Report
The Feasibility of the Circular Economy in Ireland

Table of Contents:

Line of Inquiry: Can a Circular Economic model lead Ireland into a sustainable future?

Author: Cillian Duignan
School: Coláiste Choilm Swords

Rationale Behind Project: Interest in awareness and adoption of circularity and the bio-economy.

Economic Concepts

- Sustainability
- Economic Growth
- Economic Development
- Balanced Regional Development
- Circularity & the Bio-Economy

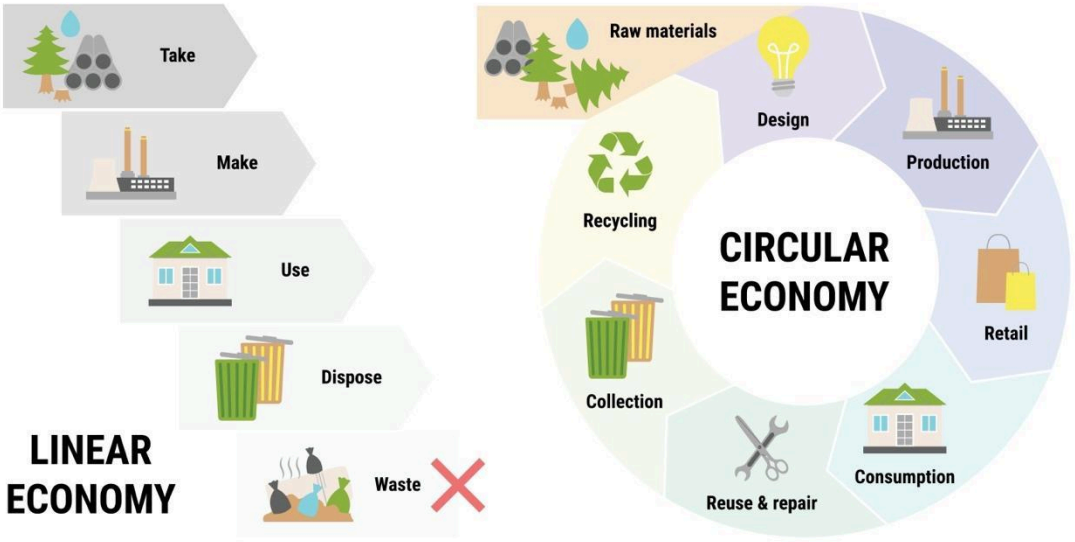
UN Sustainable Development Goals (SDGs)

In terms of the UN's Sustainable Development Goals, adopting a Circular Economy should enable Ireland to meet its commitments to a significant number of SDG targets, notably SDG **6** – Clean Water and Sanitation, **7** – Affordable and Clean Energy, **8** – Decent Work and Economic Growth, **11** - Sustainable Cities and Communities, **12** – Responsible Consumption & Production, **13** – Climate Action, **14** – Life Below Water and finally **15** – Life on Land.

Circular Economy in Ireland: Inquiry Overview

Ireland's transition to a circular economy (CE) is well under way, with the Whole of Government's Circular Economy Strategy (2022-2023) and the Circular Economy and Miscellaneous Provisions Act 2022 acting as landmark initiatives for the Irish government's commitment to European Union agendas on climate and waste and to the UN Sustainable Development Goals. The aim of my research project is to analyse the framework necessary to facilitate this transition successfully and identify challenges that may hinder the process and offer solutions. Ultimately, I wish to answer the question that initially ignited my interest in the circular economy: '**Can a Circular Economy lead Ireland into a Sustainable Future?'.**

An Introductory Exploration of the Circular Economy Model in the Context of the Irish Economic Landscape.



Definition:

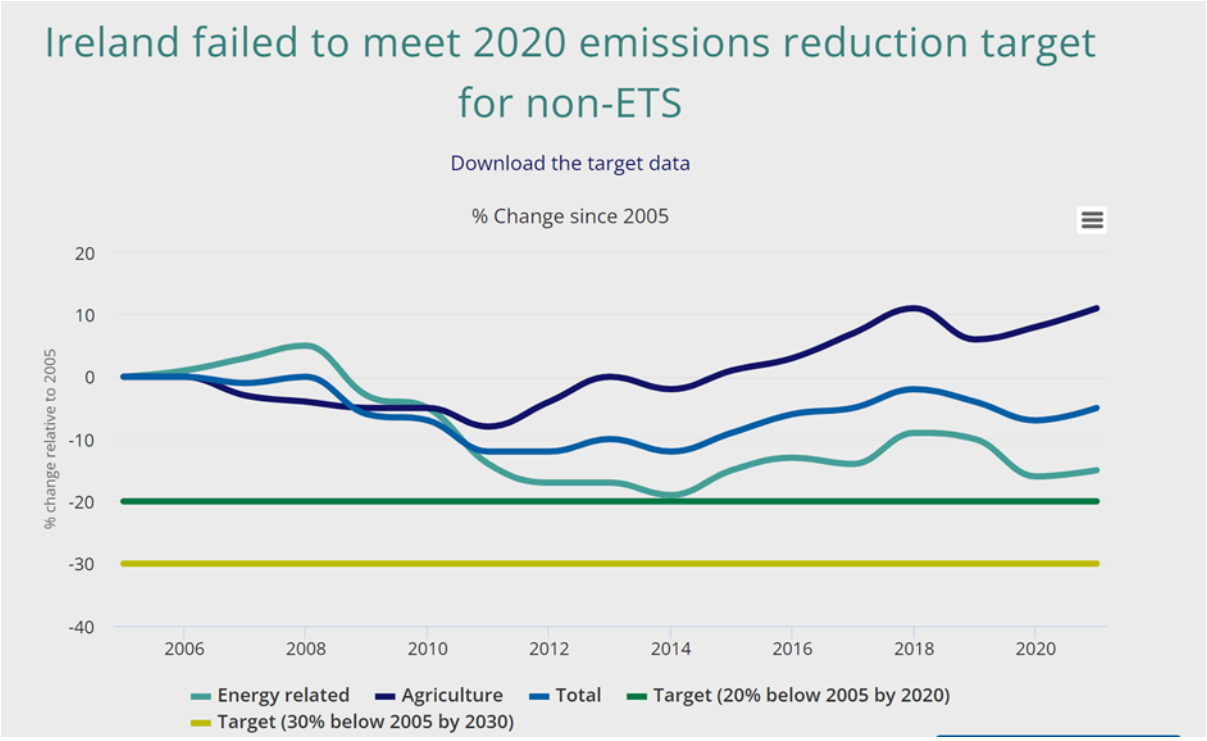
> *The circular economy is restorative and regenerative by design. Relying on system-wide innovation, it aims to redefine products and services to design waste out while minimising negative impacts. A circular economy is then an alternative to a traditional linear economy (make, use, dispose) (Ellen MacArthur Foundation, 2018).*

Contextualising the Circular Economy: Key Drivers for Adoption and Implementation

Recent economic events have had severe impacts on the Irish economy. Brexit, Russia's invasion of Ukraine and the Covid-19 pandemic halted trade and severely impacted supply chains in a way that clearly illustrated a need for a change in the way we produce goods and services. It caused me to question how reliant Ireland is on importing produce that could be sourced in Ireland, or how production and consumption patterns could be changed to capitalise on Ireland's comparative advantage. I set out to consider the possible potential for the CE in the Irish context.

The CE is an economic model of production and consumption that focuses on recycling and reusing materials to create a sustainable, regenerative economic system. There are many key motivators in switching to a CE model but none more important than our environment. Ireland has committed to accomplishing net-zero carbon emissions by 2050 through the Climate Action and Low Carbon Development Act 2020 and to reducing greenhouse gas emissions by 30% compared to the levels of 2005.
Currently, Ireland is not on track to reach these targets due to failure to meet its EU 2020 target of a 20% reduction in greenhouse gas emissions, while only achieving a 7% reduction in comparison to 2005 levels and a 5% reduction in 2021. It is significant to note in **Figure1** below, that non-ETS emissions in the Agriculture sector in 2020 were 8% higher than in 2005, and that by 2021 were11% higher than in 2005.

Figure 1:



Source: SEAI

This performance motivated me to investigate how far Ireland has progressed towards becoming a circular economy.

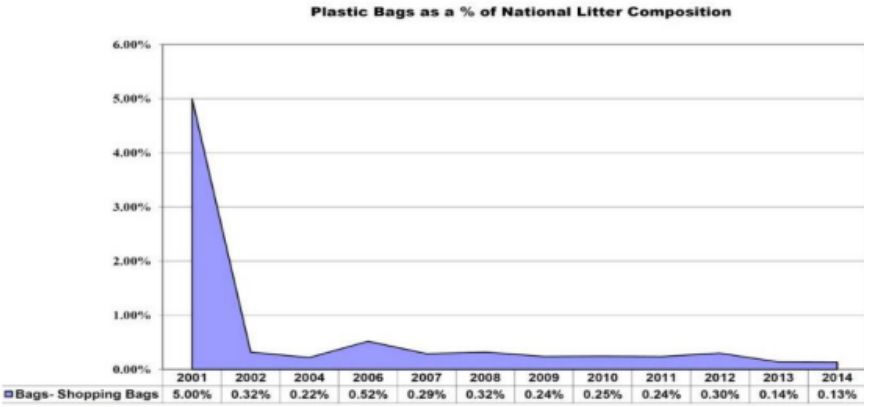
Ireland, at 2% circularity, lags behind the EU circular material use rate average of 12.8% in 2020 and our recycling rates of municipal waste have plateaued at around 40% compared to the EU target of 55% by 2025(OECD, 2022). Preventing waste and increasing our level of recycling has the potential to reduce greenhouse gas emissions and improving environmental

sustainability. Importantly, such practices could help Ireland to achieve greater resource efficiency (europa.eu, 2014). By utilising resources more efficiently through reuse and less waste Ireland may be able to keep resources productive longer and reduce dependence on uncertain supplies.

Ireland is uniquely positioned from a geographic perspective to accelerate its adoption of a circular economy. Given its small geographic footprint, proximity of rural, agricultural and urban areas and access to potentially transformative energy sources such as wind and wave power, Ireland has the raw building blocks required to create a new, circular economy.

Literature Review: Circular Economy Policy in Ireland

The Circular Economy has become a key issue in Ireland's political agenda in recent years, particularly as a result of EU directives on sustainability and waste. Irelands wider global commitments to the UN's SDGs have also brought the need for long term sustainability to the forefront. The positive response to Ireland's own efforts in the focus on personal health (such as the smoking ban and cigarette advertising restrictions) have further created momentum around the concept of improved societal and environmental health. Price-based instruments and levies (on plastic bags and waste going to landfill) have already played an important role in moving towards more circular waste practices. As **Figure 2** shows, plastic bags account for 0.13% of litter pollution compared to an estimated 5% prior to the introduction of the plastic bag levy. This would suggest that government fiscal policy has a strong track record in regard to successfully changing consumer behaviour through the use of price signals (Convery et al, 2007) **Figure 2:**



Over the past decade, Irish waste policy especially has introduced approaches to waste that are fundamentally circular. Examples include the National Waste Prevention Program (NWPP) and the End-of-Life Vehicle programs.

However, Ireland is now at a turning point in its evolution towards a broader circular economy approach, one that to date has been driven, in a narrow way, by waste management policy.

The Waste Action Plan for a Circular Economy (WAPCE), published in September 2020, paved the way for actions to:

1. Ensure that materials and products remain in use for longer by rewarding circularity and discouraging waste;

2. Increase producer responsibility for products and packaging;

3. Support sustainable business models;

4. Promote a multi-sectoral approach with the voluntary sector, R&D, producers, manufacturers, regulatory bodies and civil society; and

5. Clarify and strengthen institutional arrangements for the waste sector, including through a heightened role for local authorities.

The National Waste Management Plan for a Circular Economy 2022-2028 embeds circular economy principles to prevent waste, reduce the

consumption of single-use items, incentivise reuse and repair initiatives, maximise recycling and use waste as an energy source to replace fossil fuels.

The Environmental Protection Agency's (EPA) Circular Economy Programme, published in December 2021, replaces the NWPP. It aims to support the transition to a circular economy through innovation grants, sponsorships and seed funding, improve national knowledge and provide an evidence base to support circular economy development in Ireland.

The Circular Economy and Miscellaneous Provisions Act,
which became law in the latter half of 2022, underpins Ireland's shift to the more sustainable CE pattern of production and consumption. The key targets of this Act are:

1. Shifts Ireland away from a "take-make-waste" economy;

2. Incentivises the use of recycled and reusable alternatives to wasteful, single-use disposable packaging;

3. Moves Ireland closer to being among the first in the world to eliminate disposable drinks cups; and

4. Tackles illegal fly-tipping and littering.

The Act defines the Circular Economy for the first time in Irish domestic law. It incentivises the use of reusable and recyclable alternatives to a range of wasteful disposable packaging and other items. Further it reinforces the existing Environment Fund as a Circular Economy Fund, which will remain ring-fenced to provide support for environmental and circular economy projects. This will increase waste separation and support increased recycling

rates. Importantly, the act provides for the GDPR-compliant use of a range of technologies, such as CCTV for waste enforcement purposes. This will support efforts to tackle illegal dumping and littering, while protecting the privacy rights of citizens.

Significantly, this consolidates the government's policy of keeping fossil fuels in the ground – by introducing bans on exploration for and extraction of coal, lignite and oil shale.

Whole of Government Circular Economy Strategy (WGCES)

It's clear that the circular economy approach is becoming a key component of government policy in Ireland. The publication of the Whole of Government Circular Economy Strategy (WGCES) lays out the approach of Government for the next 2 years and crystallized the first steps in the broadening of the focus of sustainability in Ireland from a limited historical focus on waste management toward a more comprehensive CE approach. This broadening of intent is emphasized by the title of this Strategy: "Living More, Using Less"

The WGCES sets out the following key objectives as the first steps on the path to embracing the potential of a Circular Economy:

1. To provide a national policy framework for Ireland's transition to a circular economy and to promote public sector leadership in adopting circular policies and practices.

2. To support and implement measures that significantly reduce Ireland's circularity gap, in both absolute terms and in comparison, with other EU Member States, so that Ireland's rate is above the EU average by 2030; such measures to address facets of sustainable production and consumption most impactful in an Irish context.

3. To raise awareness amongst households, business and individuals about the circular economy and how it can improve their lives.

4. To support and promote increased investment in the circular economy in Ireland, with a view to delivering sustainable, regionally balanced economic growth and employment; and

5. To identify and address the economic, regulatory and social barriers to Ireland's transition to a more circular economy.

As the then Taoiseach M. Martin noted in his Forward to the WGCES:

"The role of Government is to provide a clear vision for the future and the pathway to get there. Our policies and plans set the pace and tone for all other actors in society and the economy."

It is anticipated that this Strategy document will be updated in full, every 18 months to 2 years. This commits the Irish Government to providing an evolving framework for the systemic transition of Ireland to a Circular Economy. The outline of the framework Ireland has chosen has been established by the Organisation for Economic Co-operation and Development (OECD) and is known as the 3 Ps. I will examine the 3 Ps in more detail in the next section of the report.

The OECD 3Ps framework in Ireland – People, Policy & Places

For the CE to be implemented successfully, it requires a systemic approach (a framework) driven by the policies and strategic approaches that the Irish government enacts (OECD 2022). This must be a cohesive approach across all sectors and levers in the Irish economy. In this section I will outline the 3Ps framework, how it will apply in Ireland and how it can be used to build the structure of Ireland's future Circular Economy.

What is the OECD's 3Ps Framework?

The 3 Ps Framework was developed by the OECD in 2016 for their study on *Water Governance in Cities*. The 3Ps (people, policies and places) framework **provides a framework to make circular economy a reality in cities and regions**. The circular economy requires a holistic and systemic approach that cuts across sectoral policies. As somebody's waste can be someone else's resource, the circular economy provides the opportunity to create links across policies, such as environmental, regional development, agricultural and industrial ones.

Ireland is a participant in the *OECD Survey on the Circular Economy in Cities and Regions* and the following are the key elements that the OECD has identified as critical to the achievement of a Circular Economy. This has come to be known as the 3 Ps Framework.

People (and firms)

People are at the centre of a cultural shift towards new business and governance models within a circular economy, which is a shared responsibility across levels of government and stakeholders. For example, businesses determine the shift towards new business models (e.g. using secondary materials, recycling, sharing models, etc.), knowledge institutions contribute to boosting innovation and research, and social enterprises/non-profit organisations drive citizen led initiatives in a wide range of sectors to raise awareness and build capacities.

Social enterprises

Social enterprises in Ireland contribute to product reuse and repair, sustainable manufacturing activities. According to the most recent available data, Ireland is home to 1,400 social enterprises, employing 25,000 people and generating a total income of around €1.4 billion (Forfás, 2013). Irish social enterprises contribute to the circular economy in different ways, for instance by connecting charity shops or repair businesses to consumers through online platforms (e.g. Thriftify and repairmystuff.ie), through promoting the reuse and sharing of items (e.g. Cloth Nappy Library Ireland) and collecting and recycling objects to avoid them going to landfill (e.g. Bounce Back Recycling and Recycle IT). These enterprises assist over 100,000 Irish households annually, as well as community groups and small- and medium-sized enterprises (SMEs) in the collection of waste electrical and electronic equipment (WEEE) and in raising awareness (Recycle IT, 2021).

Businesses

Multinational companies and SMEs in Ireland are starting to apply circular economy principles to their operations, driven by increasing consumer and shareholder demand for sustainability, and a desire to increase supply chain resilience. Irish companies introducing circularity in their business models generally begin by reducing waste (including packaging materials in their supply chain) and implementing energy efficiency measures, with a view to reducing their costs and carbon footprint. Retailers are increasingly introducing take-back schemes and offering repair services following consumer demand. New businesses are also launching with circular business models, such as GoCar, a car-sharing company that seeks to provide an alternative to owning a private vehicle (GoCar, 2022).

Knowledge Institutions

Several knowledge institutions and universities in Ireland are actively contributing to the circular transition by researching and analysing the feasibility of circular economy solutions and providing education programmes and training material. UCD, TCD, UCC and UL all have active research programs focusing on providing the tools for adoption of the circular economy. For example, BioBeo introduces new thinking and approaches in education and training on the circular economy across Europe (BioBeo 2023)

Policies

Policies should be coherent with one another, and as already noted, a circular economy requires a holistic and systemic approach whereby somebody's waste can be somebody else's resource. The critical areas for policy intervention are Waste and Resource Management, Built environment, Food Systems & Food Waste.

Waste and Resource Management

A circular waste management system requires, first and foremost: the prevention of waste; the ability to prepare products for reuse; the ability to recycle materials that cannot be reused; and, as a last resort, recovering and landfilling waste. Waste can be prevented by ensuring that products are made to last and that they can be prepared for reuse, repair or recycle easily. This can be done by mandating eco-design at all stages of product life-cycles and by incentivising reuse and repair over the purchase of new products.

Built environment

The built environment consists of buildings as well as physical infrastructures such as roads and dams. The circular way of building involves rethinking upstream and downstream processes to minimise waste production and maximise resource use. It also encourages new forms of collaboration among designers, constructors, contractors, real estate investors, suppliers of low and high-tech building materials and owners, while looking at the life cycle from construction to end of life. The circular focus here is on planning, material, operation and end-life.

The Irish building sector is exploring how to shift towards a more efficient built environment as a means of contributing to the European Green Deal and carbon neutrality by 2050. The Irish Green Building Council(IGBC) and nine European counterparts are part of the #BuildingLife initiative led by the World

Green Building Council, which seeks to galvanise climate action in the built environment through national and regional decarbonisation roadmaps.

Food Systems & Agriculture

Circular food systems are based on regenerative food production and the elimination of food waste (Ellen MacArthur Foundation, 2021). This implies taking a systemic approach along the value chain from production to processing, distribution and consumption, and eliminating waste by transforming it into resources. Along the circular food production cycle, external inputs are reduced; production is adapted to local contexts; negative externalities such as soil depletion and water pollution are avoided, and natural capital is restored.

Food Waste

Addressing food waste is the second part of the equation in a circular food system. Food waste should first and foremost be prevented. Unsold food that is fit for human consumption should be redistributed to people via food banks or food redistribution networks. Food unfit for human consumption should, as a precedence, be reused as animal feed; also, if then unsuitable for animal feed, be converted into energy and biofertilizer via anaerobic digestion or turned into compost for food production

The WAPCE and the Circular Economy Bill are driving action on food waste in Ireland by setting targets and making food waste a priority. The WAPCE establishes the target of a 50% reduction in food waste by 2030, in line with SDG 12.

Places

In terms of Places, embracing a functional approach, which considers material flows across urban and rural areas, where inputs and outputs are produced and consumed, is important for resource management and economic development. Fundamentally, they must connect the urban and rural.

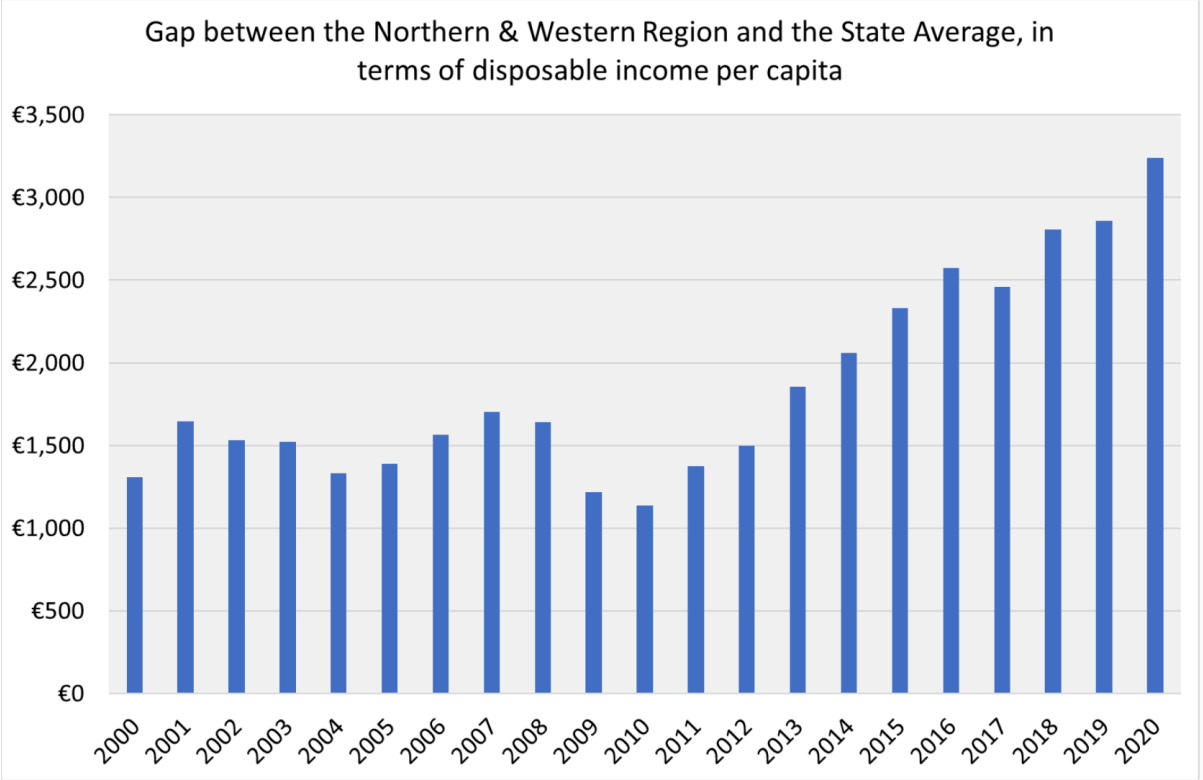
Circular economy initiatives take place at various scales, ranging from the micro level (e.g. neighbourhood) to the metropolitan, regional and national levels, where connections across urban and rural areas are particularly

relevant (OECD, 2020). These different scales are reflected in the range of Irish circular economy initiatives. At the micro level for example, certain Irish university campuses are part of the Campus Living Labs Sustainability Project, implementing initiatives related to the circular economy as part of network-supported sustainability programmes. At a larger scale, Dublin waste is used as fuel supply to the Covanta Waste to Energy plant on the Poolbeg peninsula, generating electricity and eliminating waste.

The shift to a circular economy must strengthen links between urban and rural areas in Ireland (Gov.ie).The goal will be to create a harmonious relationship between rural and urban, like the Dublin Covanta example, where the waste of one might become the fuel of another.

While the 3P framework expresses the necessity to strengthen urban-rural links, my inquiry has unveiled the extent of regional inequality that is prevalent in Ireland today. This may pose a challenge to achieving the desired relationship between regions. The gap between the Northern and Western Region and the national average for disposable income is three times higher in 2020 than it was a decade ago. Underinvestment in key areas such as infrastructure is likely to have contributed largely to the rise of regional inequality in Ireland.
This inequality threatens to undermine social cohesion and harm Ireland's delivery of key climate policies.

Figure 3



Source: CSO (2020)

Figure 3 shows that the estimated gap in disposable income between the Northern and Western Region and the State Average has risen to €3,237 per person in 2020. This is three times larger than the corresponding figure of 2010, €1,136. Rural regions such as the Northern & Western Region could be left behind unless this trend is reversed according to the Northern & Western Regional Assembly, which has analysed the newly released data and believe a change is needed to close the gap and deliver balanced regional development in line with Project Ireland 2040. According to David Minton, Director of the Northern and Western Region Assembly, a policy of "Positive Discrimination" is required to reduce the inequality and overcome the challenges they pose. This would involve a higher rate of investment – per person in our population – being allocated to the Northern and Western Region in order to stimulate the region's economy and unlock the full potential of its skills base and research and innovation capabilities.

Given that the NWR has been downgraded by the European Commission from a 'More Developed Region' to a 'Transition Region', underlines the imperative to seek economically sustainable solutions for this area. This interconnection of rural and urban is a key objective of the 3Ps and also the Bioeconomy approach to creating a circular economy. I will now examine

the potential for the Bioeconomy approach to deliver on the 3Ps framework and the vision for a sustainable Ireland.

The Bioeconomy in Ireland

Definition:

> *"The bioeconomy is the part of the economy which uses renewable resources from agriculture, forestry and the marine to produce food, feed, materials and energy, while reducing waste, in support of achieving a sustainable and climate neutral society."* ***(Irish Bioeconomy Foundation)***

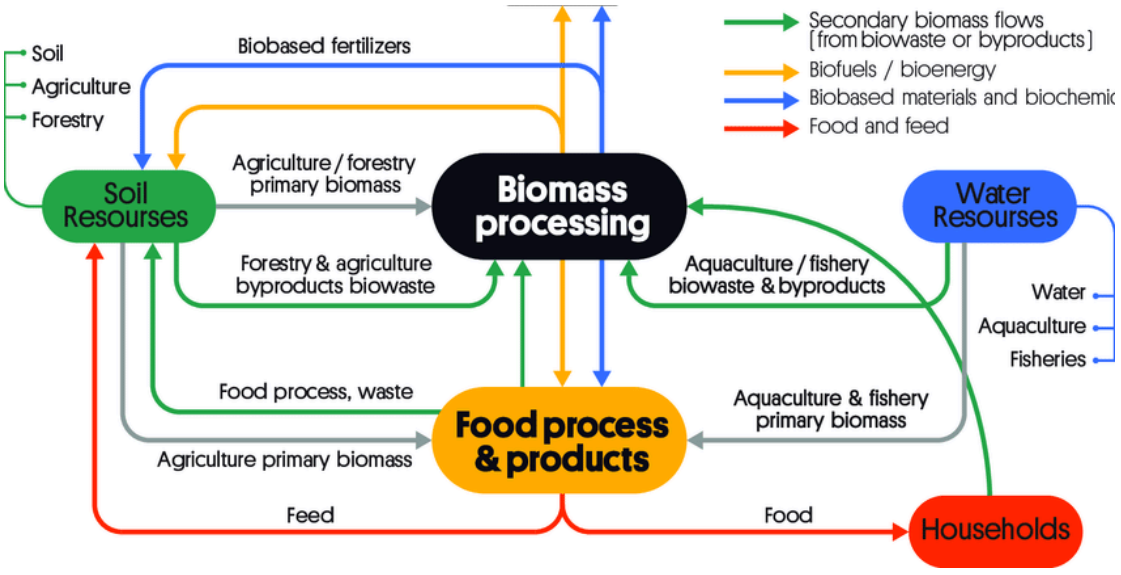
Ireland's Comparative Advantage:
Given Ireland's unique context of wind, wave and solar availability for energy, its advanced Agri-economy, its proximity to the Atlantic Ocean and ongoing re-forestation, allied to a mild and predictable climate, implementation of a Bioeconomy has been identified by the Irish Government as one of the optimal approaches for Ireland in achieving a sustainable Circular Economy.

The Irish Government's vision for the bioeconomy, as set out in the National Policy Statement on the Bioeconomy, is to achieve Ireland's ambition to be a global leader for the bioeconomy through a co-ordinated approach that

harnesses Ireland's natural resources and competitive advantage and that fully exploits the opportunities available.
In October 2020, the National Bioeconomy Forum was launched to promote, support and advocate for the sustainable development of the bioeconomy in Ireland.
In this section I will analyse the specific attributes of the Bioeconomy in the Irish context, how the Bio Economy can deliver on the 3Ps framework and current progress in the creation of a Bioeconomy in Ireland.

What is the Bioeconomy?

Many of the products and services we use today such as food and energy are produced using unsustainable fossil resources that harm our climate, nature & society. The Bioeconomy is the part of our economy which uses renewable resources such as crops, forestry, and fisheries to produce food, products, as well as energy, while also reducing waste. It encompasses a range of activities across many sectors, including agriculture, the marine, forestry, water and waste management, energy, as well as biopharmaceuticals.



The bioeconomy aims to drive both sustainable development and circularity. The principles of the circular economy — reuse, repair and recycle — are a fundamental part of the bioeconomy. Waste and its impact are reduced. It also saves energy, minimises pollution of soil, air and water, thus helping to protect the environment, climate and biodiversity.

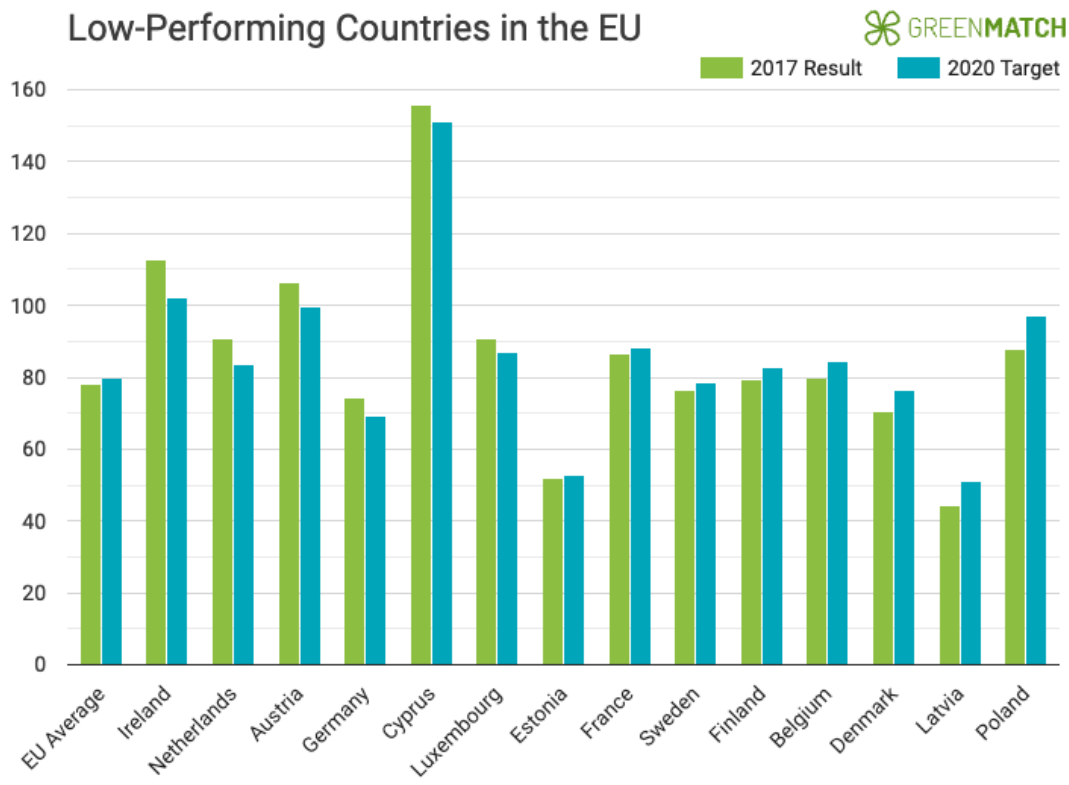
Increased scope of the bioeconomy will mean diminishing our reliance on fossil-based fuels and carbon intensive resources and will boost our use of renewable biological resources.

Opportunities exist in the bioeconomy for Ireland to create economic growth, employment and a sustainable society through leveraging our policy, industry and research and innovation capabilities in natural capital management, agriculture, forestry, the marine, bio-based processing, biotechnology and pharmaceuticals.

The bioeconomy considers our use of biological resources in a holistic way, supporting food and nutrition security, mitigating, and adapting to climate change, reducing dependence on unsustainable resources and strengthening competitiveness, creating jobs, and supporting a just transition.

An important objective of the bioeconomy is to aid Irelands transition to a carbon neutral and drive the shift to circular economy. Given Ireland's continued laggard status, as seen in **Figure 4**, in terms of GHG emissions this is even more critical.

Figure 4:



Source: Greenmatch (2023)

The Bioeconomy is a natural enabler of the transformation to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and the Climate Act 2021. For this vision to be realised it is essential that we harbour a coherent, horizontal approach to policymaking across sectors.

A prime example of what can be achieved in the bioeconomy is the success of **Glanbia (Tirlán)** in transforming whey protein, a side-stream product of the dairy industry with hitherto limited value, into a critical ingredient in the global human nutrition market.

Identified available bioresources for meeting circular bioeconomy needs in Ireland include spent mushroom compost, dairy processing residues, straw residues, forest wood biomass residues, animal manure, brewer's spent grain, organic fraction of municipal solid waste and meat processing waste.

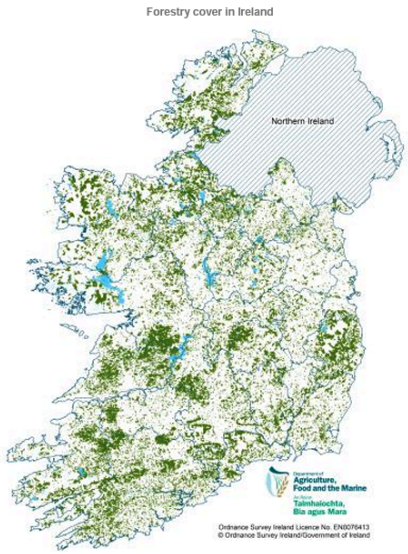
Ireland's Advantages

(as outlined in the National Policy Statement on the Bioeconomy)

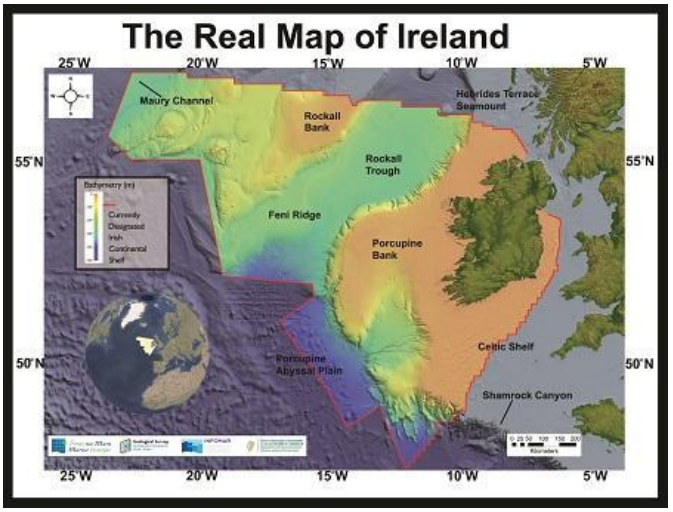
Ireland enjoys some important comparative advantages in relation to the bioeconomy. Much of Ireland's advantage in the bioeconomy sphere can be attributed to its natural capital and relatively long growing season which arises from its temperate climate and fertile soils, with potential for growth up to 10 months of the year.

Ireland has a significant agricultural footprint with about 2/3 of its land devoted to agricultural use. Agri-food is the largest indigenous business and accounts for 5.7% of our GDP. With 80% of the agri-food sector based in rural Ireland, the potential for the bioeconomy to boost employment in regions is evident.

Approximately 10.7% of Ireland is under forests which produce 3.2 million cubic metres of material each year and this is forecasted to increase to 8 million by 2035.



Source: Department of Agriculture, Food and the Marine (2015)



Ireland has also grown its bio-pharmaceutical sector rapidly with 24 out the 25 largest bio- pharmaceutical companies having a presence here with the sector producing €39bn in exports. There is potential for increased alignment of the biopharma sector and the current bioeconomy actors to produce biobased products and services, for specific high value uses from renewable biological resources.

The Irish Bioenergy Association (IrBEA) made a detailed submission to the recent Bioeconomy Action Plan 2023-2025 consultation, on behalf of its members, IrBEA highlighted the crucial role and potential of bioenergy. The organisation highlighted the role the bioenergy sectors of solid biomass, biogas/biomethane, liquid biofuels and biochar have to play in the successful development of a bioeconomy here in Ireland. The bioeconomy and the bioenergy sector are fundamentally linked and entirely complimentary.

Many stakeholders are currently key enablers of the bioeconomy and already actively involved in the bioeconomy space. These stakeholders include biofuel producers, technology providers, designers and installers, supply chains and logistics responsible for mobilising biomass feedstocks, biomass analytical companies, researchers, farmers and foresters. Bioenergy is very important to developing supply chains which in the future could evolve to feed a potential bioeconomy.

InformBio will support preparations for a bioeconomy observatory for a sustainable and circular bioeconomy. The project will deliver a first Foresight Analysis providing a clear roadmap towards a sustainable bioeconomy for Ireland. InformBio combines data driven research, analysis, and modelling with input from expert thematic groups, ensuring robust and informed outcomes for industry, policy makers and other relevant groups.

The project which is funded through the Dept. of Agriculture, Food, and the Marine's Competitive Research Call with a €1M budget will run for 4 years, from 1st of March 2022 to 28th of February 2026. I anticipate that this project will provide much needed data led insight.

Bioeconomy: Challenges and Opportunities

According to the Circular Bioeconomy 2020 Summary Report the Irish bioeconomy and circular economy has vast unexploited environmental, social and economic potentials but several growth and developmental barriers still exist.

Inefficient linear production models still thrive in Ireland and other parts of the EU. There is therefore a need for committed leadership and engagement of senior management, stakeholders of concerned businesses and industries. Clear-sighted legislation and a strong set of local governmental policies will also be key.

Current taxation patterns are not always supportive of a just transition, particularly the over taxation of labour and under taxing of raw materials and waste. This makes circular business models less attractive for businesses, hence the need for legislation and policy tools that will address this imbalance.

Overcoming the obstacles to the growth and development of the Irish circular bioeconomy will require the promotion of circular thinking, the creation of conducive environments for circular business models to thrive, and ensuring policy coherence across bioeconomy sectors, as well as between bioeconomy sectors, concerned public authorities and consumers.

Linking circularity to company's sustainability policy and objectives (such as corporate social responsibility strategies) and creating more favourable taxation systems to improve company margins, by for instance reducing VAT on repaired and reused goods, are just some of the examples of what can promote the transition of the private sector towards the adoption of circular approaches.

The major gaps and barriers for the development of the bioeconomy in Ireland include;

1 Incoherent framework for synergy building towards circular bioeconomy objectives;

2 Low competitiveness of biobased products;

3 Weak primary producer value chain;

4 Low commercialisation and market stimulation potential;

5 Less start-up capital and expansion funding opportunities in comparison to other developed economies

6 Inflexible waste classification systems and handling procedures.

Overcoming the barriers to the development of a bioeconomy include:

1 Greater stakeholder engagement, communications activities, outreach campaigns and ground up approach to embed the bioeconomy across all walks of life;

2 Facilitating more access to EU and private funding;

3 Establishing the necessary legislative and technological framework required for making biobased products commercially viable;

4 Enhanced activities with the Higher Education Institutions to ensure a pipeline of expertise and talent to service the needs of the emerging sector and

5 An emerging bioeconomy can continue to provide further decarbonisation opportunities for the transport sector through the provision of sustainable transport biofuels.

Bioeconomy Action Plan

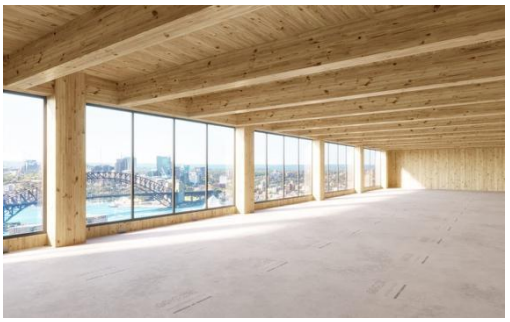
An important objective of the bioeconomy is to move Ireland beyond simply focusing on complying with targets but to integrating sustainable economic development into our economic model as we transition to a low carbon and circular economy.

The proposed pillars of the Bioeconomy Action Plan 2023-2025 are :

The bioeconomy offers society a path to apply its knowledge to how we use and consume resources from our environment that respects nature and increases social equality by reducing our use of fossil resources and developing green practices, products and local jobs in places where we wish to live.

The bioeconomy will support us to farm for carbon and nature and be less wasteful as a society. It will allow us to produce sustainable fertilizers for our fields and nutritious food for our healthy and active lives. It will also offer us sustainable packaging for the goods we buy and innovative materials to both build our homes and support our industries to re-use their waste and reduce its energy use.

In the case studies section, we will see an example of how wood, a potentially abundant Irish resource, can be used in the building industry to replace concrete (high GHG) as the primary building material. An example of "mass wood" construction material producible in Ireland is CLT. Cross-laminated timber (CLT) is a large-scale, prefabricated, solid engineered wood panel. Lightweight yet very strong, with superior acoustic, fire, seismic and thermal performance, CLT is also fast and easy to install, generating almost no waste onsite. CLT offers design flexibility and low environmental impacts.



Primary Research: Emerald Greens

I decided to conduct primary research to ascertain how feasible the transition to a bio-economy in Ireland is. I was interested in the concept of vertical farming in the context of maximising the bioeconomy's potential and the implementation of the circular economy.

Emerald Greens, located in Ballyporeen, Co Tipperary, is Ireland's first and largest vertical farm. They lead the way in controlled environment farming, producing their crops on vertical shelves under LED lights in specially kitted-out grow houses. The plants are nurtured in water only, in an eco-friendly way that eliminates the need for pesticides or herbicides. This extremely efficient system means that they produce fresher, tastier, crops for the Irish market all year round.

I conducted an interview with Emerald Greens C.E.O Brian O'Reilly and asked him questions surrounding the economic and environmental viability of vertical farming.

Mr O'Reilly stated that through the use of hydroponics, which is an innovative type of horticulture that grows plants without the use of soil, his farm uses **90% less water** and **90% less soil,** while producing yields **year-round**. This aligns with the resource efficiency principle of the circular economy (OECD). Food security was identified by EG as a driver as to why the Irish government should promote more sustainable methods, such as vertical farming, to domestic farmers. Through the use of hydroponics, farmers are capable of producing crops domestically which may reduce the need to import, further decreasing our import dependency that has recently caused supply chain shortages and damages to the Irish economy. Recently, Ireland ranked second (behind Finland) in the Global Food Security Index for 2022 with a score of 81.7 compared to Finland's 83.7(Agriland, September 2022). However, those on low and fixed incomes face food security challenges caused by the current and likely future increases in food prices, further showing the damage caused by economic inequalities.

However, there are some high costs associated with vertical farming.

1. Energy Costs
2. Set-Up Costs

Energy Costs: In May 2022,

18c per KW- Daytime Rate
8c per KW- Night-time Rate

Energy Costs: March 2023,

58c per KW- Daytime Rate
28c per KW- Night-time Rate

The increase in day rate energy cost represents a staggering 222% increase, in the space of 10 months.

To combat this price increase, this enterprise installed a wind turbine and 70 solar panels to mitigate the increase in cost. This has secured a 25% saving in energy costs for Emerald Greens. However, solar panels are only optimally effective from the months March through October.

Set-Up Costs: The cost of set-up is also a substantial barrier to implementing vertical farming. 1 Module (Growing Unit) costs €2,000. For example, Emerald Greens currently have 68 Modules which equates to a cost of €136,000 for set-up alone. This poses a large challenge for young farmers and those who are willing to adopt a new form of farming.

Conclusions and Recommendations:

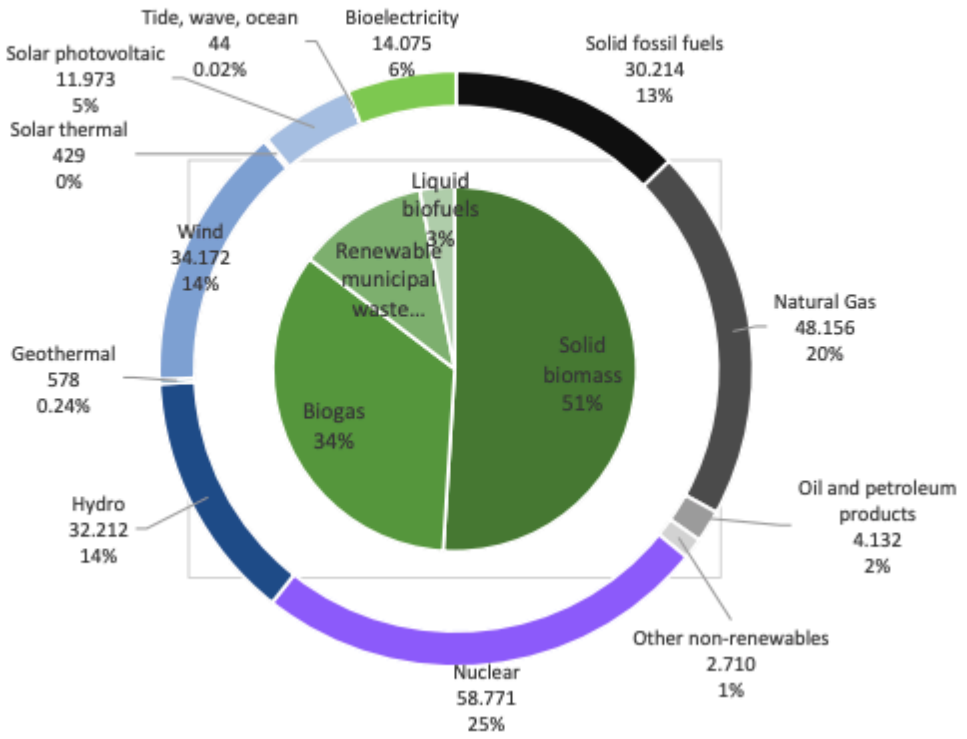
Along with high energy costs, evidence suggests that the high market concentration within the supermarket sector is threatening the viability of Irish Horticulture (Power, 2022). Low prices offered to farmers for their output is challenging the sustainability of traditional farming. The government may need to implement regulations on below cost selling to avoid market failure in this sector. Farmers face challenges in offsetting their high input costs against established selling prices due to price suppression by large supermarkets.

Evidence gained from the primary research I conducted would suggest that the government should implement grant aid to support farmers looking to implement these new sustainable methods of farming. The 3 P framework aligns with the Smart Specialisation Strategy in that it has as its focus the promotion of place-specific initiatives, which aims to capitalise on the comparative advantage particular to a region. Given that the NWR is predominantly rural such an initiative may be viable in the pursuit of furthering the circular economy.

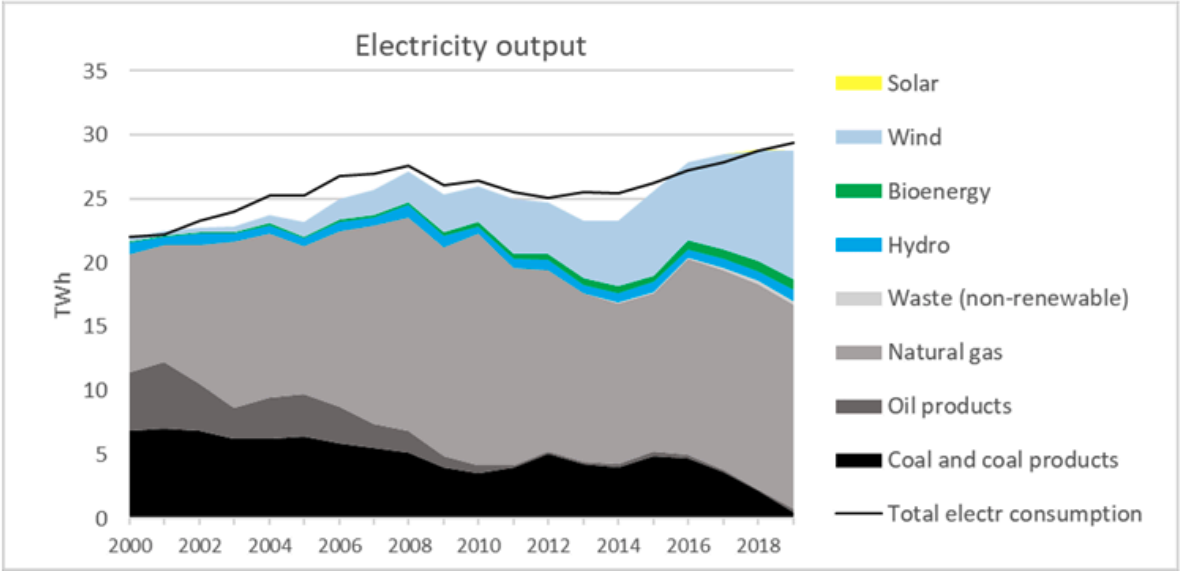
Bioeconomy and Electricity Supply in Ireland

Renewable, regenerative and waste biomass as energy sources represent a significant opportunity. These 3 sources represent almost 40% of Electricity generation across the EU27 (see diagram below which shows EU27 electricity generation is 2020). As noted in a number of sections so far, Ireland's natural advantages, especially on the Western (and North Western) seaboards with its high wind environment, would lead an observer to expect that Irish "bioeconomy" electricity generation would significantly out-perform the EU27 average.

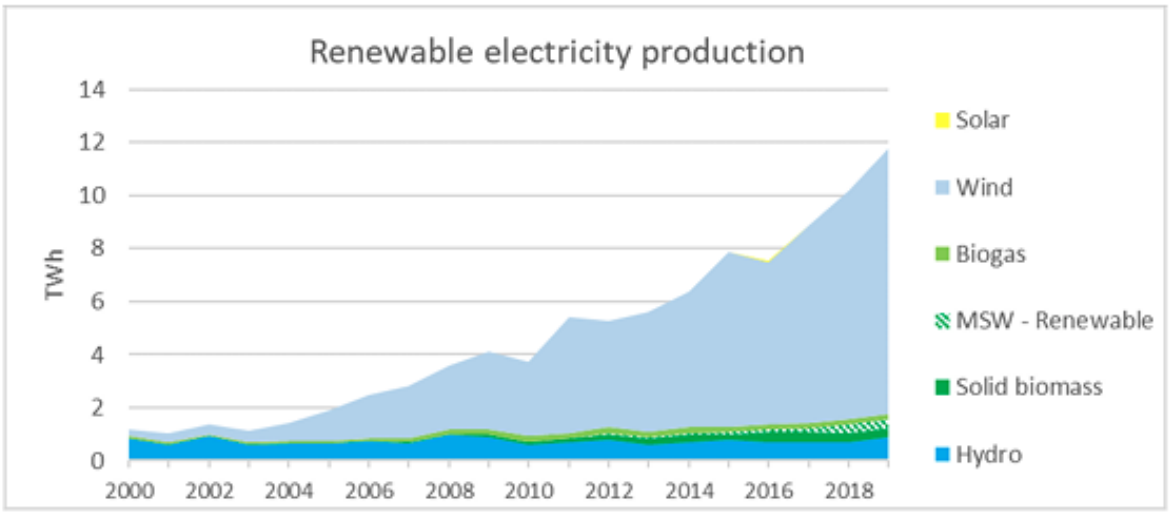
Figure 2 Gross electricity generation by product type in the EU27 in 2020 (ktoe)



However, this is not the case. If we examine the latest report from IEA BioEnergy report in 2021, we can see that Ireland performs at the average of the EU27.

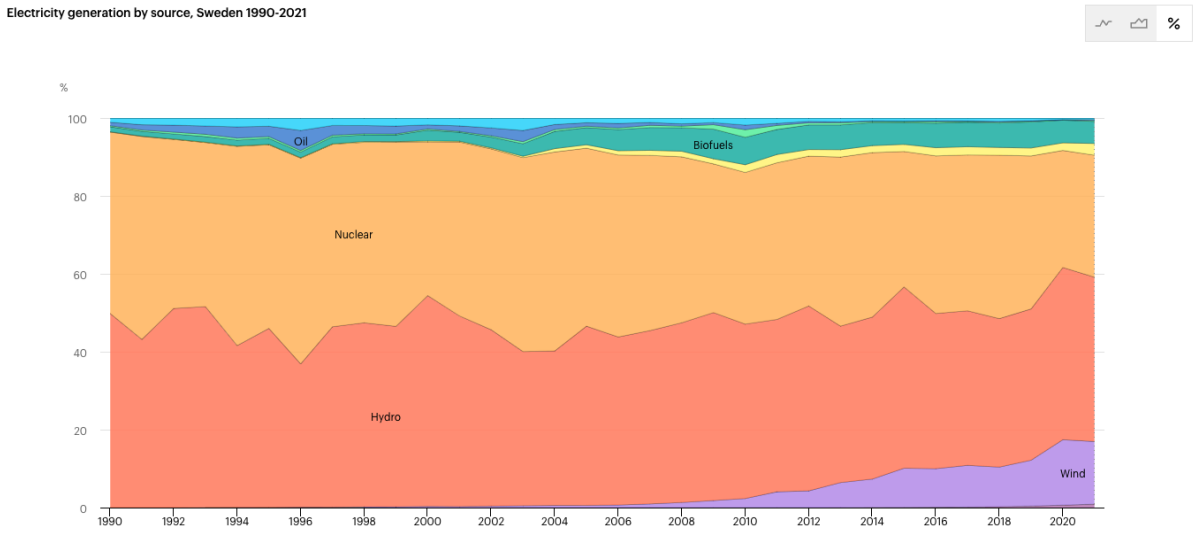


To provide a balanced view, if we look at Ireland's electricity generation over time, Ireland has significantly increased its electricity generation from regenerative and renewable (r & r) resources. This increase has been driven primarily by a roll-out of wind turbines (both on-shore and off-shore) which has led to wind dominating the contribution from these sources. Over the last 5 years, biomass and biogas have started to contribute to the electrical generation ecosystem but nowhere close to the potential for this energy source.



Ireland "r & r" Electricity Production

By comparison, the highest performer in Europe is Sweden, who derive over 68% of their electrical supply from renewable and bio sources.



In the case of Sweden, they have historically leveraged their most abundant electricity source (hydro-electric) to underpin their significant "r & r" performance. Even still, secondary "r & r" sources such as wind and biofuels have begun to contribute.

For Ireland, the opportunity to leverage our most abundant sources of "r & r" electricity is significant. The shift to wind is well underway but the potential for the other sources of bio energy to contribute, especially in situations where there is under-performance in wind generating capacities, is also important. Given that the West and Northwest of Ireland are the dominant locations for wind energy production, the opportunity for bio energy production to also

deliver on challenges such as income discrepancies in the Northern Western region, is an excellent example of how the bioeconomy in general can impact positively across multiple aspects of the 3Ps framework.

It is clear that the bioeconomy in Ireland has enormous potential which is yet to be unlocked. However, there is still a lack of broad public, community and industry understanding and awareness of the bioeconomy opportunity. Work is still required to ensure circular business approaches become the best option for companies willing to gain competitive advantage and maintain their market share, while aligning their objectives with other societal goals.

Bioeconomy and circular economy are not silver bullets for eliminating climate change and environmental degradation. However, they represent incredibly significant, important, and necessary steps towards a more sustainable future in Ireland.

Case Study 1: Clonbio Group

The ClonBio Group Ltd is a family owned Irish agribusiness that manufactures sustainable bioproducts from grain. The Group is a market leader and large-scale producer of renewable energy and animal nutrition in Europe.

The Group has developed Europe's largest grain based biorefinery over the past decade with an investment of €250 million. Managed by its operating subsidiary, Pannonia Bio, it is situated close to its corn feedstock source in the fertile crop growing regions of Hungary. The refining process separates the constituent elements of feed corn, namely starch, protein, fibre and oils, into raw materials for renewable bioproducts.

The biorefinery currently produces ethanol and protein enriched animal feed in volume. ClonBio also functions as an incubator for bioproducts, trialling laboratory proven concepts for their potential to achieve commercial scale. Innovative bioproducts are currently being developed in nutrition, health, biochemical and energy markets in partnership with the concept originators.

Their 3 primary products (ethanol, animal feed and corn oil) are all bioeconomy products sourced from the agriculture sector.

Process

The company purchases 1.1 Million tons of feed corn annually directly from farmers and produces 500 Million litres of ethanol, 350,000 tons of high protein animal feed and 15,000 tons of corn oil. Their facility is built on a 40Ha site on the west bank of the Danube River, 100km from Budapest in Hungary. The refinery runs 24 hours-a-day, seven days a week exporting to over 27 countries throughout Europe and further afield.

Case Study 2: CLT use in Dock Mills Building, Dublin 2

The Dock Mills building in Grand Canal Dock has been designed by architecture studio Urban Agency to extend an existing mill building in Dublin and in doing so create the 50-metres-high Dock Mill, which will be one of the

tallest timber buildings in Europe. The thirteen-storey building was commissioned by property development company Lioncor.

To fulfil the sustainability criteria set by Lioncor, Urban Agency chose to work with cross-laminated timber (CLT), which will suit the restrictions of the site and help with time efficiency. Dock Mill's existing facade and the floor plates of the industrial mill will be maintained and restored. A sustainably-sourced timber extension will then be added. The roof is to be removed and localised CLT columns are to be inserted in the four corners of the existing floor plate all the way to the ground floor.
CLT or cross-laminated timber is an engineered wood product consisting of layers of kiln-dried dimension lumber (usually three, five, seven or nine) oriented at right angles to one another and then glued to form structural panels. By gluing layers of wood at right angles, the panel delivers excellent structural rigidity in both directions and is an outstanding bioeconomy alternative to cement (blocks and pre-fab). A further Irish example of CLT or mass wood building is DLR CC's new Operations Center in Ballyogan.

Conclusion

The question posed at the outset of this analysis was "Can the Circular Economy lead Ireland into a sustainable future?". Through this document I have identified the potential of key strategies of a Circular Economy and Bioeconomy, the opportunities and challenges that might arise, and the potential solutions that might successfully be used to create a sustainable future for Ireland.

I have established the following:

1. Ireland's Government has committed to a long-term strategy of Circular Economy Policy development and law making, providing the pathway for Ireland to move toward a more sustainable future;

2. A strong and clear framework, the 3 Ps, is in place to enable focus and delivery on this clear strategic vision from Government;

3. The Bio-Economy is the optimal Circular Economy approach for delivering a sustainable future given Ireland's unique geographical, resource and social context and

4. While there remain large opportunities and significant challenges, these are not insurmountable and some key challenges may in fact become opportunities for sustainable growth themselves.

A critical final question to be considered is whether "Ireland Inc." has any track record in delivering sustained, long term change that has fundamentally changed Ireland. To test this, we don't need to look too far into the past. Arguably, since the introduction of the Tallaght Strategy* by the then opposition Fine Gael in 1987, Ireland has transformed from a historically unsuccessful agriculture and manufacturing economy to a fast paced, high growth, knowledge economy, led by the growth of FinTech, Big Tech and Pharma industries. Combined with a fundamental transformation of Ireland's existing Agri industry and significant tax reform, this led to the rise and fall of the Celtic Tiger era and the recovery of the last decade, forming a country that is, dramatically different from 1987.

To achieve this transformation, the key participants in the Irish economy (key political parties, Government Departments, Central Bank, State and Semi-State bodies, Industry and Employers, Education, etc) all ensured that they contributed to the achievement of this (admittedly loosely defined) goal in an aligned way. This took place over a multi-decade timeframe, enabling all the agents of the economy to realise this transformation of the Irish economy.

With this recent evidence of transformational capabilities and the analysis of key circular economy strategies that could be implemented in Ireland, it is clear to me that the answer to our posed question is very much **Yes**, implementing the Circular Economy is possible and can indeed lead Ireland to a sustainable future.

References

Drivers for the circular economy in Ireland (https://www.oecd-ilibrary.org/sites/7d25e0bb-en/index.html?itemId=/content/publication/7d25e0bb-en)

National Policy Statement on the Bioeconomy 2018 (https://assets.gov.ie/2244/241018115730-41d795e366bf4000a6bc0b69a136bda4.pdf)

7 Irish enterprises building the circular economy (https://www.thinkbusiness.ie/articles/irish-enterprises-building-the-circular-economy/)

Bioeconomy Action Plan Consultation and Discussion Document (https://assets.gov.ie/240374/042b595a-de62-469e-85b9-000f401caed2.pdf)

The Iberdrola group (https://www.iberdrola.com/sustainability/bioeconomy-what-is-it)

The Irish Bioeconomy Network (http://irishbioeconomy.com/)

Whole of Government Circular Economy Strategy 2022 – 2023 Living more, Using less (https://assets.gov.ie/207622/bd90130d-494e-4d32-8757-46d36c77b912.pdf)

Bioeconomy Action Plan Consultation and Discussion Document 2022 (https://assets.gov.ie/240374/042b595a-de62-469e-85b9-000f401caed2.pdf)

Bioeconomy Ireland Week 2022 Launch and Bioeconomy Research Symposium
(https://www.gov.ie/en/publication/45594-bioeconomy-ireland-week-2022-launch-and-bioeconomy-research-symposium-temp/)

THE CIRCULAR ECONOMY PROGRAMME 2021-2027 EPA
(https://www.epa.ie/publications/circular-economy/resources/EPA_Circular_Economy_2021_Programme_Apr22_Web.pdf)

Northern and Western Regional Assembly Submission on the National Bioeconomy Action Plan 2023-2025
(https://www.nwra.ie/wp-content/uploads/2023/01/nwra-submission-on-the-bioeconomy-action-plan-2023-2025.pdf

https://www.nwra.ie/news/new-cso-data-shows-regional-inequality-in-ireland-continues-to-rise/

History's verdict on the merit of the Tallaght Strategy remains inconclusive - Irish Examiner, Oct.
2010. *https://www.irishexaminer.com/news/arid-20133090.html*

CLT Dock Mill Reference:
https://www.dezeen.com/2020/11/26/urban-agency-dock-mill-europes-tallest-timber-buildings/

Real Map of Ireland Courtesy of Marine Institute: https://www.marine.ie/site-area/news-events/news/map-ireland-bigger-you-think

Ireland Forest Map: https://scsi.ie/wp-content/uploads/2020/11/SCSI-The-Irish-Forestry-Land-Market.pdf

InformBio: https://informbioproject.ie/informbio-project/

OECD (2022), *The Circular Economy in Ireland*, OECD Urban Studies, OECD Publishing, Paris, https://doi.org/10.1787/7d25e0bb-en.

https://ec.europa.eu/commission/presscorner/detail/el/MEMO_14_450
https://ieep.eu/wp-content/uploads/2022/12/IE-Plastic-Bag-Levy-final-1-1.pdf

Convery et al (2007) The most popular tax in Europe? Lessons from the Irish plastic bags levy. Environ Resource Econ (2007) 38:1–11. Springer Science+Business Media B.V. School of Geography, Planning and Environmental Policy, University College Dublin.

https://ieep.eu/wp-content/uploads/2022/12/IE-Plastic-Bag-Levy-final-1-1.pdf

Department of Communications, Climate Action and Environment. (2018). A Circular Economy Strategy for Ireland. https://www.dccae.gov.ie/en-ie/environment/topics/sustainability/circular-economy/Documents/Circular-Economy-Strategy-for-Ireland.pdf

Environmental Protection Agency. (2020). Ireland's National Waste Prevention Programme. https://www.epa.ie/pubs/reports/waste/prevention/NWPPReport2020.pdf

Environmental Protection Agency. (2020). Circular Economy Innovation in Ireland: A Study of Enterprise-led Initiatives. https://www.epa.ie/pubs/reports/research/waste/circular-economy-innovation/CircularEconomyInnovationIreland.pdf

Irish Environmental Network. (2019). Towards a Circular Economy in Ireland: An Overview of Circular Economy Practices, Policies and Potential. https://ien.ie/wp-content/uploads/2019/06/Towards-a-Circular-Economy-in-Ireland.pdf

Construction Industry Federation. (2021). Circular Economy - Opportunities for the Irish Construction Industry. https://www.cif.ie/wp-content/uploads/2021/02/Circular-Economy-Opps-for-Irish-Construction-Industry.pdf

European Commission. (2020). Circular Economy and Resource Efficiency Action Plan for Ireland.

https://ec.europa.eu/environment/circular-economy/pdf/new_action_plan_ireland_en.pdf

Power, Jim (2022) Retail Price Compression Threatens the Viability of Irish Horticulture

Appendix

All images received from copyright free – creative commons licenses and Unsplash.com

Annex I: Industry Resources

The National Development Plan – Project Ireland 2040 the Government's €116 billion development plan which is underpinned by a 20 year planning framework, highlights the potential of the circular bioeconomy in promoting the more efficient use of renewable resources while supporting economic development and employment in rural Ireland.

The Circular Bioeconomy 2020 Comprehensive Synthesis Report was developed as a collaboration between CIRCULÉIRE (The National Platform for Circular Manufacturing by Irish Manufacturing Research) and the Irish Bioeconomy Foundation (IBF). It provides in-depth information and insights into the Irish circular bioeconomy landscape and is the key output from CIRCULÉIRE's 2020 Thematic Working Group facilitated by the IBF.

The Irish Bioeconomy Foundation (IBF) - https://bioeconomyfoundation.com/ is headquartered on the National Bioeconomy campus in Lisheen, Co. Tipperary. The IBF has the goal of promoting the conversion of Ireland's natural land & sea resources to high-value products for the development of a sustainable bioeconomy that is globally competitive and creates local development. The Irish Bioeconomy Foundation is dedicated to the development of Ireland's bioeconomy through increased awareness of new technologies and the establishment of mutually beneficial business relationships, currently has identified 600 relevant companies.