Energy for generations

accenture

System Value Analysis for Ireland's 2030 Climate Targets

May 2021

Ireland's climate commitments

Building on the ambitious Climate Action Plan (CAP) released in 2019, the new Irish government's 'Programme for Government' targets a 7% Year-on-Year reduction in GHG emissions (on average) from 2021 to 2030.

What's been promised

By 2030

7% YoY

Average decrease in CO2eq emissions over 2021-2030 and binding **30% decrease in non-ETS emissions (from 2005 level)**

By 2050

100%

Ireland to achieve net-zero emissions across the economy

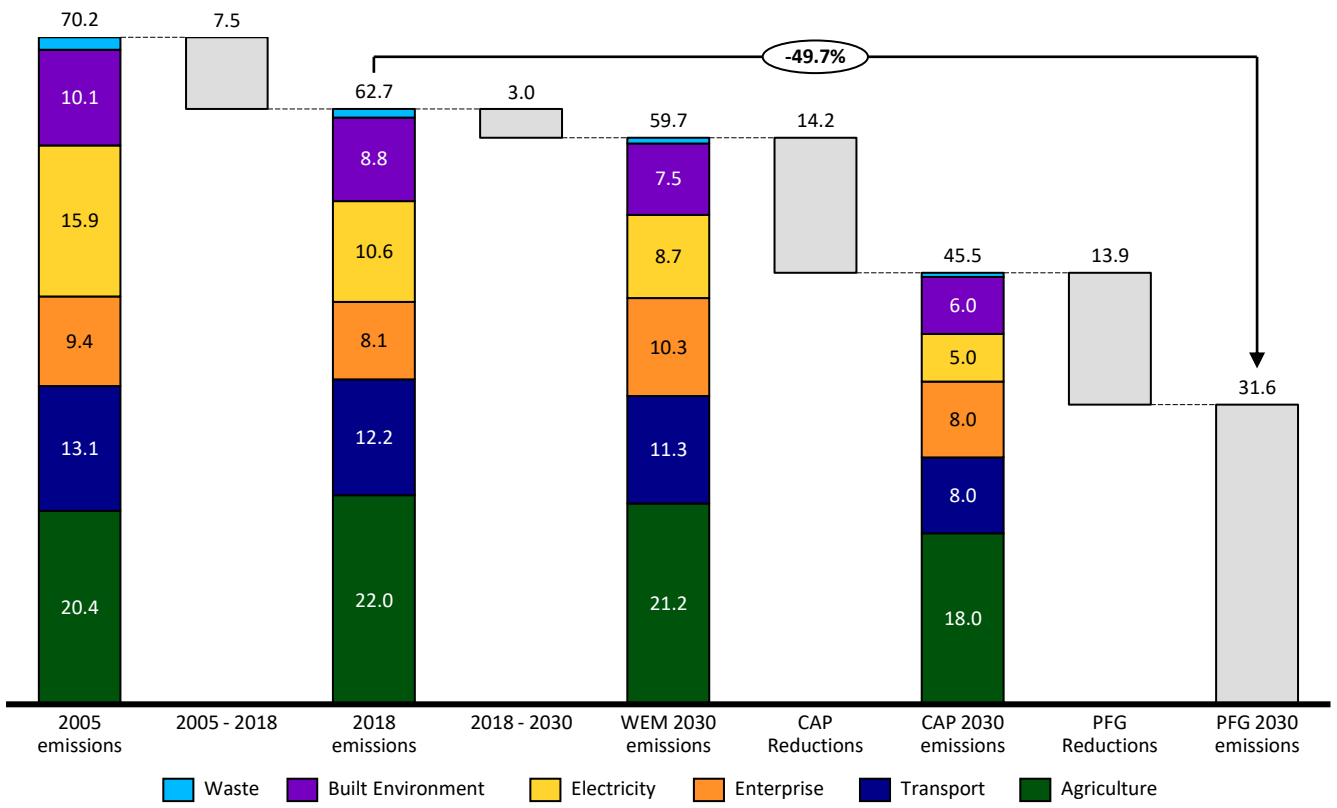
Stretching the Ambition

The new programme for government[1] doubles the target for emissions reduction over the 2021 – 2030 period compared to the 2019 CAP[2]. Achieving this new target, requires decisive action to accelerate emissions reduction beyond current plans.

This analysis presents a suite of economy-wide actions for deeper emissions reductions. Priority is given to aggressive but practical actions, however, to close the gap, additional transformation measures – requiring unprecedented levels of behavioural and system transformation – are needed and options are proposed.

Overall, a cross-sectoral, multi-stakeholder approach is necessary and swift action will enable maximum impact on the carbon budgets out to 2030.

GHG emission progress towards 2030 Ireland target ($MtCO_{2eq}$) [2,3,4]



Note: CAP refers to the 2019 Climate Action Plan and PFG refers to the Programme for Government released in 2020. WEM is "With Existing Measures" – referring to measures in place prior to the 2019 Climate Action Plan. Greenhouse gas (GHG) emissions are in CO_2 equivalent (CO_{2eq}). Mt = million (metric) tonnes.

Note: 2030 emissions are from the ranges in the CAP. There is some inconsistency between these and the 2020 National Energy and Climate Plan[5]. Historical emissions and the WEM scenario are taken from the Environmental Protection Agency[3].

Sources: (1) PFG; (2) CAP; (3) EPA; (4) Accenture Analysis; (5) NECP

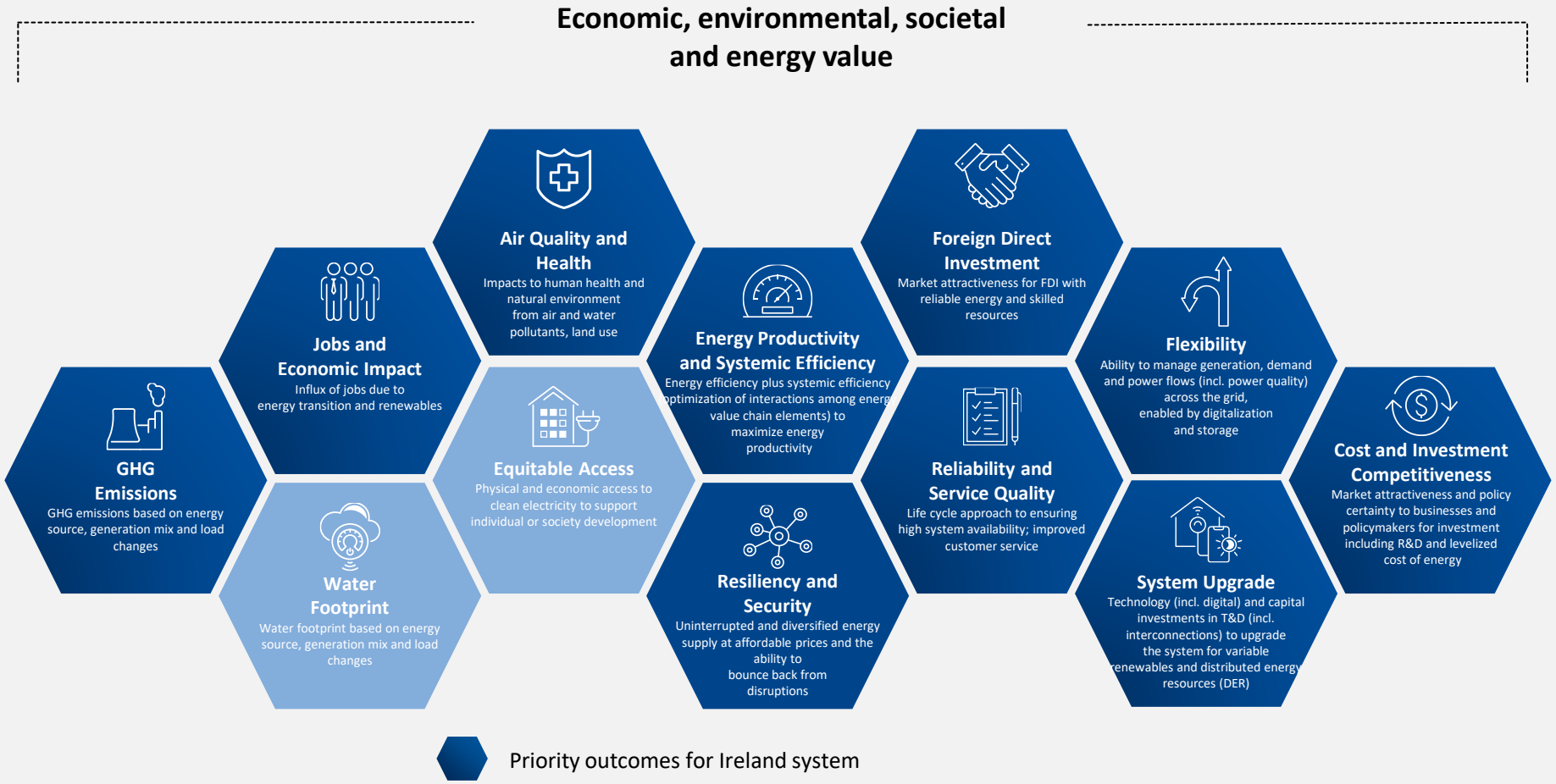
System Value of the clean energy transition in Ireland

The System Value framework more holistically evaluates economic, environmental, social and technical outcomes of potential energy solutions across markets. The framework aims to **shift political and commercial focus beyond cost to include value.**

Each of these key dimensions represent **an outcome that delivers value to society or the energy system** (e.g. jobs & economic impact, system flexibility).

The framework considers both quantitative and qualitative outcomes.

Key dimensions for Ireland have been prioritized based on current market dynamics and relative maturity of transition towards an integrated energy system delivering net-zero GHG emissions.



Potential solutions for Ireland

Solutions to close the gap between CAP and the 7% YoY reduction ambition

Power System Decarbonisation

Deploy an additional 1.5GW of offshore wind, with a diverse portfolio of energy storage options and implement CCS on 1GW of CCGT capacity.

Up to 2 Mt
CO_2 reduction in energy industries in 2030

15k – 20k
Jobs from CCS and Offshore Wind expansion by 2030

€8mn
Human health benefits in 2030

Data Centre Demand Optimisation

Mandate "24/7 Carbon Free" operation of data centres through carbon intelligent computing and multi-technology renewable PPAs to maximise renewable electricity use.

~1 Mt
CO_2 reduction from electricity generation in 2030

€16mn
Human health benefits in 2030

Decarbonisation of Heavy Duty Transport

Eliminate emissions from 50% of heavy goods vehicles and 80% of buses respectively in 2030, substituting diesel with HVO blending, hydrogen, electric and Bio-CNG.

~0.8 Mt
CO_2 reduction from HGVs and Buses in 2030

2k – 8k
Economy-wide jobs by 2030

€24mn
Human health benefits in 2030

Industry Fuel Switching

Use direct electrification and renewable heat for low temperature process heat in industry, and waste derived fuels in cement to reduce emissions from fossil fuel combustion.

Up to 2 Mt
CO_2 reduction from fuel switching in 2030

€72mn
Human health benefits in 2030

Public Sector Decarbonisation

Stretch the emissions reduction target in the public sector from 30% to 80% of 2018 levels leveraging heating electrification and energy efficiency.

~0.4 Mt
CO_2 reduction from heat pumps and efficiency in 2030

€47mn
Human health benefits in 2030

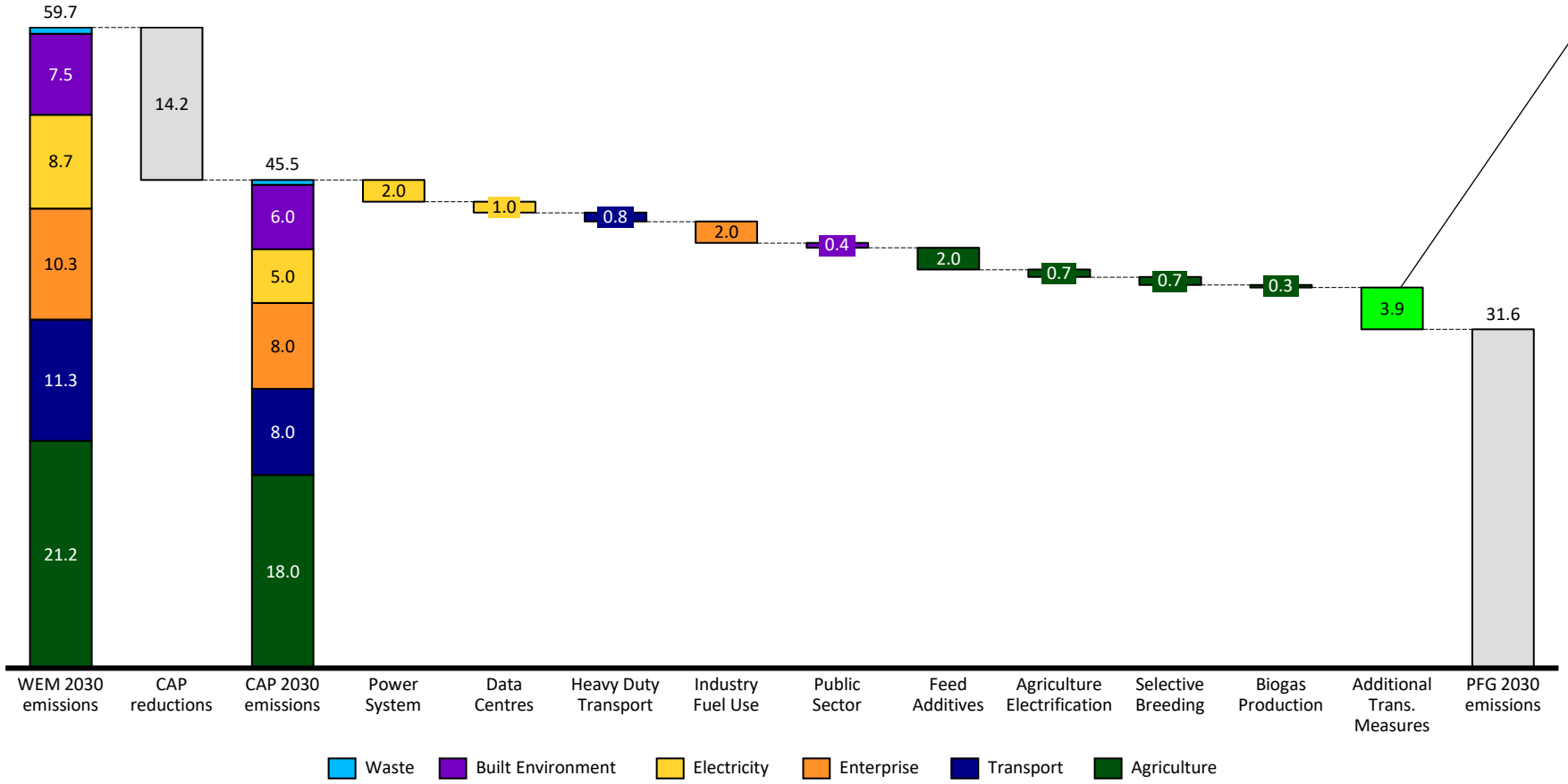
Decarbonisation of Agriculture

Reduce emissions by adopting best practice in selective breeding and the use of feed additives. Produce biogas using anaerobic digesters and electrify fuel combustion applications.

~3.7 Mt
CO_{2eq} reduction from best practices in 2030

Closing the gap: CAP to Programme for Government

To meet the Programme for Government 2030 ambition, Ireland will need to double planned GHG emissions reductions compared to CAP. The solutions below are aggressive but practical ways to drive further reductions, however, 3.9MtCO_{2eq} will need to be addressed with additional transformation measures requiring unprecedented behavioural and system transformation.



Additional Transformation Measures ***(Illustrative)***

Transformational actions that could provide additional saving to close the gap include:

Zero unabated natural gas generation

- Implementing CCS on all generation from natural gas by 2030 – could deliver up to **1.6MtCO_2**

Accelerated retrofits and heat pump rollout

- Retrofitting and electrifying heating in all homes on oil, coal and peat and scaling up district heating with waste heat from data centres and industry could deliver up to **2.5MtCO_2**

Double passenger EV ambition with 2025 ICE ban

- Doubling the passenger EV ambition to 1.7m vehicles by banning ICE vehicle purchases from 2025 could deliver up to **2.2MtCO_2**

Dramatic Transport Demand Reduction

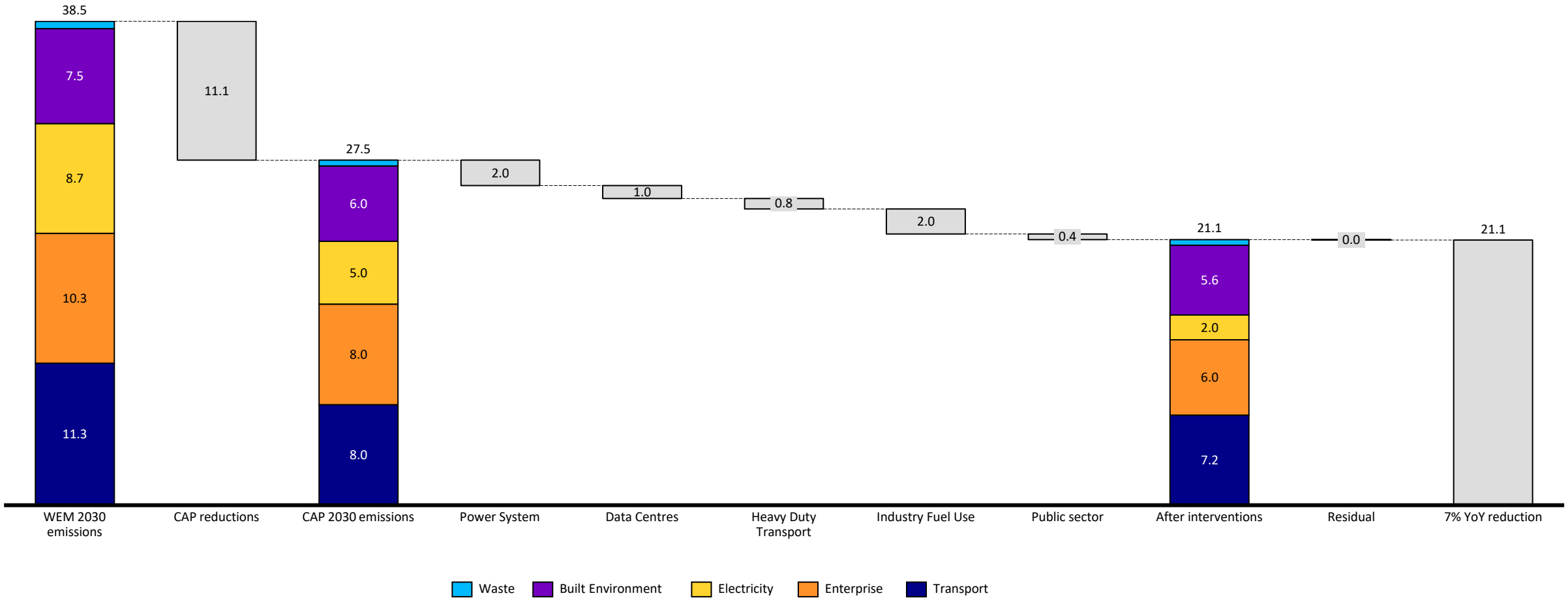
- Additional savings from mass adoption of active transport and e-scooters for short distance journeys and increased remote working **~ 1MtCO_2**

Note: (1) Emissions reductions of proposed solutions are reductions in 2030 – their impact on the carbon budgets between 2021 and 2030 depend on speed of implementation
(2) Numbers have been rounded

Sources: EPA; CAP; Accenture Analysis

Reaching 7% YoY reduction in energy system emissions

While additional transformation measures are necessary to meet the equivalent of a 7% YoY reduction on system-wide emissions in 2030, the solutions outlined here (and detailed later in this document) enable Ireland to meet this target in the energy system.



Note: (1) Emissions reductions of proposed solutions are reductions in 2030 – their impact on the carbon budgets between 2021 and 2030 depend on speed of implementation
(2) Numbers have been rounded

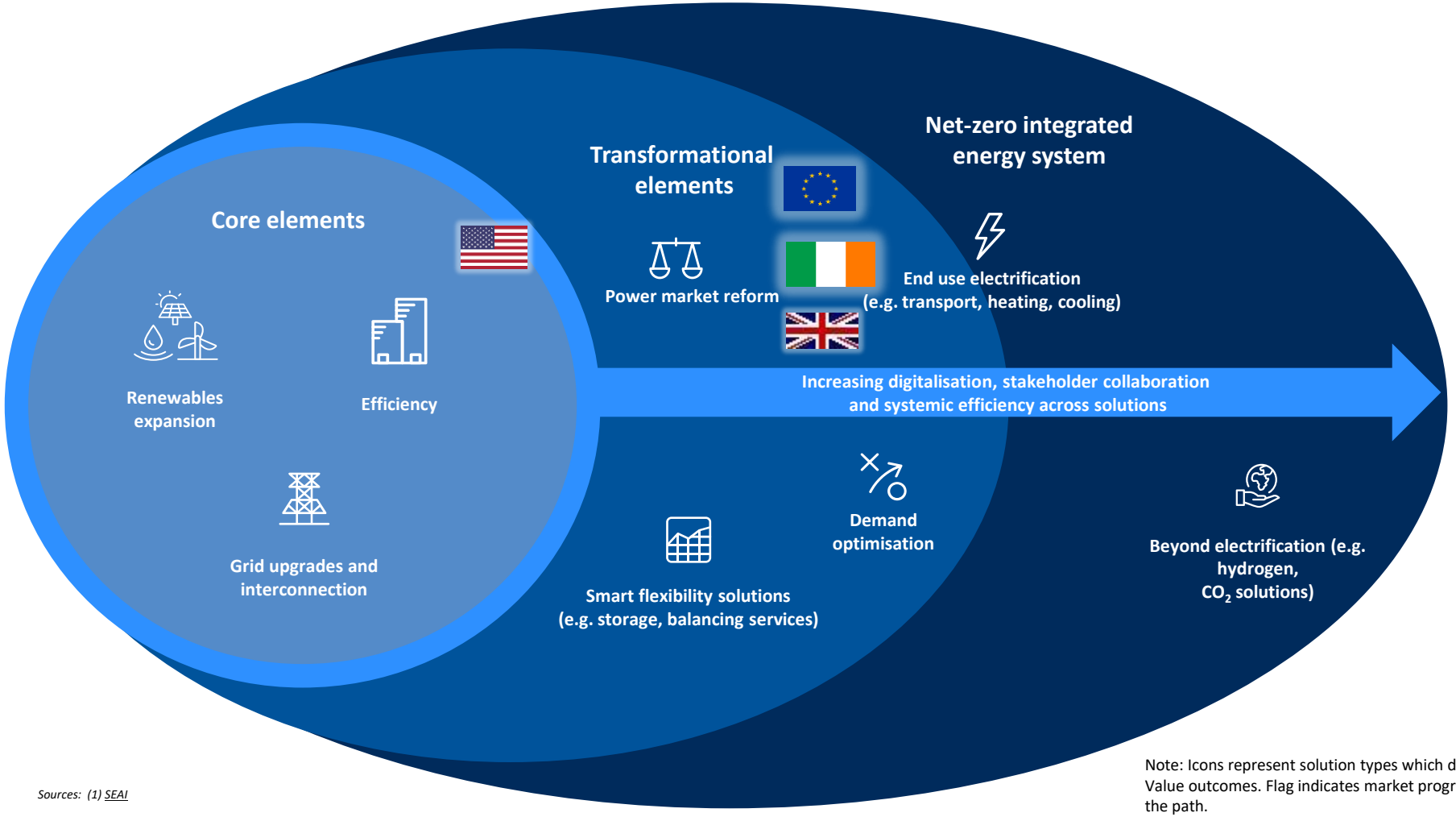
Sources: EPA; CAP; Accenture Analysis

Ireland's path to maximise System Value

Markets are moving from addressing core elements of the electricity sector transition…

…through "pivot points" where generation mix hits 20%-30% annual variable renewables (>50% instantaneous) and transformational elements enable…

… acceleration to a net-zero integrated energy system with a strong focus on systemic efficiency



Ireland is at the pivot point, with 36% variable renewables in the annual electricity generation mix in 2019[1]

Transforming power market and networks, electrifying carbon-intensive sectors, and **advancing solutions beyond electricity such as CCS and hydrogen** will have increased importance through the 2020s and beyond

Note: Icons represent solution types which deliver System Value outcomes. Flag indicates market progression along the path.

Sources: (1) SEAI

Potential solutions for Ireland

01 Power System Decarbonisation

02 Data Centre Demand Optimisation

03 Decarbonisation of Heavy Duty Transport

04 Industry Fuel Switching

05 Public Sector Decarbonisation

06 Decarbonisation of Agriculture

1. Power System Decarbonisation

Overview

Ireland has a target to generate 70% of its electricity from renewables by 2030[1]. Natural gas will play a key role in this high variable renewables system, hedging intermittency and ensuring reliability alongside flexibility measures. However, to meet Ireland's Programme for Government ambition will require emissions from natural gas in power generation to be reduced.

CCGT with CCS

- CCS provides an option to keep baseload generation from natural gas with very low emissions. CCS on 2 x 500 MW CCGTs, could save ~1.5 $MtCO_2$ in 2030[2]
- Ireland has the potential for local storage in the nearly depleted Kinsale Gas Field or to ship captured CO_2 to storage locations in the UK (Northern Endurance) and Norway (Northern Lights)

Renewables Expansion

- The Irish Government stated the intention to increase offshore wind to 5GW by 2030 in the 2020 Programme for Government[3]. This represents a 1.5GW increase on the 3.5GW target used to model a 70% RES-E system in CAP[1]
- The additional 1.5GW of offshore wind capacity could be combined with energy storage to enable greater electrification of enterprise and the built environment without additional gas peaking[4]

Energy Storage Expansion

- To maximise the use of renewable electricity and reduce peaking requirement from OCGT and CCGT, energy storage can be expanded via a variety of solutions and deliver ~0.5 $MtCO_2$ in 2030[2]. These solutions include:
  - Batteries for intra-day renewables volatility, demand peaks and constraints
  - Pumped hydro for longer term storage and system balancing
  - Green hydrogen for long term storage and decarbonising other sectors

Flexibility

- A high level of renewables penetration and reduced reliance on natural gas will need to be underpinned by sweeping reform in network operation and power markets to increase flexibility through measures such as EirGrid's DS3+ programme

Offshore Wind Expansion

System Value Impacts of Power System Decarbonisation

Up to 2 Mt
CO_2 reduction in energy industries in 2030

15k-20k
Jobs from CCS and Offshore Wind expansion by 2030

€8mn
Human health benefits in 2030

Sources: (1) CAP; (2) Accenture Analysis; (3) Programme for Government; (4) Greentech Media

2. Data Centre Demand Optimisation

Overview

The presence of large energy users, primarily data centres is a growing feature of Ireland's electricity demand mix and is set to grow up to 26% of electricity demand by 2030[1]. These will provide an economic boost to the country but are also set to increase the generation capacity requirements and necessitate network investment to cope with their demand. However, given the concentrated and flexible nature of this demand source compared to sectors like residential or public sector, it provides a promising opportunity for demand-side intervention to reduce renewable curtailment and the required generation from gas.

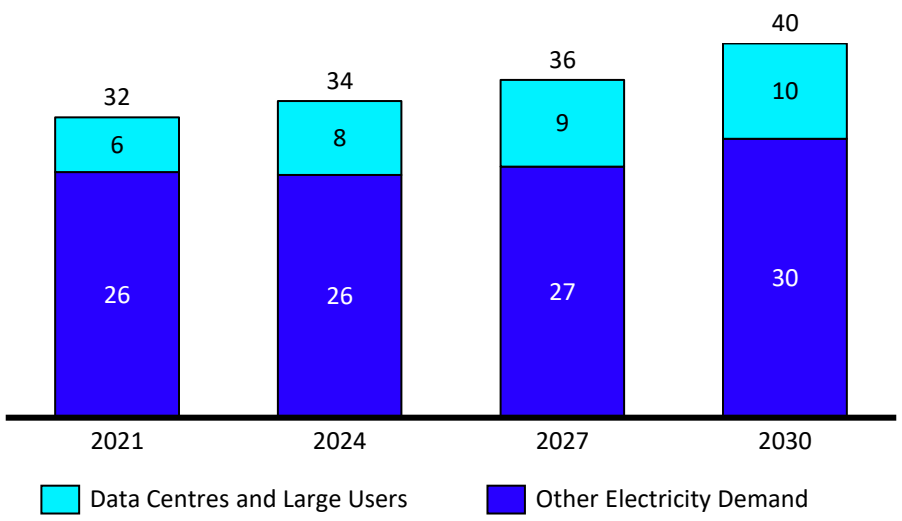
24/7 Carbon Free Data Centres

- In 2020, Google announced their target to run their data centres on zero carbon electricity 24/7 by 2030[2] through commercial and technical measures including matching their operational electricity use to availability of variable renewable generation through carbon-intelligent computing[3]
- As Ireland continues to be a destination of choice for new data centres, policy measures could mandate flexible operation from data centres and other large energy users to reduce renewables curtailment and natural gas generation
- Taking the 70% RES-E target in 2030 and the data centre demand projection in the CAP[1], by shifting 95% of the data centre demand that would be met by natural gas fired generation to carbon-free generation, generation from natural gas would reduce by ~2.9TWh[4]
- Multi-technology PPAs should be encouraged to smooth the supply curve, with technologies like solar and battery storage helping complement the wind variability

Data Centre District Heating

- In addition to reducing emissions from data centre energy use, data centres can implement heat recovery to provide low cost, low carbon heating to residential, commercial and public sector buildings. This is currently being trialled in Dublin[5]

Data Centre Projected Electricity Demand (TWh)[1]



System Value Impacts of Demand Optimisation

~1 Mt

CO_2 reduction from electricity generation in 2030

€16mn

Human health benefits in 2030

Sources: (1) NECP; (2) Google; (3) Google ; (4) Accenture Analysis; (5) Amazon

3. Decarbonisation of Heavy Duty Transport

Overview

- HGVs and public passenger transport (buses) accounted for 16.6% of transport final energy use in 2018 and generated 2.3 Mt of CO_2 emissions in 2018[1]
- The CAP targets equate to decarbonisation of 25% of HGVs and 11% of buses by 2030[2], resulting in a 0.6MtCO_2 reduction in emissions

Zero or Low Emission HGVs and Buses

- Options to increase penetration of zero or low emissions HGVs and buses include:
- Biofuels:
  - Increase HVO blending in addition to statutory E10 and B12 biodiesel blend
- Electric:
  - Electric (or hybrid) buses are particularly suitable for inter and intra city travel
  - The longest bus route in Dublin is around 145 km. The London electric bus (330 kWh engine) has a range of ~240 km[3]. City centres are also likely to be provided with sufficient charging infrastructure first
- Hydrogen:
  - Hydrogen is particularly suitable for long range buses and trucks
  - Hydrogen trucks can drive as far as 1,200 km on a full tank[4], almost three times the length of Ireland and equal in range to most diesel trucks
  - A hydrogen bus is currently being trialled in Dublin, with ESB providing green electricity from the Ardnacrusha hydroelectric plant to make this hydrogen[5]
- Bio-CNG:
  - Bio-CNG is suitable for mid-long range trucks, as they typically have a range of up to 800km[6]

Recommendation

- The CAP suggests actions to implement all the options listed above. We propose increasing the ambition to eliminate emissions from 50% of HGVs and 80% of buses resulting in an additional reduction of 0.83MtCO_2 above the CAP plan in 2030. We recommend a technology-agnostic mix of the solutions listed above to achieve this reduction, allowing market forces to decide the ultimate split.

The Hydrogen Fuel Cell Bus in Dublin

System Value Impacts of Zero or Low Emissions HGVs & Buses

~0.8 Mt	2k – 8k	€24mn
CO_2 reduction from buses and HGVs in 2030	Economy-wide jobs by 2030	Human health benefits in 2030

Sources: (1) EPA; (2) CAP; (3) Alexander Dennis; (4) Agility fuels; (5) ESB; (6) Sustainability Journal

4. Industry Fuel Switching

Overview

The majority of industry in Ireland is light industry with notable exceptions being cement and alumina refining. The CAP suggests 80% alternative fuels in the cement production mix and 80% low carbon heat in the food industry[1] by 2030. Given the concentrated nature of industrial emissions and small number of actors relative to other sectors, the ambition in this sector should be stretched to increase electrification and renewable heat

Electrification of Light Industry

- Heating in light industry can be electrified with proven and commercially available technology. Some industries outside of food and beverage to consider are:
- Pharmaceuticals & specialty chemicals – 36% of energy from fuel combustion in 2018[3]
- Light manufacturing (electrical and optical equipment, other manufacturing) – 52% of 2018 energy demand from fuel combustion, mainly gas[3]

Partial Electrification and Green Gas in Alumina Refining

- According to Alcoa[4], a leading aluminium industry player, 70% of alumina refining emissions are from the low-temperature Bayer process and can be electrified using mechanical vapour recompression (MVR) powered by renewable electricity. MVR is in use at industrial scale currently but yet to be applied in alumina refining
- Zero carbon gas (syngas, biogas, hydrogen etc.) with industrial CHP could be done in addition to partial electrification to decarbonise high temperature heat processes

Industrial Cluster Collaboration

- Where industry is co-located, efficiency benefits can be gained from: aggregating demand to purchase renewable PPAs, arranging on-site behind-the-meter renewables generation, and recovery and reuse of waste heat at a cluster level. This can reduce the potential demand uplift and required network investment from greater electrification

Recommendation

- Additional to the CAP, a push for deep adoption of electrification and renewable heat in light industry (>80% of energy use) and in alumina refining (up to 50% emissions reduction), could provide ~2 $MtCO_2$ emissions savings

Fuel Switching for Industrial Process Heat

Direct Electrification & Renewable Heat

- Electrify low-to-medium temperature and pressure processes
- Generate low-cost, renewable electricity and heat onsite (e.g. rooftop solar, biomass, CSP)
- Pursue shared infrastructure (e.g. storage, flexibility)

System Value Impacts of Industry Fuel Switching

Up to 2 Mt
CO_2 reduction from fuel combustion in 2030

€72mn
Human health benefits in 2030

Sources: (1) CAP; (2) EPA; (3) SEAI; (4) Alcoa

5. Public Sector Decarbonisation

Overview

The CAP targets public sector emissions reductions of 30% and energy efficiency improvements of 50% by 2030 compared to 2017 levels[1]. This level of ambition is lower than that of the residential sector and can be stretched to reflect the public sector's commitment in leading the charge on emissions reduction.

Space and Hot Water Heating

- The CAP ambition is a 30% reduction from 2017 levels, which results in a reduction of 0.26 $MtCO_2$ of emissions. We propose increasing this ambition to 80%, resulting in an additional 0.44 $MtCO_2$ emissions reduction, using a combination of the following:
- Heat Pumps:
  - Reducing combustion of heating fuels, such as kerosene and wood fuels, for space and water heating by switching to heat pumps for public buildings
- Energy Efficiency Retrofits:
  - The CAP states a need for all Public Buildings to reach BER 'B' Rating. However, efficiency retrofits could be more effective and implemented to a BER 'A' Rating

Recommendation

- It is proposed to increase the ambition to eliminate emissions from 80% of the public sector from 2017 levels, resulting in an additional reduction of 0.44 $MtCO_2$ above the CAP plan in 2030

Public Sector Energy Efficiency

System Value Impacts of Public Sector Decarbonisation

~0.4 Mt
CO_2 reduction from heat pumps and efficiency in 2030

€47mn
Human health benefits in 2030

Sources: (1) CAP; (2) EPA

6A. Decarbonisation of Agriculture

Overview

The agricultural sector is a key contributor to non-ETS emissions in Ireland, accounting for 33% of total GHG emissions in 2019, and 45% of non-ETS emissions[1]. This is significantly higher than other EU-27 countries, with average agricultural emissions of 10% of total emissions. With the importance of the agricultural sector and plans to increase the dairy herd further under the Food Wise 2025 plan, reducing emissions in this sector is essential for Ireland to meet its climate targets.

Electrification of Fuel Combustion Processes

- 0.68 $MtCO_{2eq}$ of emissions in the agricultural sector are from fuel combustion[2]. This includes powering heavy farming machinery, processing & refrigerating foods, producing packaging materials, and manufacturing and transporting fertiliser etc
- These emissions are forecast to increase to 0.98 $MtCO_2$ by 2030[4]. By electrifying 70% of fuel combustion applications, ~ 0.7 $MtCO_2$ of emissions could be avoided

Feed Additives

- Feed additives can reduce methane emissions from ruminant livestock enteric fermentation
- Effective additives include organic nutrients, fats and oils - feeding one type of seaweed at 5% of the diet has resulted in up to 95% reduction in methane emissions from cows without altering milk taste[3]. These additives can be easily combined with milk-optimising dry feed cycles
- From a typical feed additive with ~33% effective reduction[4], with a 50% take up rate for cows in Ireland, a sizeable annual reduction in enteric fermentation methane emissions, based on 2019 cow population[5], of 2 $MtCO_{2eq}$ could be achieved

An Effective Additive - Asparagopsis Armata

System Value Impacts of Agriculture Interventions

~0.7 Mt
CO_2 reduction from electrification of agriculture in 2030

~2 Mt
CO_2eq reduction from feed additives in 2030

Sources: (1) SEAI; (2) EPA; (3) Abbot et. Al; (4) Dairy Cares; (5) CSO

6B. Decarbonisation of Agriculture

Animal Production Efficiency

- The CAP highlights the need to address animal production efficiency but does not state any ambitions[1]
- Implementing optimal selective breeding practices can reduce required life span of cows by 10% - increasing the Economic Breeding Index of the dairy herd - as found by the GreenBreed breeding optimisation programme[2]
- Taking into account 10% lifetime emission reductions from manure & enteric fermentation and a 50% uptake rate would result in a reduction of 0.73 $MtCO_{2eq}$

Anaerobic Digesters to Produce Biogas

- Ireland can reduce a portion of methane emissions from agriculture by converting manure into biogas through anaerobic digestion
- 2.4TWh of biogas for end use in heavy duty transport could provide an emissions saving of 0.26 $MtCO_{2eq}$ from manure management in 2030[3,4]
- This amount of biogas would replace a portion of diesel purchases, instead partially directing this to the agricultural sector and displacing part of Ireland's diesel imports. This supports energy independence & security for Ireland
- There are further circular economy benefits associated with the use of digestate by-product from anaerobic digestion to displace chemical fertiliser

The Huntstown Bioenergy Plant

System Value Impacts of Agriculture Interventions

~0.7 Mt
CO_2eq reduction from selective breeding in 2030

~0.3 Mt
CO_2eq reduction from use of anaerobic digesters in 2030

Sources: (1) CAP; (2) Teagasc; (3) GNI; (4) UCC/MaREI

System Value outcomes for the energy system

System Value Dimension with Quantitative Analysis

System Value Dimension with Qualitative Analysis

	Solution Area	GHG Emissions	Job Impact	Air Quality & Health	Energy Productivity and Systemic Efficiency	Resiliency & Security	Reliability and Service Quality	Flexibility	System Upgrade	Foreign Direct Investment	Cost and Investment Competitiveness
1	**Power System Decarbonisation**	**Up to 2 Mt** CO_2 reduction in energy industries in 2030	**15k – 20k** Jobs from CCS and offshore wind by 2030	**€8mn** Human health benefits in 2030	●	●	●	●	●	●	CCS Association estimate initial abatement cost at 60-90€/ton[1]
2	**Data Centre Demand Optimisation**	**~1 Mt** CO_2 reduction from electricity generation in 2030		**€16mn** Human health benefits in 2030	●	◐	◐	●	◐	●	Avoided natural gas demand could cut €44m in annual capacity market payments[2,3]
3	**Decarbonisation of Heavy Duty Transport**	**~0.8 Mt** CO_2 reduction from HGVs and Buses in 2030	**2k – 8k** Economy-wide jobs by 2030	**€24mn** Human health benefits in 2030	◐	◐	◐	◐	●	◐	Hydrogen bus cost fall to €350k by 2030[4]; Electric vs diesel bus TCO comparable[5]
4	**Industry Fuel Switching**	**Up to 2 Mt** CO_2 reduction from fuel switching in 2030		**€72mn** Human health benefits in 2030	●	◐	◐	◐	●	◐	Carbon price of 80€/ton will encourage switching to low-carbon alternative fuels[6]
5	**Public Sector**	**~0.4 Mt** CO_2 reduction from heat pumps and efficiency in 2030		**€47mn** Human health benefits in 2030	◐	○	○	○	◐	○	Government energy spend was €668 million in 2018[7]. This could be reduced with energy efficiency

Sources: (1) Power Technology; (2) Accenture Analysis; (3) EirGrid; (4) Hydrogen Europe,; (5) Transport & Environment; (6) CAP; (7) SEAI

System Value Dimension Benefit from Given Solution

● High Benefit ◐ Medium Benefit ○ Minimal-to-no Benefit

System Value dimensions – Energy system (1/3)

Benefits realised from the solutions in: Energy Productivity and Systemic Efficiency and Resiliency and Security

Solution	Energy Productivity and Systemic Efficiency	Benefit	Resiliency and Security	Benefit
Power System Decarbonisation	• Raising the ambition on storage solutions, both short-term (batteries, thermal storage) and longer-term (pumped storage, green hydrogen) will enable significant capture of excess renewables generation	●	• CCGT with CCS provide a low emissions option to diversify the power generation mix and boost system security with uninterrupted supply while offshore wind and storage expansion will reduce reliance on imported natural gas	●
Data Centre Demand Optimisation	• Flexible operation of data centres will provide option to turn up demand during high renewables generation periods, reducing curtailment	●	• Data centre demand optimisation enables avoidance of ~2.9TWh of natural gas which reduces reliance on natural gas imports	◐
Decarbonisation of Heavy Duty Transport	• Greater deployment of vehicles powered by green hydrogen (FCEVs) and electricity (BEVs) could reduce renewables curtailment and improve efficiency relative to diesel powered vehicles	◐	• Converting from HGVs and Buses from diesel to locally sourced electricity, green hydrogen and biogas will significantly reduce fossil fuel import dependency	◐
Industry Fuel Switching	• Electric appliances are often more efficient than fossil fuel fired equivalents, reducing primary energy need. Industry can also collaborate on circularity and efficiency initiatives	●	• Fuel switching in industry reduces fossil fuel import dependency	◐
Public Sector	• Public sector building retrofits will create an initial consumer base that accelerates the development of local commercial retrofit supply chains benefitting the private residential and commercial sectors	◐	• Electrifying heating and making buildings more efficient reduces reliance on fossil fuel imports for use in public sector buildings	○

Relative System Value dimension benefit for given recovery solution within market

● High benefit ◐ Medium benefit ○ Minimal-to-no benefit

System Value dimensions – Energy system (2/3)

Benefits realised from the solutions in: Reliability and Service Quality and Flexibility

Solution	Reliability and Service Quality	Benefit	Flexibility	Benefit
Power System Decarbonisation	• CCGT with CCS and storage expansion will maintain system availability and hedge renewables intermittency	●	• CCGT with CCS and storage expansion will provide flexible supply to the generation mix	●
Data Centre Demand Optimisation	• Flexible operation enables data centres to adjust demand in times of system stress	◐	• Demand optimisation from data centres increases flexible demand on the system	●
Decarbonisation of Heavy Duty Transport	• Vehicle-to-Grid (V2G) and smart charging enable electric HGVs and buses to provide balancing services	◐	• V2G and smart charging enable electric HGVs and buses to act like battery storage in regulating demand	◐
Industry Fuel Switching	• Electrification enables more balancing participation for industry which supports service quality and reliability	◐	• With electrified energy use, industry can increase flexible demand on the system	◐
Public Sector	• Limited system impact	○	• Limited system impact	○

Relative System Value dimension benefit for given recovery solution within market

● High benefit ◐ Medium benefit ○ Minimal-to-no benefit

System Value dimensions – Energy system (3/3)

Benefits realised from the solutions in: System Upgrade and Foreign Direct Investment

Solution	System Upgrade	Benefit	Foreign Direct Investment	Benefit
Power System Decarbonisation	• CCS requires development of CO_2 transport and storage infrastructure. Storage expansion requires network and infrastructure investment	●	• This will attract FDI from global renewable generation and energy storage players. It will also make Ireland a location of choice for companies looking to reduce scope 2 emissions	●
Data Centre Demand Optimisation	• Multi-technology renewable PPAs for data centres could encourage build out of more battery storage and behind-the-meter wind and solar	◐	• With most major data centre operators pursing aggressive sustainability goals, Ireland could attract additional FDI through policies that encourage 24/7 carbon-free data centre operation	●
Decarbonisation of Heavy Duty Transport	• Significant infrastructure investment required e.g. electrolysers, charging and refuelling stations, network investment etc.	●	• Encouraging policy and infrastructure could attract FDI from companies looking to cut freight emissions and companies looking for markets for the sale of zero-emissions heavy duty vehicles	◐
Industry Fuel Switching	• Significant investment in electric/biomass powered heating and potential network reinforcement needed	●	• Incentives and support for industry to switch fuels e.g. electricity network reinforcement, green gas injection etc. will attract FDI from industrial companies looking to reduce carbon footprint	◐
Public Sector	• Investment required for scaled up building retrofits and heat pump deployment and potential local network reinforcement	◐	• Limited system impact	○

Relative System Value dimension benefit for given recovery solution within market

● High benefit ◐ Medium benefit ○ Minimal-to-no benefit

System Value outcomes for Agriculture

Reducing emissions in agriculture yields environmental, economic and social benefits for the sector and the wider system

	Solution	Emissions Reduction	Overall System Value Benefits
i	**Electrification of Fuel Combustion Processes**	**~0.7 Mt** CO_2eq reduction from electrification of agriculture in 2030	• Electrifying fuel combustion processes in agriculture will reduce emissions of air pollutants like NOx, SOx and particulate matter released when fossil fuels like diesel are burnt resulting in an air quality and health benefits • Converting from fuel combustion processes to clean renewable sources with storage will create local jobs and increase energy resiliency due to reduced reliance on fossil fuel imports to power this sector • Long term this can reduce operating costs as carbon price increases the cost of fossil fuels relative to renewable electricity
ii	**Feed Additives**	**~2 Mt** CO_2eq reduction from feed additives in 2030	• Feed additives provide a potentially highly effective way to reduce enteric fermentation without herd reduction thus protecting jobs, ensuring a just transition and protecting the economic contribution the agriculture sector
iii	**Animal Production Efficiency**	**~0.7 Mt** CO_2eq reduction from selective breeding in 2030	• Ireland imported 1.5 million tonnes of feed in 2018[1]. Selective breeding could reduce the amount of feed consumed over the lifetime of the herd[2], reducing reliance on feed imports • Selective breeding provides both an emissions saving and economic benefit with increased profit per head of cows
iv	**Anaerobic Digesters to Produce Biogas**	**~0.3 Mt** CO_2eq reduction from use of anaerobic digesters in 2030	• Local production of biomethane using anaerobic digesters will reduce reliance on fossil fuel imports and provide an additional source of revenue to the agriculture sector, stimulating the local economy • Ireland imported 532,000 tonnes of CAN fertiliser in the 2019/20 season[3]. Digestate from anaerobic digesters can be an effective fertiliser substituting for imports and creating a local fertiliser supply chain and new revenue for the sector

Sources: (1) Minister for Agriculture; (2) Selective Breeding; (3) Argus

Appendix

Overview of Ireland 2019 Climate Action Plan

The 2019 Climate Action Plan set out more than 180 actions to reduce emissions across electricity, the built environment, enterprise, transport and agriculture out to 2030. Some of these actions are summarised below.

ELECTRICITY GENERATION

- **70% Renewable electricity** by 2030 – 3.5 GW offshore, 8.2 GW onshore and 1.5 GW solar
- **Phase out of coal and peat-fired** generation
- Carbon price of **€80 per tonne by 2030**
- Support microgeneration, allowing **excess electricity to be sold back** to the grid

TRANSPORT

- Increase the **number of EVs to 936,000** (including passenger vehicles, trucks, vans and buses) by 2030
- **Ban petrol and diesel cars** by 2030
- **Increase renewable biofuel content** of motor fuels

HEATING

- Renewable heating sources in **600,000** residential and **25,000** commercial buildings by 2030
- **Ban oil & gas boilers** by 2025
- New homes to be Nearly Zero Energy Buildings
- B1 energy rating for **500,000** homes and **33%** of commercial buildings by 2030

AGRICULTURE

- **2.68 MtCO2eq. p.a. of emissions abatement** through LULUCF measures
- Support **fertilizer CAN replacement** and **trailing-shoe slurry spreading**

ELECTRICITY CONSUMPTION

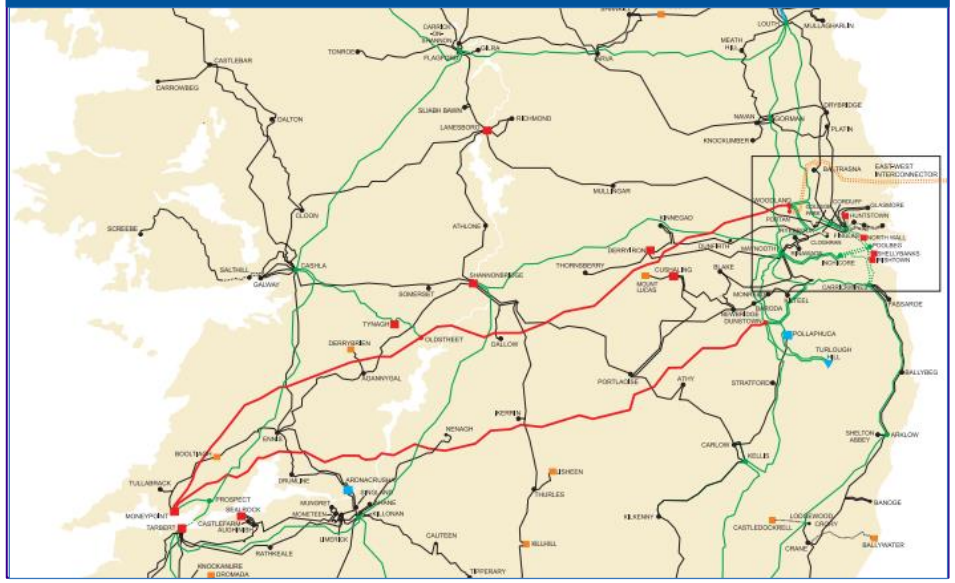
- **Replace all mechanical meters** by 2024
- Facilitate high penetration of variable renewable electricity through **system services and market arrangements**
- 15% of demand met by **corporate PPAs**

Local supply for zero-emissions transport

Offshore Wind for Green Hydrogen and Green Electricity

- With Moneypoint ceasing coal use in 2025[1], its connection to two 400kV transmission lines[2] will be available to ESB for other purposes. Given Moneypoint's location in the Shannon estuary within close proximity of the west coast of Ireland, its connection point can be leveraged to connect offshore wind capacity and create an energy hub in the region
- Offshore wind connected on the west coast can kickstart Ireland's green hydrogen economy. Dedicated capacity can be used to produce green hydrogen onshore at Moneypoint to supply local demand (in heavy duty transport and other uses) with surplus exported to the UK and EU
- Moneypoint's 400kV transmission lines extend across Ireland, being stepped down in demand centres – County Galway and Dublin. They can transmit green electricity to refuelling stations to power electric vehicle charging and electrolysers for onsite hydrogen production
- An offshore wind energy hub could also be started in Cork and used in a similar manner with the added benefit of proximity to the Celtic interconnector to export excess electricity generated

Moneypoint 400kV Transmission Lines (in Red)[2]



Anaerobic Digesters to Produce Biogas

- Methane emissions account for nearly 58% of agricultural emissions[3]. While the majority of methane emissions are from enteric fermentation, a portion is released from manure management and Ireland can reduce this portion by converting manure into biogas using anaerobic digesters
- Biogas production would support the local agricultural economy by creating a new revenue source through gas purchases which would displace a portion of Ireland's diesel imports. This supports energy independence & security for Ireland
- The Causeway Project is developing the infrastructure necessary for a compressed natural gas (CNG/Bio-GNG) refuelling network, including delivering 14 high capacity fast-fill stations[4]

The Causeway Project CNG refuelling network

Sources: (1) EirGrid; (2) EirGrid, (3) RTE, (4) Causeway Project