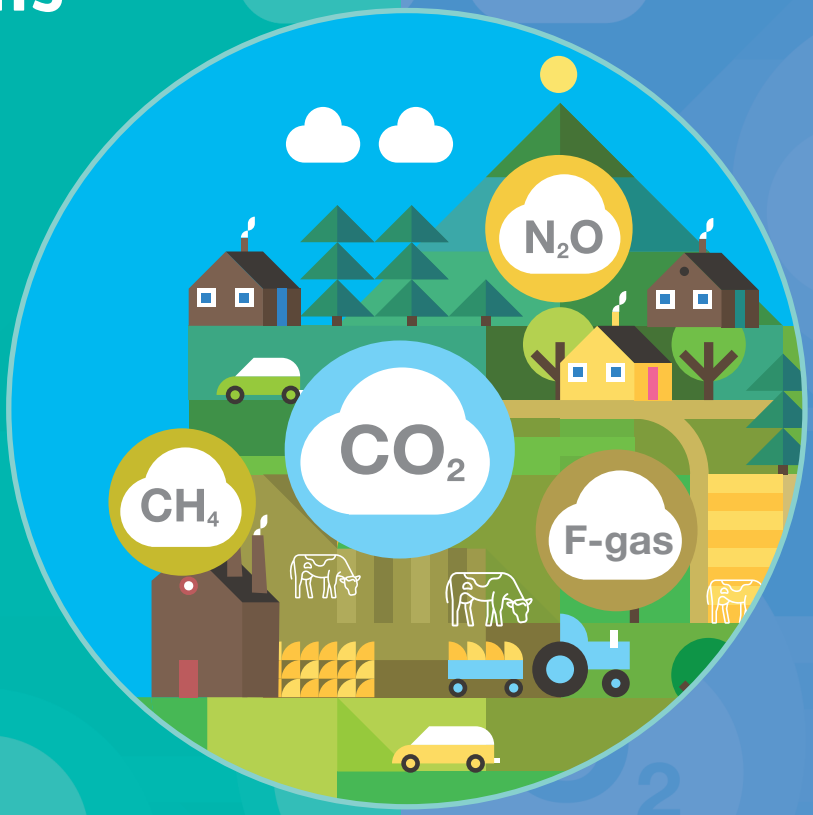
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Input Assumptions for Ireland's Greenhouse Gas Emissions Projections

2022-2040

June 2023



1. Introduction

The Environmental Protection Agency (EPA) is the national body with responsibility to develop, prepare and publish projections of greenhouse gas emissions for Ireland. The EPA produces national greenhouse gas emission projections on an annual basis. The latest EPA Greenhouse Gas Emissions Projections Report provides an assessment of Ireland's total projected greenhouse gas (GHG) emissions from 2022 to 2040.

This document was produced to supplement the above report and provides information on the input assumptions that support the development of the scenarios used to forecast Irelands emissions 2022-2040.

Two policy scenarios are modelled, using EU recommended harmonised fuel price trajectories, the scenarios are:

- **Projections With Existing Measures (WEM):** policies implemented and adopted by the end of the latest inventory year i.e., 31 December 2021. This scenario includes a varying carbon tax that increases by €7.50 per annum and reaches €100 per tonne by 2030 in all scenarios. Post 2030 the carbon tax remains constant at €100 per tonne to 2050. This scenario includes a varying Emissions Trading Scheme (ETS) price that increase annually to €80 per tonne by 2030 and €160 per tonne by 2050.
- **Projections With Additional Measures (WAM):** planned policies from Climate Action Plan 2021 and 2023 and a varying carbon tax that increases by €7.50 per annum and reaches €100 per tonne by 2030 in all scenarios. Post 2030 the carbon tax remains constant at €100 per tonne to 2050. This scenario includes a varying Emissions Trading Scheme (ETS) price that increase annually to €80 per tonne by 2030 and €160 per tonne by 2050.

2. Input Assumptions

Policy Input Assumptions for each sector are set out in Table 1 below.

The first scenario, **With Existing Measures** (WEM), forecasts Ireland's emissions including all national policies and measures implemented by the end of 2021. Implemented policies and measures such as those in the National Development Plan6 (NDP), Climate Action Plan 20197 and Climate Action Plan 2021 are included in this scenario. Many Climate Action Plan 2021 policies and measures are not in the WEM scenario as they are still considered to be planned rather than implemented.

The **With Additional Measures** (WAM) scenario has a higher level of ambition and includes government policies and measures to reduce emissions such as those in Ireland's Climate Action Plan 2023. This was published in December 2022 and the included policies and measures have not yet moved into implementation phase.

Table 1 Input Assumptions used in the With Existing Measures and With Additional Measures scenarios

<table>
<tr><th>Electricity</th><th>With Existing Measures (WEM)</th><th>With Additional Measures (WAM)</th></tr>
<tr><td>Coal (Moneypoint)</td><td>Assumed Moneypoint shut down by 2030 (Modelling Assumption due to plant age, not implemented measure).

Moneypoint full fuel switching from coal to oil in Oct 2024 (Nord Pool Remark).</td><td>Measure: “Phase out and end the use of coal and peat in electricity generation” No date given.

Modelling assumptions:
= WEM</td></tr>
<tr><td>Peat (Edenderry)</td><td>Assumed Edenderry 100% biomass 2024-2030 and close thereafter (Policy assumption from phase out of peat by 2030 in CAP21 and CAP 19 (page 56), closure date in Climate Action Plan 2021 and Edenderry closure by 2030 noted in 2022 GCS (page 38); Modelling Assumption on fuel mix from planning permission and company plans).</td><td>Measure: “Phase out and end the use of coal and peat in electricity generation” No date given.

Modelling assumptions:
= WEM</td></tr>
<tr><td>Oil (Heavy Fuel Oil - Tarbert)</td><td>No HFO past end 2023. Assumed Tarbert shut down by end of 2023. TB1 and TB2 placed on outage until Dec 2023 and TB4 placed on outage until Mar 2023 (Model Assumption from owner's website and Eirgrid Generation Capacity Outlook 2022, not implemented measure).</td><td>Measure
No additional defined target.

Modelling assumptions:
= WEM</td></tr>
<tr><td>Oil (Distillate Oil)</td><td>Assumed shut down by 2035 (Modelling Assumption due to plant age, not implemented measure).</td><td>Measure
No additional defined target.

Modelling assumptions:
= WEM</td></tr>
<tr><td>RES-E</td><td>Assume trajectories from best estimate of renewables provided by DECC. The RES-E yield achieved in the WEM scenario is 68% by 2030</td><td>Measure
2025 50% RES-E (% of electricity demand from renewable energy)
2030 80% RES E (% of electricity demand from renewable energy.

Modelling assumptions:
The 2030 RES-E target of at least 80% of electricity demand from renewable energy has been modelled, rather than the GW targets stated in CAP23. To achieve the RES-E target in CAP23, the following GW targets were modelled:
<table>
<tr><td>Onshore wind</td><td>7.8 GW</td></tr>
<tr><td>Offshore wind</td><td>5 GW</td></tr>
<tr><td>Solar PV</td><td>6 GW</td></tr>
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</td></tr>
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Onshore Wind	Assume best estimate trajectory to 2030 provided by DECC (Measure Assumption based on future RESS auctions and indicative schedule).	**Measure** **2025** 6 GW **2030** 9 GW **Modelling assumptions:** See above for RES-E **2025** 5.8 GW **2030** 7.8 GW
Solar PV	Assume best estimate trajectory to 2030 provided by DECC which continues trend of first 2 successful RESS auctions (Measure Assumption based on future RESS auctions and indicative schedule)	**Measure** 2025 up to 5GW **2030 8GW**. **Modelling assumptions** See above for RES-E **2025** 3 GW **2030** 6 GW
Offshore Wind	Assume best estimate trajectory to 2030 provided by DECC but with 1 year delay, accounting for unpublished ORESS (Offshore Auction run under the Government of Ireland's Renewable Electricity Support Scheme) volumes, delays in phase 1 delivery and uncertainty around timely delivery of phase 2 projects (Modelling Assumption based on expected Phase 1 project delivery at end of 2029 if best estimate pathway from DECC delayed by 1 year)	**Measure** **2025 -**no target **2030** "at least" **5** GW Plus **2 GW** for green hydrogen post- 2030 **Modelling assumptions** See above for RES-E **2030** 5GW Additional 2GW of offshore by end of 2030 reserved for green hydrogen in "green energy parks" post-2030. Not modelled as the hydrogen strategy is not finalised.
Zero-carbon Gas	Biomethane: 0 TWh (No assumption basis meeting WEM criteria at time of Projections)	**Measure** **2 GW** of Offshore wind to produce green hydrogen **5.7 TWh of** Biomethane

	Hydrogen: 0 Twh (No assumption basis meeting WEM criteria at time of Projections)	**Modelling assumptions** 2GW for Green hydrogen post-2030 not modelled (as above). 5.7 TWh Biomethane consumption modelled and allocated to the Heat sector, pro-rated based on gas usage (rather than across the electricity, heat and transport sectors).
Flexible gas fired generation		**Measure** At least 2GW new Flexible gas fired generation by 2030 **Modelling assumptions** 1.2 GW of new open cycle gas turbines included in modelling.
Other	Interconnection in-service dates: Greenlink (01/01/2025) 500MW; North-South (01/01/2026) 300 MW to end of 2025, increasing to 1500 MW from 2026; Celtic (01/01/2027) 700MW DSU: 660 MW by 2030 with new gas turbines as per GCS22 Energy Storage: 800 MW by 2030 (as per GCS21 and 22 battery pipelines from auctions held) No ocean energy until after 2030 No growth in biomass CHP, hydro, waste to energy	**Measure** **2025:** Level of renewables on the grid at any one time 2025: 85% Ensure that 15-20% of electricity demand is flexible **2030:** Level of renewables on the grid at any one time 2030: 95-100%. Increasing to flexible demand 20-30% by 2030 to reduce peak demand and move to times of high renewable output. **Modelling assumptions** As per WEM except Energy Storage: 1700 MW by 2030 with 2-hour fleet average (from CAP 2019 and CAP 2021 modelling).
Large Energy Users (Data centres)	Eirgrid median data centre demand scenario from GCS22 with higher demand forecast over GCS21; 10% higher in 2025, 12% higher in 2030	**Measure** CAP23: “growth from large energy users, such as data centres, will have to be moderated to protect security of supply and ensure consistency with the carbon budget programme" **Modelling assumptions** As per WEM

Transport	With Existing Measures (WEM)	With Additional Measures (WAM)
Biofuels	Based on 2021 Policy statement, assume increase to E10 and B12 by 2025, flat thereafter.	**Measure** **2025:** E10:B12 **2030:** E10:B20 **Modelling assumptions** Based on 2021 Policy statement, assume increase to E10 and B12 by 2025. Then increasing to CAP21 targets post 2025: Further increase to E10 and B20 by 2030 Further increase to E10 and B39 by 2050
Electric Vehicles	Electric Vehicles increase to the following levels in 2025: · Passenger BEV: 126,027 · Passenger PHEV: 62,777 · Electric delivery vans: 12,000 · Electric trucks: 420 · Electric buses: 300 Total: 201,525 Geometric growth in annual sales to reach 2030 values Electric Vehicles increase to the following levels in 2030: · Passenger BEV: 404,275 · Passenger PHEV: 89,576 · Electric delivery vans: 57,000 · Electric trucks: 2,100 · Electric buses: 1,500 Total: 554,451 No new ICE sales post 2035	**Measures** **2025**: 175,000 passenger EV's; 20,000 commercial vans; 700 low emissions HGVs; 300 EV buses in PSO bus fleet; Expansion of electrified rail services. **2030**: **Private Fleet:** EVs make up 30% of total passenger car fleet. EVs make up 100% of new vehicle registrations in privet car fleet. 845,000 Private EV's **Commercial fleet**: 20% EV share of total LGV fleet 95000 commerical EVs 30% ZE share of new HGV registrations 3500 HGVs. **Public transport**:

		1500 EV buses in PSO bus fleet and expansion of the electrified rail services Total EVs 945,000 **Modelling assumption** EV numbers as above No new ICE sales by 2030
'Avoid' (Reduction in ICE Vkm) **&** **'Shift' (behavioural and sustainable transport)**	Impacts of fuel price accounted for endogenously within ESRI demand projections. Modal shift accounted for separately below. An additional 500,000 public transport and active travel journeys daily by 2035 as outlined in CAP 2019	**Measures** **2030** 'Avoid' measures: 20% reduction in total vehicle kms; 20% reduction in total car kms; 20% reduction in commuting car kms; 50 % reduction in fuel usage. To be achieved by 'shift' (behavioural and sustainable transport measures): • 50% increase in daily active travel journeys • 130% increase in daily public transport journeys. • 25% reduction in daily car journeys. • Shift in Daily Mode Share 2018: 72% (car), 8% (PT), 20% (AT) 2030: 53% (car), 19% (PT), 28% (AT) • 30% shift of all E-to-E car journeys to sustainable modes **Modelling assumption:** Modelled a 20% reduction in passenger car kms by 2030 compared to 2019.
Alternative Fuel Vehicles	Implementation of the Clean Vehicle Directive. 150 CNG vehicles by 2030 from the National Policy Framework.	**Measures** **Modelling assumption**

	No diesel-only urban PSO buses will be purchased post July 2019. All public PSO urban bus fleets to become LEVs by 2035	WEM Plus: 100% of CNG assumed to be from Biomethane i.e. direct use of AD biomethane assumed. 1500 low emitting buses to be purchased by 2030 for the urban bus fleet (BEV buses mentioned in CAP21)
Energy Efficiency in Transport	2021 targets for new cars and vans met. Full implementation of Directive (EU) 2019/1161. EU post-2020 CO2 targets for cars and vans. By 2030, emissions from new cars will have to be 37.5% lower and emissions from new vans 31% lower, compared to 2021.	**Measures** **Modelling assumption** As per WEM
Enterprise, Built Environment and Public Sector	**With Existing Measures (WEM)**	**With Additional Measures (WAM)**
Projected Demand	Underlying growth in demand is based on the ESRI I3E macroeconomic for Industry & agriculture sectors. For Residential and Services sectors, the demand is based on a bottom-up estimate using the baseline demand of existing stock from the NEMF archetype model with additional demand allowed for new builds. New build projections are in line with the 'Housing for all' projections up until 2030 and ESRI housing projections thereafter. This approach is consistent with the SEAI National Heat Study.	As per WEM
Support Scheme for Renewable Heat (SSRH)	Current SSRH tariffs to be simulated – extended to 2027. No SSRH post 2027	**Measures** 70-75% share in renewable heating **Modelling assumption** ~60% share of low carbon heat based on current SSRH tariffs.
District Heating	Based on expected completion of schemes currently under development. Flat thereafter.	**Measure** **2025**: Up to 0.7 TWh of district heating installed capacity (Residential).

	Tallaght – in place and looking to expand (4,500MWh expected by end 2022, 7,000MWh likely by end 2023, 10,000 MWh likely by end 2025; 21,500MWh possible by 2030) Dublin City – hitting delays but looking to complete by 2030 (45,000MWh by 2030, 106,000 MWh by 2040) Total 2030 MWh 66,500 or 0.07 TWh	**2030**: Up to 2.5 TWh District Heating (Residential) Up to 0.2 TWh District Heating (Commercial/Public Sector heating) **2.7 TWh** in total **Modelling assumption** The total district heating target of 2.7 TWh split between Residential (1.2TWh) and Commercial/Services (1.5TWh). rather than the Residential-heavy emphasis in CAP23.
Electric Heat Pumps outside of SSRH	February 2022 grant rates for domestic heat pumps modelled until 2030 (subject to available funding - NDP includes an allocation of €5bn, the National Retrofit Plan increases this to €8bn. This allocation includes residential retrofit and heat pumps, other than local authority homes.) Ban on oil boilers (from 2022) and gas boilers (from 2025) in new dwellings. New non-domestic buildings assumed to all install heat pumps from 2025 (increasing proportion of heat pumps until then).	**Measure:** **2025**: 45,000 heat pumps in existing homes 170,000 heat pumps in new builds. **2030**: 400,000 heat pumps in existing homes 280,000 heat pumps in new builds. **Modelling assumption:** As per CAP23 'Effective' ban on boilers post-2030 based on changes to building regulations.
Biomethane	No measures as evidence of implementation meeting requirements for WEM not available at time of projections	**Measure:** **2025** Up to 0.4TWh of heating provided by renewable gas (Ag-based supply chain where target is 'up to' 1TWh biomethane production **2030** up to 0.7 TWh of heating provided by renewable gas (Ag-based supply chain where target is 'up to'5.7 TWh biomethane production. **Modelling Assumption** 5.7 TWh of Biomethane as indicated in CAP23 modelled and allocated to heat sector pro-rated based on gas consumption.

Residential energy efficiency programmes	February 2022 grant rates modelled until 2030 (subject to €8bn funding - NDP allocation).	**Measure:** **2025**: Equivalent of 120,000 dwellings retrofitted to BER B2 'or cost optimal equivalent' **2030** Reaching 500,000 dwellings **Modelling assumption** The model is not manipulated to hit savings that could be achieved by hitting B2 targets set out in CAP23. Instead, the cost optimal equivalent savings achieved are used.
Public sector energy efficiency programmes	Current levels of Community Energy and EXEED grants assumed to continue until 2030. Mandatory energy audits for large organisations. Including increased savings from implementation of Pathfinder Programme in line with approved budget.	**Measure** As per WEM and See District Heating measure See Heat Pump Measure See Biomethane Measure See Carbon-Neutral Heating measure
Commercial sector energy efficiency programmes	Current levels of Community Energy and EXEED grants until 2030. Mandatory energy audits for large organisations. SEAI grant for SME energy audit	**Measure** Current levels of Community Energy and EXEED grants until 2033 (i.e. the year before the ban on new fossil fuel boilers in existing buildings is assumed to come into force). See CAP21 Sections 12.2 and 12.3.3 Mandatory energy audits for large organisations (see and Legislation https://www.seai.ie/business-and-public-sector/energy-auditing/ SEAI grant for SME energy audit (CAP21 Section 12.3.3) **And** See Biomethane Measure See Carbon-Neutral Heating measure
Energy Efficiency Obligation Scheme	Assume 2021 level of savings (that are uniquely attributable to EEOS) continues until 2030.	Assume 60% of Article 8 target will be met through EEOS. (See CAP21 Section 14.2.8 EEOS)

	Not currently modelled in NEMF so an off-model calculation/adjustment will be needed.	Not currently modelled in NEMF so an off-model calculation/adjustment will be needed.
Building Regulations	All new buildings are NZEB	**Measure** All new buildings NZEB by 2025. All new buildings ZEB by 2030. (ZEB =new standard which does not cause any on-site carbon emissions from fossil fuels). **Modelling Assumption** As above
Decrease embodied carbon in construction materials		**Measure** Decrease by 30% for materials produced and used in Ireland **Modelling Assumption** Not modelled - No agreed method for measuring embodied carbon.
Accelerate uptake of carbon neutral heating in industry	Not modelled explicitly - the growth in RES-H is an outcome of the model depending on demand growth and the assumptions on individual renewable heat sources.	**Measure** **2025:** 50-55% share in carbon neutral heating **2030** 70-75% share of carbon neutral heating in total fuel demand made up of: 55% of low/medium heat to be electrified; 20% of low/medium grade heatto be converted to sustainable biomass; 88% of high grade heat to be converted to direct/hybrid Electrification technology. **Modelling Assumption** Uptake of renewable heating technologies based on SEAI's uptake modelling rather than hard-coding the targets until there is a direct measure to apply in input assumptions.
Construction Materials	Not in WEM	**Measure** **2025:**

		Decrease by 10% for materials produced and used in Ireland. Products substitution and reduction of clinker content in cement. **2030** Decrease by at least 30% for materials produced and used in Ireland. Products substitution and reduction of clinker content in cement. **Modelling Assumption** Not modelled - there is no agreed method for measuring embodied carbon. There is a post-2030 measure to implement a Carbon Capture and Storage Framework and to have products substitution and reduction of clinker content in cement
Agriculture	With Existing Measures (WEM)	With Additional Measures (WAM)
Projected activity data	Activity data (animal numbers, crop areas and fertiliser use) projected from Teagasc Base Case Scenario	Activity data (animal numbers, crop areas and fertiliser use) projected from Teagasc Base Case Scenario
Low Emission Slurry Spreading - Bovines	Nitrous oxide savings from Ammonia abatement measures: Target of 60% of all slurry spread by low emissions slurry spreading by 2022; 80% by 2025; and 90% by 2027.	Nitrous oxide savings from Ammonia abatement measures: Target of 60% of all slurry spread by low emissions slurry spreading by 2022; 80% by 2025; and 90% by 2027.
Low Emission Slurry Spreading – Pigs	Not in WEM	100% use of low emission slurry spreading for 1/1/23 as per Nitrates Action Plan
Reduction in Crude protein for Dairy cows	Reduction in the crude protein content of Dairy cow concentrates to 15% during grazing season. (AgClimatise)	Reduction in the crude protein content of Dairy cow concentrates to 15% during grazing season. (AgClimatise)
Increased Liming for mineral soils	Reduced N fertiliser use due to improved nutrient use efficiency from liming (target liming usage of 2 Mt per annum). Increase in direct CO2 emissions from lime application to soils	Reduced N fertiliser use due to improved nutrient use efficiency from liming (target liming usage of 2 Mt per annum). Increase in direct CO2 emissions from lime application to soils
Reduction in Crude protein of pig feed	Not in WEM	Reduced crude protein in finishing pig diets of 4% as per Teagasc GHG MACC and AgClimatise
Manure management measures	Not in WEM	Slurry additives to reduce NH_3 (and thus indirect N_2O) and CH_4 emissions. Covering of uncovered manure stores as per AgClimatise for both cattle and pigs. Drying of poultry manure.
Fertiliser use measures	Not in WEM	Reduce fertiliser nitrogen use to 330,000 t by 2025 and 300,000 t by 2030

Increased adoption protected urea	Not in WEM	80-90% uptake of protected urea replacing CAN and AN fertilisers on grassland farms by 2025 and 90-100% uptake by 2030. Includes increased direct emissions of CO2 from protected urea application to soils.
Earlier finishing of Beef Cattle (26 to 22-23 months)	Not in WEM	Target 24-25 months by 2025 and 22-23 months by 2030.
Reduced age at first calving of suckler beef cows	Not in WEM	Reduce age of first calving by 2 months by 2025 and 3.9 months by 2030.
Dairy economic breeding index improvements	Not in WEM	Improved animal breeding by focusing on low methane traits
Use of CH_4 inhibitors	Not in WEM	Winter milk systems fed total mixed rations, progressing to spring calving cohort of herd. Addition of a slow-release bolus pasture-based feed additive.
Diversification	Not in WEM	Diversification measures with annual savings by 2030 of 1.5 Mt CO2 eq not included.
LULUCF	With Existing Measures (WEM)	With Additional Measures (WAM)
Peatlands rehabilitation	In 2020 the Irish government approved a €108 million funding for Bord Na Mona (a semi-state body) to undertake restoration activities on 33.5 kha of peatland between the years 2021 and 2025.	In addition to WEM, 41.7 kHa of rehabilitated peatlands. Reduced emission factors.
New afforestation	2,000 hectares per annum afforestation rate	Increase annual afforestation rates from approximately 2,000 hectares (ha) per annum in 2021 and 2022 to 8,000 ha per annum from 2023 onwards.
Water table management on drained organic soils and improved grassland & cropland management.	Not in WEM	The Climate Action Plan states a goal of reduced management intensity (water table management) of 80,000 hectares on drained organic soils by 2030. Assumed linear increase. Improved carbon sequestration on grasslands due to improved pasture and nitrogen management (as per MACC). Cover crops and straw incorporation on croplands (as per MACC).

3. Policy Input Assumptions not included in the WAM Scenario

In so far as possible, the policies and measures contained in the Climate Action Plan 2023 are included in these projections. However, there are a number of exceptions where policies and measures were not included as the EPA could not see an implementation pathway to merit their inclusion at this point in time. These are detailed below:

Electricity

Policies and Measures up to 2030

- The Climate Action Plan 2023 target of 80% share from renewable electricity is projected as being exceeded. Onshore wind of 7.8 GW in 2030 and 6 GW of Solar PV was required to achieve this level of renewable electricity. This compares with 9 GW onshore wind and 8 GW of solar PV from CAP 2023;
- A pathway could not yet be modelled for the full 2GW target for new flexible gas fired generation, however, 1.2GW is included.
- *Policies and Measures post-2030*
- 2 GW offshore wind for green hydrogen use in industry post-2030 (as outlined in Chapters 12 and 13 of the Climate Action Plan 2023) is not currently included.
- Demand-side measures to mitigate and manage energy demand such as growth from large energy users are not included.

Enterprise, Built Environment and Public Sector

Policies and Measures up to 2030

- Measures aimed at achieving emissions savings from a decrease in embodied carbon in construction materials (0.4 Mt CO2 abatement by 2030) aren't currently modelled;
- The full target for 70-75% share of carbon neutral heating in Industry is not currently modelled.

Policies and Measures post-2030

- Emissions reductions associated with Carbon Capture and Storage are not modelled;
- 60-70% Share of carbon neutral heating in total fuel demand is not modelled.

Agriculture

Measures up to 2030

- Diversification measures with annual savings by 2030 of 1.5 Mt CO2 eq. Further information is needed to model an implementation pathway for these measures.

Overall

- Unallocated savings of 5.25 Mt CO2 eq per annum 2026-2030 (or 26.25 Mt CO2 eq cumulatively by 2030) as stated in the Climate Action Plan 2023 are not modelled;
- Further measures post-2030 in the electricity, industry, built environment and transport sectors where no specific measures have been identified are not modelled;
- These savings combined are estimated provide an additional abatement of approximately 9 Mt CO2 eq in 2030, based on the modelling used to prepare the Climate Action Plan 2023. The projections in this report are informed by the EPA's most recent inventories, updated macroeconomic inputs and new modelling data and research.