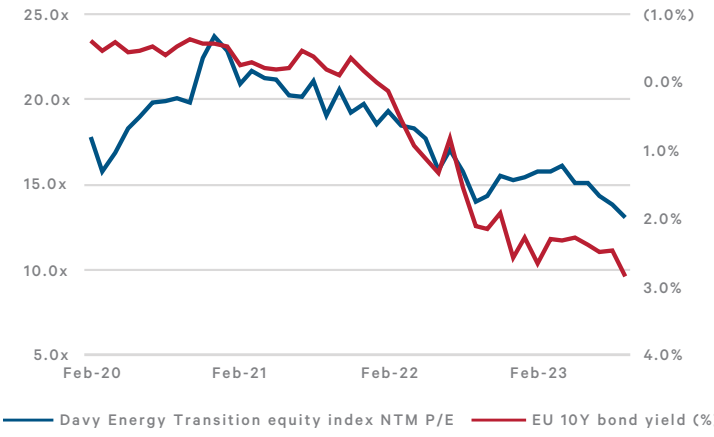
Sector valuation has followed a similar path: having peaked in December 2020 at 24x the next-twelve-months profit to earnings ratio, it has since de-rated heavily, coinciding with the step-up in economic headwinds (and developed world government bond yields (Figures 3 and 4)). Valuations today are materially different as a result, with the index trading on 13x next-twelve-months profit to earnings ratio.

Figure 3: The sector has de-rated significantly in absolute and relative terms since the end of 2020 (NTM P/E)



Source: Davy Research; FactSet

Figure 4: The sector de-rating coincided with the rise in European government bond yields (and economic headwinds)



Source: Davy Research; FactSet

Capacity Additions

The uncertain returns outlook and less financeable development conditions are challenging the desired build-out of renewable power generation capacity.

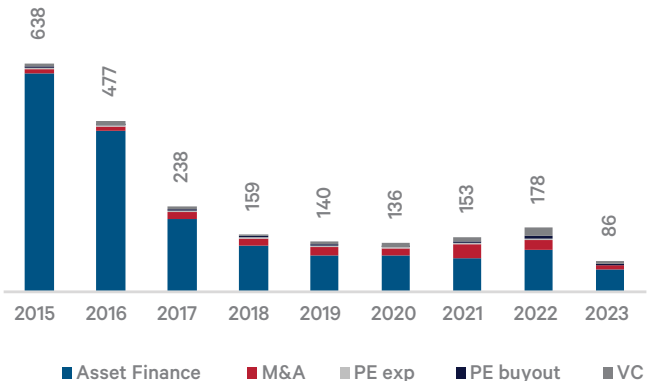
So far in 2023, there have been several disappointing industry developments that suggest capacity additions are being (or will be) delayed or put at risk. Many projects are now also likely to be of less value than previously anticipated. For example:

- There were disappointing results in the UK Auction Round #5 **(AR5)** that have cast doubt on the UK offshore 50GW 2030 target: the strike price on offer in the recent Contracts for Difference auction was insufficient to secure a single bid from a new offshore wind farm. This disappointing result followed confirmation that Vattenfall will halt Boreas, its 1.4GW offshore wind farm that had successfully secured subsidy support in the previous AR4 auction. Unviable project economics are now risking a medium-term capacity gap, which may hinder the UK's efforts to increase the installed offshore capacity base from 14GW to 50GW by 2030. The AR5 subsidies awarded to other technologies including onshore wind, solar and other technologies was also the lowest since 2017.

- In August, **Ørsted** announced the anticipated DKK16bn ($2.3bn) write-down of its near-term US offshore development portfolio due to the impact of supply chain disruption (c.$0.7bn), lack of favourable progress in investment tax credit guidance (c.$0.8bn) and increased interest rates (c.$0.7bn). It stated that its near-term US offshore wind development portfolio does not meet its value creation target on a lifecycle basis. Similarly, subsidiaries of **Shell** and **Iberdrola** have both recently paid termination fines to cancel offshore power purchase agreements as the previously agreed terms meant the projects were no longer economic.

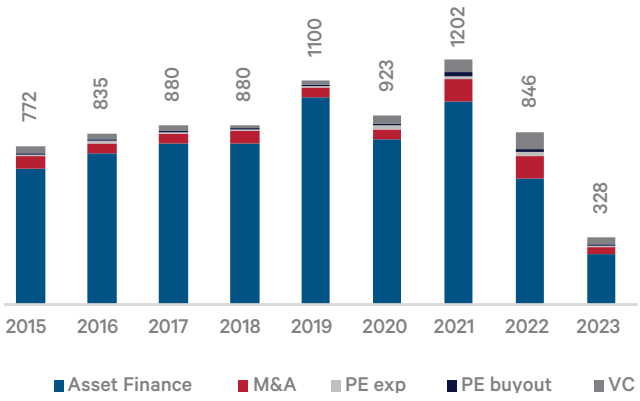
These anecdotal examples chime with the broader data sets and experience. There has been a meaningful decline in asset financing transactions in both the US and UK markets. The 2023 year-to-date transactions in the UK and US are just 61% and 30% of 2019 levels respectively (Figures 5 and 6).

Figure 5: Number of financial transactions in UK renewable energy sector per annum



Source: BNEF

Figure 6: Number of financial transactions in US renewable energy sector per annum



Source: BNEF

Ireland Renewable Energy Support Scheme Auctions

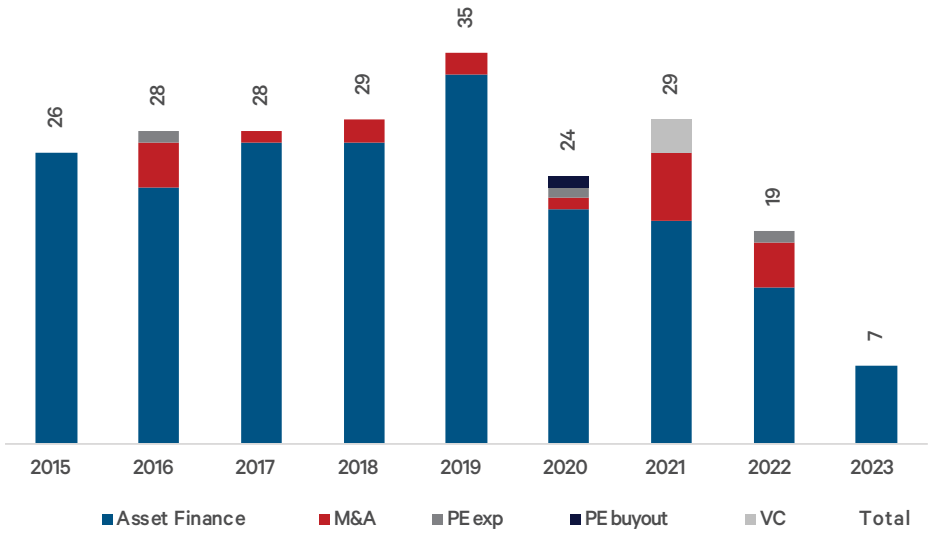
Ireland is no different and the recent RESS 3 auction results highlight risks to medium-term capacity additions. A similar set of challenges is threatening the continued expansion of renewable and associated infrastructure in Ireland.

Alongside economy-wide headwinds (rapid increase in interest rates; rising cost and complexity of construction), the investment community is especially mindful of several other issues that may impact the investment opportunity in Ireland discussed above.

- Limited progress in establishing an offshore sector, including the absence of a robust planning and development framework to date and insufficient associated infrastructure (including ports) and skills.
- Planning constraints now impacting the onshore sector – it is now over 12 months since the last onshore wind farm was granted planning permission.
- Little available grid capacity to match the needs of an increasingly distributed and renewable power generation model. As an island, the development of sufficient interconnection and energy storage capacity is also critical.
- A scarcity of required labour skills and expertise across most elements of the energy transition value chain.

The impact of these headwinds is also similar – there has been a significant decline in the quantity of recent Irish energy transition transactions. While there were 35 renewable energy financial transactions in Ireland in 2019, there were just 19 transactions in 2022. So far in 2023, there has been just seven renewable energy financial transactions (Figure 7).

Figure 7: Number of financial transactions in Irish renewable energy sector per annum



Source BNEF:

The recent RESS 3 auction results confirm that these developments and financing challenges are already impacting the pace of medium-term onshore capacity additions (just three of the 23 successful RESS 3 projects were onshore wind, with the remainder solar).

Table 19: Overview of RESS auction submissions

	RESS 1	RESS 2	RESS 3	RESS 3 v. RESS 1
Date	Aug - 20	Jun - 22	Sep - 23	
Successful projects	82	80	23	-72%
Unsuccessful projects	26	50	8	
Total submissions	**108**	**130**	**31**	**-71%**
Total subsidies awarded (GWh)	**2,236**	**2,748**	**934**	**-58%**

Source: Eirgrid

Compared to RESS 1, there was approximately 70% fewer individual submitting applications for support in RESS 3, with challenges in the planning system and auction structures, alongside the inflationary impact on potential project returns, among the issues cited for below expected interest levels.

Compared to an initial RESS3 target of 2,500-3,000GWh, just 935GWh of subsidy support was awarded. The disappointing auction results alone have created a c.0.6GW hole in Ireland's previous onshore wind growth expectations.

Discussion and Conclusions

The purpose of this paper is to catalogue the **investment opportunities** that are arising from the energy transition; to set out the **quantum** and **scale**; to classify it as either **public** or **private** spending; and to establish how it could be **funded**.

Given the nature of the underlying issue (i.e. climate change), it is in the first instance the role and responsibility of government to address it (in a Hobbesian sense). This is accomplished by putting in place a policy and legislative framework that causes coordinated action (specifically for our purpose, investment). The framework is therefore interesting insofar as it creates and reveals (in many publications) the approximate investment opportunity and quantum. This White Paper therefore reviewed the literature to outline and catalogue the investment opportunity and quantum by researching international norms (i.e. 'top down') and examining the domestic sectors (i.e. 'bottom-up').

Investors and the financial services industry are very interested in whether the framework is investable, i.e. whether business cases can be formed, and the benefits realised. This requires a framework that is **supportive** and **enduring**. We have concluded that the framework is in fact set to **intensify** in the coming years. An on-the-ground equity markets' perspective has also been given.

The Investment Quantum

A review of the literature internationally and various studies established that the quantum is of the order of $5 trillion or 5% of World GDP per year out to 2050.

Given the historic way in which climate targets have evolved in Ireland, there are currently two major milestones at 2030 and 2050. There is more detail and research material available for 2030 than for 2050. Our overall view of the investment quantum to 2030 – as discussed sector-by-sector in this paper and aggregated and set out in Table 19 – is approximately €129 billion – €18.5 billion, or 6.8% of GNI*, per year (in incremental terms €7.8 billion or 2.9% of GNI*).

From 2030 to 2050, the quantum is of the order of €200-250 billion (or €10-12.5 billion or 4.1% of GNI* per year).

Table 20: Investment Requirement for the Energy Transition in Ireland to 2030. All figures are given in €bn unless otherwise stated

Sector Initiative	Climate Action Plan III						Davy Estimate				
	Low	Mid	High	Increment		Total	Total	Public	Private	Debt	Equity
Electricity				50%	€18	€35	€43		€43	€32	€11
Wind and Solar		€23					€24		€24	€17	€7
TSO/DSO Upgrades	€9	€11	€13				€14		€14	€13	€1
Backup Capacity		€1					€1		€1	€1	
Storage							€4		€4	€1	€3
Transport				25%	€11	€43	€43	€4	€39	€39	
EV passenger cars		€34					€42	€4	€38		
EV trucks/vans		€7									
EV buses		€1									
EV charging infrastructure		€1					€1	€0	€1		
Buildings Residential				50%	€12	€23	€23	€13	€10	€10	
Insulation in homes (retrofitted)		€11									
Heat Pumps in homes		€9									
District Heating in homes		€3									
Buildings Commercial				53%	€7	€13	€13		€13	€12	€1.3
Insultation in commercial buildings		€2									
DH and HP in commercial buildings		€3									
Other		€8									
Industry				63%	€2	€3	€3		€3	€3	€0.3
Electrified heat supply in alumina		€2									
Heat pumps and electric boilers		€1									
Agriculture				50%	€2	€3	€4.3	€1.7	€2.6	€2.3	€0.3
Electrification		€1					€1.0		€1.0	€1.0	
Reforestation		€1					€1.0	€1.0			
Anaerobic digesters		€1					€1.6		€1.6	€1.3	€0.3
Organic Farming							€0.7	€0.7			
Total		**€120**		**42%**	**€50**	**€120**	**€129**	**€18**	**€110**	**€97**	**€12.9**
Consumer Spending							€57				

Source: CAP-III and Davy Analysis

Government Investment

Government's role in the energy transition will be to develop and implement the policy and legislative framework and to provide for and make the necessary public spending. For the purpose of this White Paper, government or public spending is interesting insofar as it demonstrates the state's commitment to the framework, advances its objectives (e.g. encourages behavioural change) and results in 'crowding in' of private investment. The latter is exemplified by the EV grants and the home retrofit grants.

Of the €18 billion (to 2030) of public spending identified in Table 19, it is unclear what proportion may result in fixed capital formation and could therefore strictly be regarded as investment per se. It is, however, clear that this €18 billion is only a portion of the overall government spending on net-zero out to 2050. For example:

- The **Transport** sector has €35 billion earmarked in the NDP (which is distinct from the amounts set out in Table 19).
- **Uisce Éireann**[27] is investing €5 billion up to 2024 (2020/24 Revenue Control #3).
- **The Ports**[28] are making significant investment, informed to some extent by a *Policy Statement on the facilitation of Offshore Renewable Energy by Commercial Ports in Ireland*.

Some portion of these (and other government spends) could reasonably be attributed to net-zero. However, there is no overall figure available regarding the total government spend that can be attributed to net-zero. Therefore, the €18 billion (above) is a lower-bound estimate and a large portion, likely tens of billions, of the NDP expenditures that could also be reasonably included.

For completeness, one of the impact themes of the Irish sovereign development fund **Ireland Strategic Investment Fund (ISIF)** is also climate. ISIF has a commitment to invest €1 billion over a five-year period and has to date invested in several companies and dedicated funds.

Consumer Spending

Consumer spending of €57 billion, including electric cars (€34 billion) and home retrofits/heat pumps (€23 billion), have been identified above (along with grant aid). Clearly, there is also much more extensive consumer spending on net-zero. This spending will be financed from a combination of debt and savings. SBCI is seeking to introduce a new loan guarantee product and the retail banks are active in this sector.

Private Sector Investment

A key interest of this White Paper is to establish the quantum of private investment that will be funded by the capital markets. For clarity, the investment is hereby classified or referred to as private regardless of whether it is undertaken by a state-owned company or whether it is on foot of a regulatory arrangement, the cost of which is ultimately recovered from the electricity customer by tariffs and/or levies. For example, electricity sector investments may come about by way of:

- contracts let pursuant to the **Renewable Energy Support Scheme** (backed by a Public Service Obligation levy[29]); let by the **Capacity Market**; let by the **Temporary Emergency Generation Scheme**; or let under the EirGrid **DS3** programme;

27 Uisce Éireann is the national water utility and is funded by a combination of commercial revenue and Exchequer funding. It is currently operating under the approved Revenue Control #3 (2020-2024), which provided for a capital allowance of €4,523m, recently increased by €556m. Uisce Eireann has some revenue that is commercial and the balance Exchequer funded.
28 With the exception of Greenore port, Ireland's ports are state owned, raising revenue from pilotage, towage, storage, cargo handling and ancillary services.
29 The PSO levy in the electricity sector is paid by electricity consumers (no Exchequer impact), whereas the PSO routes in the transport sector are Exchequer funded by the Public Service Provision Payments. Interestingly, the operation of the PSO and its connection with financing has drawn some criticism by industry players in the recent CRU docket on setting the PSO and R-Factor for the 2023/2024 period.

- in the case of the transmission and distribution operators undertaken by way of a **regulatory compact.**

- a **cap-and-floor** regulatory regime for interconnectors.

For these purposes, in the Electricity sector, the entities fall into three categories of interest:

(a) the commercial state companies (discussed separately below);

(b) the multi-national corporations and/or or utility majors; and

(c) the 'balance'.

The Irish market is part of the wider Ireland/Northern Ireland Single Electricity Market and is tightly connected with the GB market[30] and also part of the EU internal energy market. In recent years, multinational utility majors and conglomerates are investing on land and in the offshore sectors including **Engie, SSE, EDF, Statkraft, Hanwa, Mitsui, Mitsubishi, RWE, Orsted** (with **ESB**), **Ibderola, ENEL** and **EDP/Engie** (with **BnM** in **Ocean Winds**). Some of these investors are state owned, whereas some are private and some are listed.

Electricity Markets

The European Internal Energy Market is making cross-border investment a reality and Ireland is no exception. The Single Electricity Market **(SEM)** for the island of Ireland was opened in November 2007. It was significantly reformed to conform with the then emerging European Target Model (as set out in the third legislative package and subsidiary Network Codes/ Guidelines to promote market integration) in October 2018. The capacity payment mechanism was also reformed to introduce a Capacity Market at that time.

The 'coupling' of markets by way of interconnectors requires a coordinated calculation of the capacity available by corresponding TSOs. Accordingly, Interim Cross Zonal TSO Arrangements were put in place in September 2017 for a region that became known as Ireland-UK (IU). The island of Ireland then became coupled (in the day-ahead timeframe) with GB and the wider EU and intra-day markets were also established. There arrangements were expected to be replaced by enduring arrangements to be undertaken in the fullness of time by the relevant **Regional Security Coordinator** (in this case **Coreso**).

Long-term transmission rights in the form of Financial Transmission Rights-Obligations (**FTRs**) on the interconnectors were introduced for timescales longer than Day-Ahead and allocated on the Single Allocation Platform administered by the **Joint Allocation Office**.

However, following the withdrawal of the UK from the EU (31/12/2020), limited coupling with GB now takes place only in the Intra Day time period (and the island of Ireland is no longer coupled with the EU) nor are FTRs sold for the Irish Sea interconnectors (but regulatory inquiry is underway about possibility of selling Physical Transmission Rights and on compensation for curtailment). Work is underway on a new GB-EU coupling arrangement as set out in the Trade and Cooperation Agreement known as Multi-Region Loose Volume Coupling.

30 UK withdrawal from the EU saw it depart from EU market coupling arrangements (known as Single Day Ahead Coupling, and the Ireland-UK Capacity Calculation Region ceased to exist) . Replacement arrangements for the Irish Sea interconnectors were put in place pending progress on new arrangements known as multi-region loose volume coupling (as contemplated in the Trade and Cooperation Agreement).

There is also a vibrant domestic sector with a wide range of entities participating in renewable auctions (wind and solar), in energy storage, EV infrastructure and in grid edge services (**GridBeyond, ElectroRoute**). In a former Davy White Paper Irish Solar's Time to Shine, an analysis of the players in that sector was presented that was seen as largely fragmented and may mature by way of a consolidator, in the same manner as **Greencoat Renewables plc** (brought to market by Davy in 2017) performed in the wind sector.

Overall, and by this reckoning of private investment, the Davy view of the private investment to 2030 built up sector by sector above is of the order of €110 billion.

State Owned Enterprice/Semi State Investment

The commercial state companies will make a significant contribution to the energy transition and account for a large proportion of the investment.

- **GNI** is making a significant contribution to accommodate biomethane onto the existing gas grid and ultimately to repurpose the whole grid for the hydrogen economy, as set out in its strategy *Keeping Ireland's Energy Moving*. CRU has recently proposed a total capital allowance of €952 million for Price Control #5 period from October 2022-September 2027, which is an increase over that spent on capital in Price Control #4 period of €725 million.

- **ESB** (*Driven to Make a Difference: Net Zero by 2040*) itself and as owner of **ESB Networks** (*Networks for Net Zero Strategy* above) will have a role in expanding the on-land grid to accommodate electrification and other activities in the power generation and customer services areas, all of which will require a significant upswing in investment.

- **Bord na Móna** is undertaking a significant transformation *From Brown to Green* from a peat/horticultural business to a leading national renewable energy company and is undertaking a €2.7 billion investment programme.

- **EirGrid** has a central role in the industry (this is well set out in *Shaping (ibid)*) and has taken on a significant new role as developer of the offshore grid and the Celtic Interconnector (and a perhaps future interconnection) involving a spend (as set out above) of c.€5.0 billion to 2030.

- **Coillte** and **ESB** have entered a joint venture **FuturEnergy** Ireland to develop renewable energy and have recently put in place a strategic relationship with **Greencoat Renewables plc** to purchase future assets (see below).

Incremental Investment

It is interesting to view the aggregate investment requirement in comparison to business-as-usual and as a proportion of modified GNI. Table 20 sets out the incremental investment requirement and the reported 2022 gross capital formation sector by sector in the National Accounts.

Table 21: Incremental investment requirement for the energy transition in Ireland to 2030

Sector	Davy Estimate						Incremental Investment				
	Total €bn	Public €bn	Private €bn	Debt €bn	Equity €bn	Per Annum 24-30 €bn	% GNI*	GFCF 22 € bn	%GNI*	Incremental Investment €bn	%GNI*
Electricity	€43		€43	€32	€11	€6.1	2.3%	€1.6	0.6%	€3.1	1.1%
Transport	€43	€4	€39	€39		€6.1	2.3%	€3.2	1.2%	€1.5	0.6%
Buildings Residential	€23	€13	€10	€10		€3.3	1.2%	€7.0	2.6%	€1.6	0.6%
Buildings Commercial	€13		€13	€12	€1.3	€1.9	0.7%	€16.7	6.1%	€1.0	0.4%
Industry	€3		€3	€3	€0.3	€0.43	0.2%			€0.3	0.1%
Agriculture	€4.3	€1.7	€2.6	€2.3	€0.3	€0.6	0.2%	€1.3	0.5%	€0.3	0.1%
Total	**€129**	**€18**	**€110**	**€97**	**€12.9**	**€18.5**	**6.8%**	**€29.8**	**10.9%**	**€7.8**	**2.9%**

Source: Climate Action Plan, National Accounts, Davy Analysis

The overall quantum of €129 billion to be spent over seven years (2024 to 2030) represents an annual investment of approximately €18.5 billion per year or €7.8 billion incremental (2.9% of GNI*). This may appear high; however, it should be recalled that GNI* excludes a part of the multinational sector.

The total economy-wide modified investment in 2022 was €54.2 billion or approximately 20% of GNI*. Viewed in this light, the incremental investment from the energy transition would raise this to approximately 23% of GNI*.

In the electricity sector, the largest increment would need to take place with annual average investment rising from €1.6 billion to €3.1 billion or an increment of 1.1% of GNI*.

The combined annual spends on retrofitting of both residential and commercial buildings at €2.6 billion per annum could also be usefully viewed in light of the total repair and maintenance investment spending on buildings in 2022, which was €4.2 billion or 60%.

Funding

Given that the commercial state companies are government owned, they mostly rely on the debt capital markets and bank borrowings for their financing. **ESB** and **GNI** both have credit ratings and can therefore directly access the bond markets. For example, ESB recently sold bonds (€500 million 5-year at 4.074% and €500 million 12-year green bond at 4.361%). The other companies may access the private placement markets.

Individual projects may be structured and organised so that they can engage partners (with expertise and finance), access project finance, grant funding and, in some cases, funding from the **European Investment Bank**. In the future, as the need arises this could also be adapted to bring in innovative forms of equity, especially given the scale of the above investment demand.

The projected growth of EirGrid, as discussed above, is striking. In the CRU paper Offshore Revenue Recovery Model – EirGrid, the following interesting statement is made:

"The CRU is of the view that EirGrid will require significant levels of equity to be injected into the business in order to raise sufficient capital to fund the build out of the offshore transmission grid. Clarity is required on the sources and level of equity that will be provided (i.e., will it be provided by its Shareholder, European grant funding, energy consumers, third-party, etc.) This is paramount to support the obligations that are placed on EirGrid and the development of an appropriate revenue recovery model."

Private equity is already beginning to play an increasing role. **Energia/I-Squared**, **Gore Street**, **Gresham House** along with the **Temporis Aurora Fund** and the **AIB/Foresight SME Impact Fund** are all active along with a variety of players in the wind and solar sector. For example, **Macquarie** is active in offshore Wind; **Partners Group** in the Greenlink interconnector; and **Foresight** in MaresConnect interconnector.

The overall Davy view is that of the €110 billion of private investment by 2030, €97 billion will be debt funded and €13 billion equity funded. As discussed above, the current economic conditions are challenging for investment in the required energy transition infrastructure. This therefore requires:

- The realignment of support for the industry, including greater incentives and a reassessment of subsidy budgets that better reflect the true increase in development and build cost inflation.
- Delivery on recent commitments to make the progressing of projects through the planning and design phase easier; and
- Evidence that projects can be delivered on a predictable timeline.

Unless private capital returns are underpinned in such a fashion, the current pressure on equity valuations, and as such investment activity, is likely to persist.

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Davy Decarbonization Corporate Finance

Davy recognises the importance of decarbonization in the fight to protect our environment. We also know that it will take a lot of innovation and investment to achieve the ambitious targets set by Governments across Europe and the world. That is why we have set up our Decarbonization Team to help existing and new businesses develop and fund decarbonization strategies and solutions.

Our expertise includes:

- Fundraising for public and private companies across the capital structure
- Mergers and acquisitions
- Strategic advice
- Sector expertise

The team's focus is on the decarbonization of five core sectors:

- Power Generation and associated supply chains
- Commercial & Industrial processes
- Transport
- Built Environment
- Agriculture

Contact Us

For further information, please contact the team at **decarbonization@davy.ie**

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