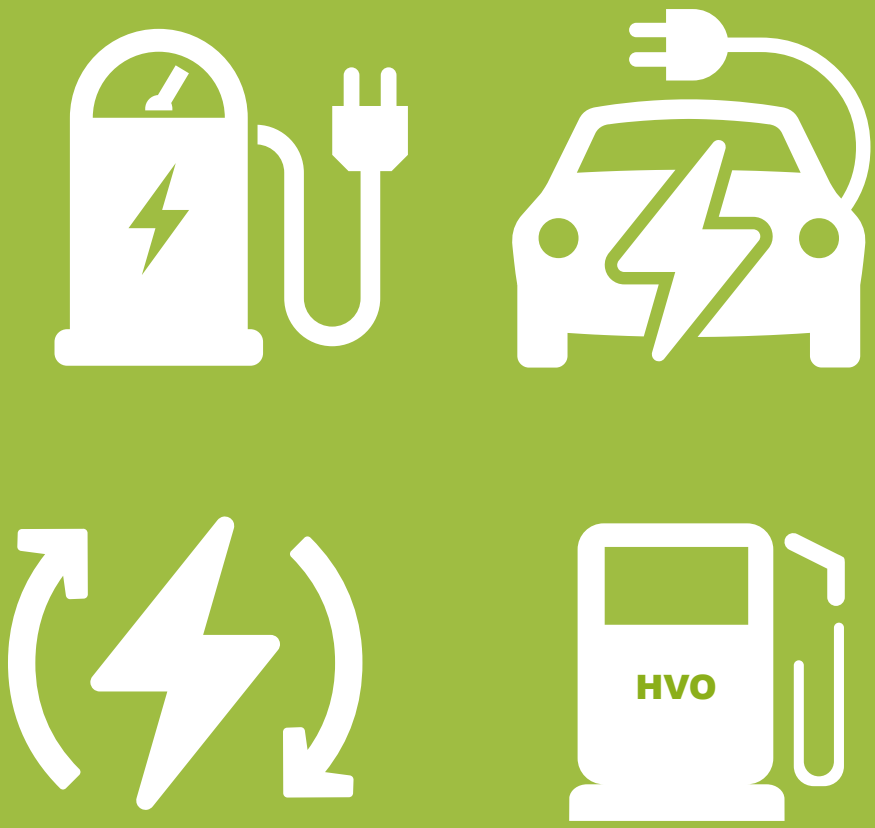

Local Authority Fleet

Strategy to Decarbonisation

Annex 2: Relevant supporting information

June 2023

CCMA
Cumann Lucht Bainistíochta Contae agus Cathrach
County and City Management Association

LGMA
Local Government
Management Agency

CARO

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Introduction

The task to decarbonise the local authority (LA) fleet by 2050is not only challenging given the timeframes involved, but it is also set against the backdrop of uncertainty and unanswered questions when it comes to the most appropriate course of action to decarbonisation. While LAs grapple with creating a definitive pathway to decarbonisation, it is important to note that this process is laden with a range of other dependencies that LAs have no control over.

There are numerous issues being faced along the supply line with vehicle manufacturers having to meet their own obligations on clean vehicles, prevailing economic circumstances giving rise to demand/supply issues and the anxiety related to reliance on new innovative technologies, which may or may not become mainstream in the near future.

This annex sets out an array of relevant supporting information that will help LAs to understand various considerations that are relevant to developing a fleet decarbonisation roadmap including:

- Alternative fuels
- Hydrogen infrastructure
- Light Duty Vehicle (LDV) and Heavy Duty Vehicle (HDV) availability
- Vehicle manufacturers' obligations
- Clean Vehicle Directive
- Carbon Tax
- GHG/CO_2 factors and conversions
- EU best practice

Alternative fuels

Battery electric vehicles

All mainstream heavy goods vehicle (HGV) truck manufacturers are taking orders for rigid and artic battery electric vehicles with lead times long due to microchip and other supply chain constraints. There is currently no constraint on lithium or rare earths. Prices will go up with demand, but economies of scale are also starting to take effect, making Total Cost of Ownership much closer to diesel than ever before, once government supports are taken into account. It is also worth noting that battery electric has the added benefit that it contributes to energy efficiency targets, as well as CO_2 reduction targets.

Gas

Compressed Natural Gas (CNG) is considered a transitionary fossil fuel. It offers a viable option to reducing air pollution of diesel engines, but it does produce 80% of the carbon of its diesel counterpart, for this reason CNG is deemed an interim solution. Natural gas is stored under high pressure as CNG. It can be used to fuel vehicles and is commonly used as an alternative to diesel for HGVs. CNG vehicles are available with current lead in times for delivery of vehicles of up to 2 years. Public refuelling infrastructure is only available in a number of locations nationally, so additional costs for installing refuelling infrastructure should be considered.

Biomethane is a renewable gas made from biological feedstocks including food waste and agricultural feedstocks (such as animal manures, grass, grass silage, etc.), through a process known as Anaerobic Digestion (AD). The anaerobic digestion process produces biogas from feedstocks, through the breaking down of organic material by micro-organisms in large oxygen-free tanks. A by-product of this process is known as digestate, which can be used as an organic fertiliser. The biogas can then be 'cleaned' or upgraded to biomethane, which is structurally identical to natural gas and can therefore be used as a direct substitute.

The Climate Action Plan (CAP) 2023 commits to the increasing uses of zero emission gases to help in the decarbonisation from combustion engines:

"Enterprise Ireland and IDA Ireland, with the support of the SEAI, will work closely with their client companies in manufacturing sectors to assess which processes and operations can utilise biogas or biomethane sustainably and cost effectively. Our enterprise agencies will work to support these businesses decarbonise their processes and align any supports with the incentives and interventions under a Renewable Heat Obligation, or any support provided to the agriculture supply chain for such a fuel".

Fuel supply mix

Eirgrid and the NORA Biofuels Obligation scheme both to date and projected, from the Gap to Target tool (GtT) shows how the grid will get greener over the decade to come. Eirgrid delivered on the 40% target to 2020 with 42% renewables on the grid in 2019. This will vary by year, but the downwards trend is clear.

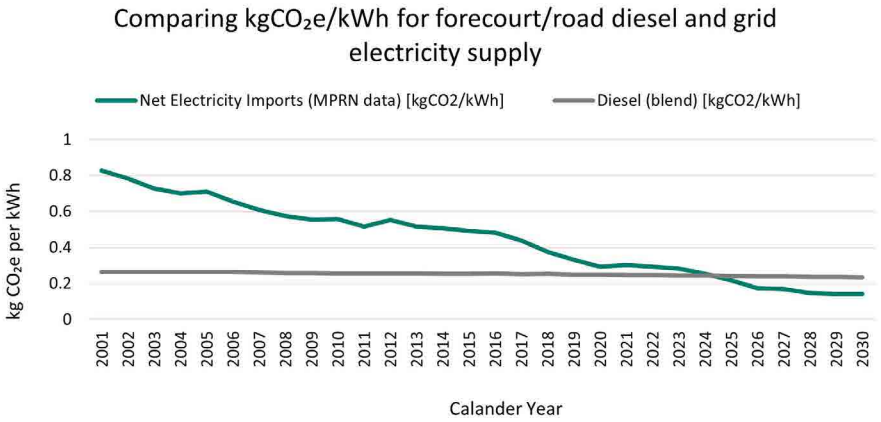


Figure 1 Comparing the electricity grid to road diesel 2001-2030 (excluding conversion losses i.e. for every one unit of electricity above you will need 2.5 to 5 units of diesel).

Biofuel outlook to 2030

On the 3rd of November 2022 the Department of Transport (DoT) published a report by consultants Byrne O'Cleirigh on the outlook for liquid biofuels for transport in Ireland. The full report is available on www.gov.ie or The full report is available on www.gov.ie here.

This is a comprehensive report concerning the future demand and supply of biofuels under ambitious climate action plan targets, which was progressed on behalf of DoT with the collaboration of University College Cork and consultants Byrne O'Cleirigh.

The study clearly illustrates the quantum of biofuel and related feedstock supply and production needed to 2030. It sets out the policy challenge for implementation of European renewable energy targets and constraints alongside ambitious national biofuel targets in transport. The Report concludes that both targets can be complied with by 2030 (under existing assumptions for renewable electricity) through meeting and possibly exceeding advanced biofuel targets.

The report notes the establishment of the EU database to ensure the integrity of the biofuel supply chain and new supervision responsibilities on Member States as being significant. It recommends the implementation of policy and regulation for renewable energy in transport to manage risks concerning biofuel sustainability and limits on supply, and to investigate how fraudulent activity might occur within the supply chain to further safeguard against this risk.

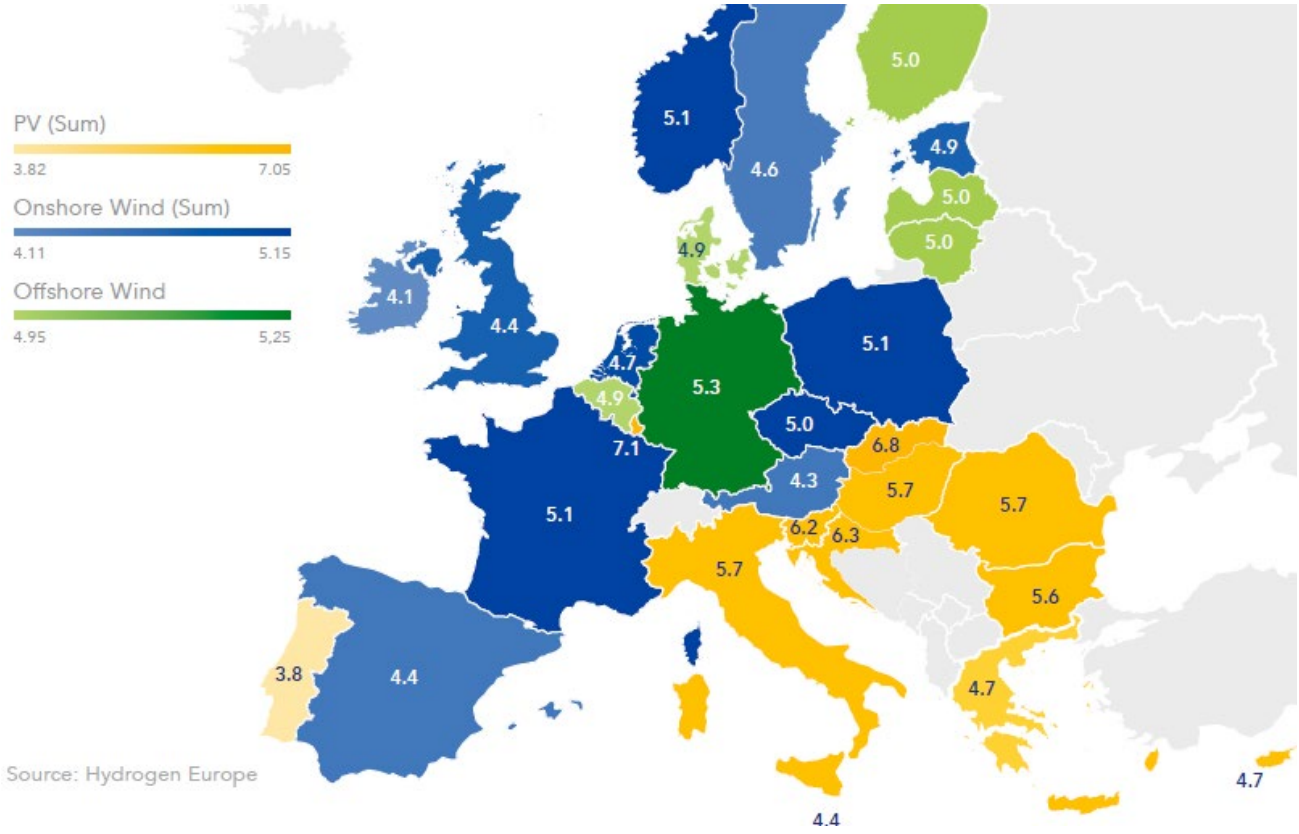
Biofuel supply and demand - in figures

- Biofuel supply and demand by 2030 will be significant – an estimated 72m-78m litres of bioethanol and between 570m-730m litres of biodiesel/Hydrotreated Vegetable Oil (HVO) for use in transport.
- The composition of Ireland's biodiesel/HVO differs considerably from European norms:
  - approximately 81% of Ireland's biodiesel/HVO is produced from used cooking oil (UCO) – the EU average, including the UK, is 25%;
  - approximately 18% of Ireland's biodiesel/HVO is produced from category 1 tallow – the EU average, including the UK, is 4%;
  - other countries have a significantly higher reliance on crop-based biofuel with the EU average standing at 67% – Ireland is 5%.
- There is potential for indigenous production to scale up to between 435m and 735m litres of biodiesel/HVO in 2030, but with low recoverable feedstock supplies (potential for 70m litres of biodiesel from indigenous feedstock) reliance on imported feedstocks (UCO and tallow) will continue to be high.
- In the absence of indigenous HVO production, Ireland would be relying on HVO imports that could amount to between 4% and 5% of European HVO capacity and 1% to 2% of global capacity.

The report confirms the limited (if adequate) availability of HVO for the foreseeable future, however any product offering significant CO_2 reductions will be in high demand and therefore be at a higher price. The price premium for HVO to date should be taken as a floor despite lower prices being cited.

Hydrogen infrastructure

Since the onset of the war in Ukraine the EU has made a concerted effort to remove itself from Russian gas supplies (RePowerEU)[1]. The EU JRC published a report **Clean Energy Technology Observatory:** Water Electrolysis and Hydrogen in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets[2]. The full range of hydrogen publications can be accessed here.



Source: Clean Hydrogen Monitor, 2021, Hydrogen Europe

Figure 2 Hydrogen costs from renewables across Europe

[1] REPowerEU: affordable, secure and sustainable energy for Europe (europa.eu)
[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC130683

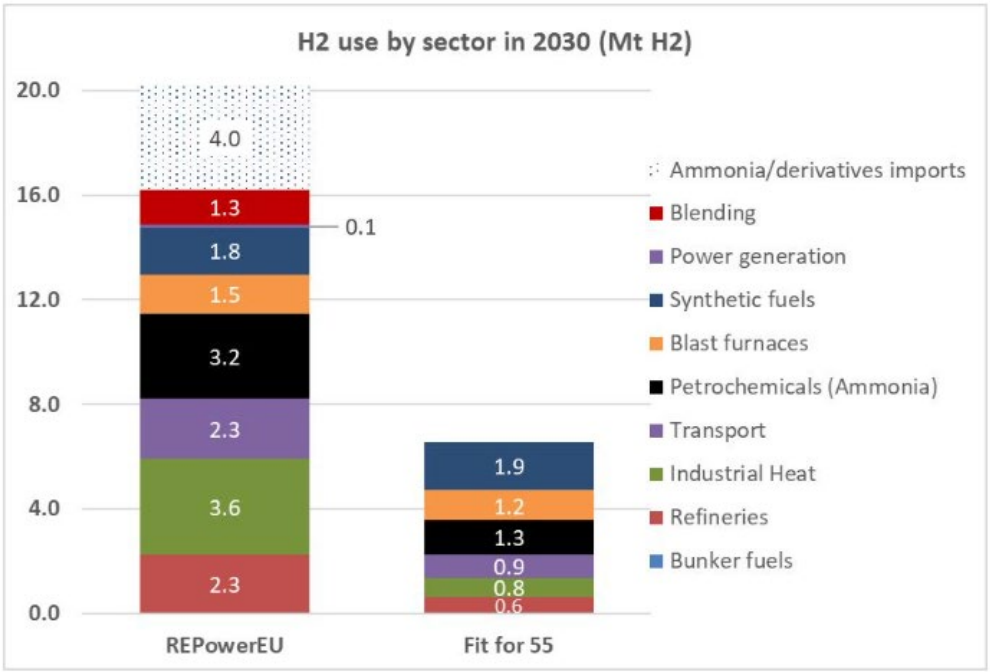
The projection for hydrogen production costs by 2030 is over 50% cheaper than current rates, which is roughly €10/kg now vs €4.10/kg in 2030 according to the EU projections.

The same report shows relatively small demand from transport compared to other uses – see figure 3. This makes sense in that industrial users offer a much easier route to critical mass for hydrogen with transport following.

Diesel was originally a waste refining product surplus to requirements; the same pattern may be repeated with hydrogen i.e. only when surplus green hydrogen becomes available does transport accelerate its adoption.

To keep abreast of latest updates regarding hydrogen, register with Hydrogen Mobility Ireland - https://h2mi.ie/

Figure 3 illustrates the significant 2.5 fold increase in hydrogen use targets in the transport sector, from the initial Fit for 55 ambition of 0.9 megatonnes H2 to 2.3 megatonnes in the REPowerEU plan.



Source: European Commission, SWD(2022) 230.

Figure 3 Uptake of hydrogen by sector in Europe to 2030 - EU JRC

Electric LDV and HDV availability

Following the impact of Covid in 2020, sales were recovering strongly across the motor industry in 2021, albeit with micro-chip shortages. 2022 has brought new supply chain challenges with the onset of the war in Ukraine, which has impacted on a range of automotive parts, but in particular labour-intensive wiring looms for all vehicles. In the future it is widely expected across the industry there will be less and less issues with raw materials.

Society of the Irish Motor Industry (SIMI) via BeepBeep.ie provides detail on registrations (not orders), where the uptake in LDV (Battery Electric vans) and now electric heavy-duty vehicles (eHDVs) is promising; in particular buses (with over 800 on order) and refuse collection vehicles. Registrations for electric light duty vehicles (eLDVs) and eHDVs can be found here. The impact of government intervention in the bus market is clear in 2021.

In CAP21 (9.3.7) it referenced the NTA announcement on 13th June 2022 that they had ordered 120 double-deck battery-electric buses from Bamford Bus Company (trading as Wrightbus). These 120 buses are part of a framework agreement which provides for the procurement of up to 800 zero emission battery-electric buses over a period of five years.

Figure 4 & figure 5 show the total sales of commercial eLDV and eHDV in Ireland for 2021 & 2022. This table shows a wide range of electric powered vehicles available within the Irish market.

Whilst widely available reasonably priced electric heavy duty trucks are still a number of years away, there is progression in the sector for the development of heavy-duty vehicles.

Commercial Light Duty (Electric) vehicles

**NB restricted availability in 2022 due to microchip shortages and war in Ukraine **

Light Duty electric vehicle (commercial) sales 2021 & 2022

Make	Units Sold in 2021 & 2022
OPEL	177
PEUGEOT	93
LDV	113
CITROEN	45
TOYOTA	20
NISSAN	188
MERCEDES-BENZ	145
RENAULT	250
KIA	7
FORD	3
MG	3
HYUNDAI	7
VOLKSWAGEN	2
Total	**1053**

Body Type	
Van	1028
MPV	19
Tipper	6

Figure 4 Table detailing Light Duty electric vehicle (commercial) sales 2021 & 2022

Heavy Duty (Electric) vehicles

Results below compare Jan - Dec 2021 and 2022 and were based on new registrations of all vehicle types:

Heavy Duty electric vehicle sales 2021 & 2022

Make	Units Sold in 2021 & 2022
HIGER	8
DENNIS EAGLE	6
FUSO	3
ALEXANDER	100
WRIGHTBUS	3
Total	**120**

Body Type	
Bus	111
Refuse Collector	6
Box Van	3

Figure 5 Table detailing Heavy Duty electric vehicle sales 2021 & 2022

Vehicle manufacturers' obligations

From 1st January 2020 manufacturers must comply with (EU) 2019/631, which means the average CO_2 emitted across the LDVs and HDVs they sell must be below a maximum threshold or else they must pay fines (or buy out their obligation). Manufacturers can trade obligations, so manufacturers may be seen to join or leave a pool as they work to comply.

The phased implementation of these obligations should be studied by LAs when developing a business case for replacing their older fleet. The replacement of older fossil fuel vehicles with newer fossil fuel vehicles with similar specification will result in CO_2 emission reduction, simply due to the emission reduction obligations on manufacturers.

- Light Duty Vehicles (LDV) 15% of EU Total CO_2 emissions
  - 2015/17 targets achieved 2013 (130gCO_{2e}/km)
  - 2021 phased in target of 95g/km 3.6L/100km
  - Reducing to zero by 2035 i.e. the EU Parliament has agreed to end the sale of internal combustion engines for LDVs by 2035. Manufacturers will get ahead of this target.
- Heavy Duty Vehicles (HDV) 5% of total EU CO_2 emissions
  - Agreed first ever CO_2 emissions targets for HDVs adopted Feb'19
  - 15% reduction vs 2019 by 2025
  - 30% reduction vs 2019 by 2030 (review in 2022)

Clean Vehicle Directive (CVD)

The CVD (S.I. No. 381/2021) came into law on the 2nd of August 2021, setting out the minimum clean vehicle procurement targets across the EU for all member states.. It requires a minimum proportion of new vehicles purchased by public sector organisations to be 'clean'. See Figure 7 below for CVD targets applicable to the LA sector. Some key features over the previous CVD (S.I. No. 339/2011) are that specifications are provided for clean vehicles, specific targets are set and LAs are now legally required to report on progress. This is a new requirement and is thought to be indicative of where the EU and Government will go with targets in the years to come.

Reporting commences in 2022 and LAs are obliged to report every 3 years thereafter. The contract award date is the relevant reporting date, i.e. all contracts awarded from 2nd August 2021 onwards. It is recognised that the targets set within the CVD in relation to HDVs will be challenging, so LAs are encouraged to plan ahead in order to that targets may be achieved.

Action	282	Set a roadmap for more LEVs in Public Sector Fleets			
Steps Necessary for Delivery		**Proposed Output**	**Timeline**	**Lead**	**Key Stakeholders**
Issue circular to all Local Authorities and Public Sector Bodies calling for the cessation of ICE vehicle procurement in the car and van fleets – with excepts for certain vehicle categories		Circular issued	Q4 2021	DECC	Local Authorities, Public Sector Bodies, DPER

Figure 6 Action 282 from the Climate Action Plan 2021

Category	From 2 August 2021 to 31 December 2025	From 1 January 2026 to 31 December 2030
Light vehicles (cars, vans)	38.5%	38.5%
Minimum criteria to qualify as clean vehicles	**< 50gCO_2/km**	**0 g CO_2/km**
Trucks (vehicle category N2 and N3)	10 %	15 %
Buses (vehicle category M3)	45 %	65 %

Figure 7 CVD 2021 targets and definitions

Carbon tax

Up until recently, carbon tax comprises only a small proportion of the price paid at the pump. This is illustrated by the yellow line below in the graphic (fig 8). However, as set out in the main strategy document, all transport users will pay a higher carbon tax year on year to 2050 increasing by €7.50/tonne or c.2c/L per year (see fig9) (Increasing carbon tax to 2050).

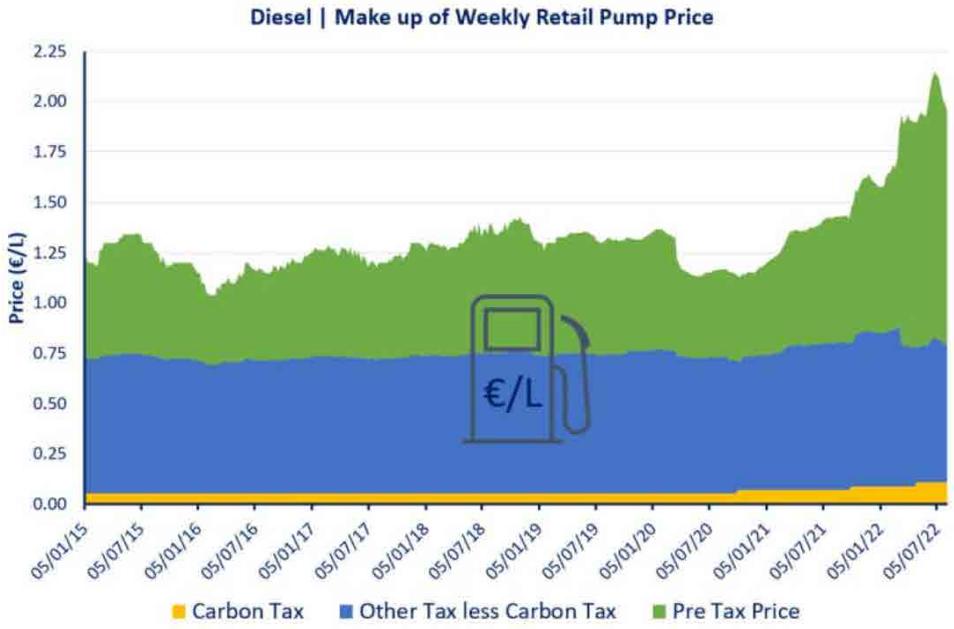
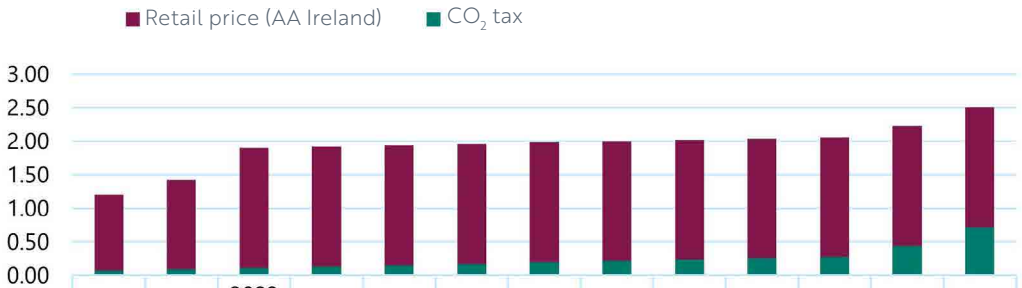


Figure 8 Carbon Tax as proportion of pump price 2015-22 (courtesy Paul Deane at UCC MARei)

Carbonn tax component of retail price of Diesel (inc. VAT) 2020-2030 and then based on 2022 YTG of €1.90/L to 2050



	2020	2021	2022 YTD	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Retail price (AA Ireland)	1.20	1.42	1.899	1.92	1.94	1.96	1.98	2.00	2.02	2.04	2.06	2.23	2.50
CO_2 tax (€)/L (373L/t)	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.44	0.71

Figure 9 Increasing carbon tax to 2050

GHG/CO_2 factors and conversions

Each year the CO_2 conversion factors for electricity and diesel are updated depending on the mix of renewables and fossil fuels used. Often an estimated figure is published in Jan-Feb and updated until a final figure is arrived at around mid to late summer.

For example in 2022, the gCO_{2e}/kWh for electricity was initially 305g and was updated through Q1 and Q2 until the final figure of 345g CO_2e/kWh as arrived at in September 2022 (published via https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/).

The SEAI GtT is essential for this process with its regular updates, but it is important to download the latest version of the GtT when making calculations or projections for energy efficiency and carbon savings (SEAI PSMs can also assist). The GtT does all the CO_2 calculations needed based on estimates provided by the LA, including costings or estimations.

It also helps to de-risk the decision-making process on decarbonisation options, by providing detailed information on necessary actions, their cost and effect – insights that are crucial for every investment decision. It contains the best-available decarbonisation data gathered from collaboration across centres of expertise at national level to ensure consistency for all public sector entities.

All fleet managers should have direct access to GtT via a Public Sector Monitoring and Reporting (PSMR) system, read-only login at a minimum. The same applies to all staff across every LA who need to do CO_2 calculations.

Figure 10 CO_2 emission factors – energy type as per M&R system

Conversion factors

CO2 emission factors | energy types as per M&R system	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Aviation Gasoline (AVGAS)	[kgCO2/kWh]	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856
Biogas	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
BioLPG	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Coal	[kgCO2/kWh]	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560	0.340560
Gasoil	[kgCO2/kWh]	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868
Jet A1 Kerosene (Aviation)	[kgCO2/kWh]	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004
Kerosene	[kgCO2/kWh]	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004	0.257004
LPG (purchased by volume)	[kgCO2/kWh]	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284
LPG (purchased by weight)	[kgCO2/kWh]	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284	0.229284
Manufactured Ovoids	[kgCO2/kWh]	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760	0.353760
Marked Diesel (Non-thermal)	[kgCO2/kWh]	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868
Light, Medium & Heavy Fuel Oils	[kgCO2/kWh]	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636	0.273636
Milled Peat	[kgCO2/kWh]	0.390324	0.390324	0.390324	0.438979	0.419245	0.411958	0.406641	0.416000	0.420019	0.412953	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783	0.413783
Natural Gas (GPRN data)	[kgCO2/kWh]	0.205867	0.205141	0.204687	0.204381	0.204492	0.204595	0.205602	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741
Natural Gas (non-GPRN data)	[kgCO2/kWh]	0.205867	0.205141	0.204687	0.204381	0.204492	0.204595	0.205602	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741	0.204741
Net Electricity Imports (MPRN data)	[kgCO2/kWh]	0.828520	0.784606	0.728744	0.702103	0.711339	0.655272	0.609647	0.576161	0.555278	0.558438	0.517744	0.552872	0.516598	0.507731	0.492935	0.483811	0.439143	0.376743	0.331892	0.294124	0.302615	0.294216	0.282346	0.253461	0.217781	0.174343	0.169123	0.146372	0.142266	0.141768
Net Electricity Imports (non-MPRN data)	[kgCO2/kWh]	0.828520	0.784606	0.728744	0.702103	0.711339	0.655272	0.609647	0.576161	0.555278	0.558438	0.517744	0.552872	0.516598	0.507731	0.492935	0.483811	0.439143	0.376743	0.331892	0.294124	0.302615	0.294216	0.282346	0.253461	0.217781	0.174343	0.169123	0.146372	0.142266	0.141768
Offsite Charging of Electric Vehicles	[kgCO2/kWh]	0.828520	0.784606	0.728744	0.702103	0.711339	0.655272	0.609647	0.576161	0.555278	0.558438	0.517744	0.552872	0.516598	0.507731	0.492935	0.483811	0.439143	0.376743	0.331892	0.294124	0.302615	0.294216	0.282346	0.253461	0.217781	0.174343	0.169123	0.146372	0.142266	0.141768
Onsite Generation by Non-Fuel Renewables or Landfill Gas	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Peat Briquettes	[kgCO2/kWh]	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896	0.355896
Petrol (fossil)	[kgCO2/kWh]	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856
Pure Biodiesel	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pure Bioethanol	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Diesel (fossil)	[kgCO2/kWh]	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868
Sod Peat	[kgCO2/kWh]	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400	0.374400
Solar Thermal	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Wood Briquettes / Logs	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Wood Chips (35% moisture)	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Wood Pellets	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
District heating (imports)	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
District heating (exports)	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Other Solid Biomass	[kgCO2/kWh]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Marine gasoil	[kgCO2/kWh]	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868
Biodiesel Blends other than standard spec DERV	[kgCO2/kWh]																														
Bioethanol Blends other than standard spec Petrol	[kgCO2/kWh]																														
Diesel (blend)	[kgCO2/kWh]	0.263868	0.263868	0.263868	0.263868	0.263868	0.263868	0.262340	0.260231	0.259338	0.256985	0.255913	0.257209	0.255580	0.254410	0.254344	0.256113	0.252383	0.253186	0.250494	0.249033	0.247652	0.246269	0.244884	0.243498	0.242110	0.240720	0.239329	0.237935	0.236541	0.235144
Petrol (blend)	[kgCO2/kWh]	0.251856	0.251856	0.251856	0.251856	0.251856	0.251856	0.250829	0.249405	0.248800	0.247201	0.246819	0.246454	0.246090	0.246181	0.245170	0.244033	0.244018	0.243913	0.243824	0.243809	0.243809	0.243809	0.235383	0.235383	0.235383	0.235383	0.235383	0.235383	0.235383	0.235383
Electricity Exports (Sales)	[kgCO2/kWh]	0.828520	0.784606	0.728744	0.702103	0.711339	0.655272	0.609647	0.576161	0.555278	0.558438	0.517744	0.552872	0.516598	0.507731	0.492935	0.483811	0.439143	0.376743	0.331892	0.294124	0.302615	0.294216	0.282346	0.253461	0.217781	0.174343	0.169123	0.146372	0.142266	0.141768

The graph below summarises the factors and illustrates the change over time of electric vs diesel blend CO_2e/kWh, conveying the highs/lows and projected renewables over time. As can be seen the Kg CO_2e for electric is on a trajectory toward zero. Even with technological advances the Kg CO_2e for diesel has limited improvements, thus further emphasising the benefit of transitioning fleet to electric. When reviewing this graph, it should be noted that 1 unit of diesel is approximately 40% efficient whilst 1 unit of electricity is approximately 95% efficient.

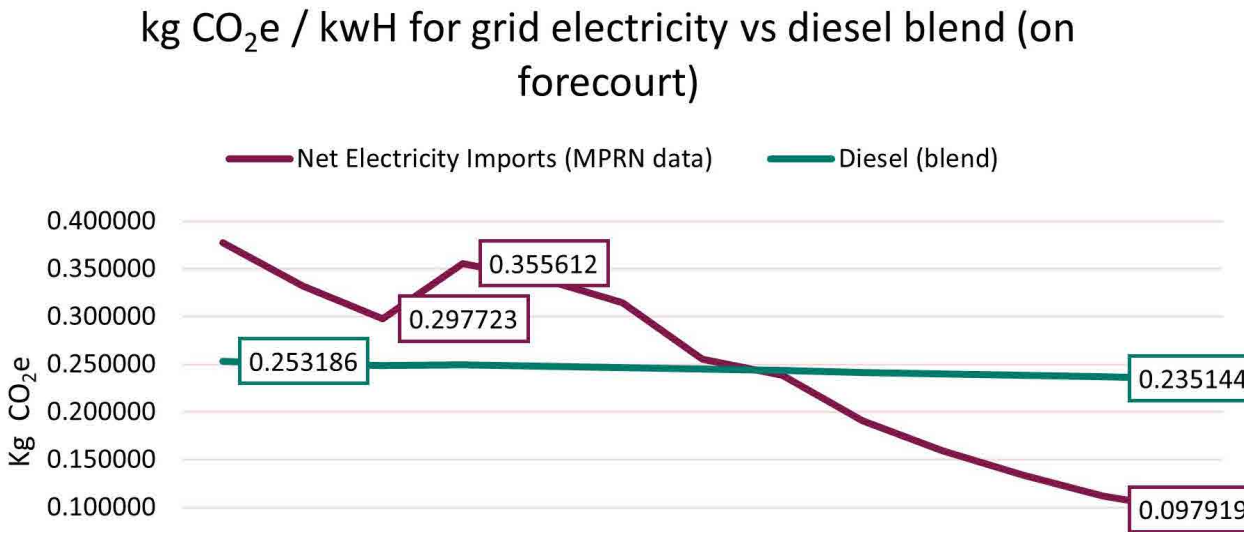


Figure 11 Kg CO_2e / Kwh for grid electricity vs diesel blend

EU best practice

This list of European public sector green procurement projects in transport is not exhaustive and is taken from here. Please visit the EU GPP site to see the latest case stories and guidance.

- Procuring solar vehicle-to-grid (V2G) charging stations for electric vehicles, Barcelona Metropolitan Area (Spain, 2021)
- Procurement of hybrid electric buses, Romania, 2021
- Procurement of electric buses and charging system, Ostrów Wielkopolski, Poland
- Reducing food transport emissions through route optimisation and more efficient vehicles - City of Helsinki,, Finland
- An electric vehicle car sharing service for city workers and citizens in Lappeenranta, Finland
- Procurement of sustainable, customer-oriented transport services - City of Rotterdam, Netherlands
- Framework for alternatively powered vehicles, Federal Procurement Agency, Austria
- Recovering biogas to power public transport, City of Vaasa, Finland
- Towards zero emission public transport in the Province of North-Brabant, Netherlands
- Innovative green solutions for decarbonising Malta's ports, Malta
- Croatian Post purchases e-bikes for mail deliveries, Croatia
- Sustainable city logistics in London, UK
- Greener waste collection services, Malta
- Cleaner vehicles and electricity, Slovenia
- Technology-Neutral Procurement of a Full-Electric Ferry, Lavik and Oppedal, Norway
- Electric vehicle docking stations (e-fuel stations), Germany
- EEV certified biomethane bus service, Reading, UK
- CNG and hybrid buses: Alternative vehicles for a cleaner city, Madrid, Spain
- Framework agreement for zero-emission vehicles, Oslo, Norway
- Procurement of electric vehicles for public use, Paris, France
- Cost-efficient and clean police cars, Berlin, Germany
- Pre-Commercial Procurement for Smart Energy and Intelligent Mobility Solutions, Italy
- Joint National Procurement of Electrical Vehicles, Sweden
- Retrofitting trams for energy efficiency, Craiova, Romania
- Replacement of diesel trucks with electric fleet, Stuttgart, Germany
- Green ambulance procurement, Stockholm, Sweden
- Hybrid cars for city administration, Ljubljana, Slovenia

As of 9th November 2022 OGP is publishing a centralised list of green public criteria including transport.

Links and resources

Throughout the text, information has been cited from various agencies, but they are consolidated in the below listing.

Sites worth subscribing to:

1. SEAI https://www.seai.ie/technologies/electric-vehicles/why-drive-electric/
2. ZEVI https://www.gov.ie/en/campaigns/18b95-zero-emission-vehicles-ireland/?referrer=http://www.gov.ie/zevi/ http://www.gov.ie/zevi/
3. FTAI https://www.ftai.ie/our-standards-2
4. https://www.transportenvironment.org/
5. https://www.zemo.org.uk/

It may also be useful to join the SEAI Public Sector Transport Community on LinkedIn for news and knowledge sharing https://energylink.seai.ie/community/view/13

Links in this document

- Department of Transport
- SEAI LA CAP Dashboard - https://www.seai.ie/data-and-insights/seai-statistics/la-cap-dashboard/
- SEAI's Electric Vehicle web-page – https://www.seai.ie/technologies/electric-vehicles/
- SEAI's 2021 Energy in Ireland, Section 7.2 PDF - https://www.seai.ie/publications/Energy-in-Ireland-2021_Final.pdf
- EPA's Opportunities to Decarbonise the Irish Transport Sector, Section 3 PDF - https://www.epa.ie/publications/research/climate-change/research-321-opportunities-to-decarbonise-the-irish-transport-sector.php
- CSO's National Travel Survey 2019, Electric Vehicles page - https://www.cso.ie/en/releasesandpublications/ep/p-nts/nationaltravelsurvey2019/electricvehicles/

Glossary & abbreviations; terminology & acronyms

AFHDV: Alternative Fuel Heavy Duty Vehicle

BEVs: Battery Electric Vehicles

CO_2: Carbon dioxide is a powerful greenhouse gas. It is naturally part of the air we breathe. However, human activities like burning of fossil fuels and deforestation have led to an increase in CO_2 in the air that contributes to climate change. CO_2 refers to Carbon Dioxide, while CO_2e stands for "Carbon Dioxide Equivalent" which includes CO_2 and other greenhouse gases.

CVD: Clean Vehicle Directive

EV (electric vehicle): a broad category used to describe all vehicles that are powered by a battery electric motor, but for the purposes of this document, refers to smaller cars and vans.

GHG: Greenhouse gases

GPP: Green Public Procurement

GtT: Gap to Target

HDV: Heavy Duty Vehicle

$KgCO_2e$: Kilograms per CO_2 equivalent

HVO: Hydrotreated vegetable oil

ICE: Internal Combustion Engine

JRC: Joint Research Committee

KWH: Kilo-watt hour

LDV: Light duty vehicle

NORA: National Oil Reserves Agency

NRMM: Non-road mobile machinery

PHEV Plug-in hybrid electric: plug-in hybrid electric vehicles can power their movement on electricity or on petrol or diesel (depending on the powertrain). They typically have smaller batteries than fully electric cars with short ranges. Unlike conventional hybrids, they have a plug to be recharged directly from the grid to enable all electric driving, studies have shown they need to have an all range of 90+km to make a material contribution to emissions reduction, current vehicles generally have a range of 60km and can use AC chargers.

$PM_{2.5}$: refers to tiny particles or droplets in the air that are two and one half microns or less in width.

Range anxiety: the worry that an EV will run out of battery power before you arrive at your destination.

RED: Renewable Energy Directive

RED II: Renewable Energy Directive 2

Re-Power EU: In response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine, the European Commission presented the REPowerEU which is aimed at saving energy, producing clean energy & diversifying our energy supplies.

REX – Range Extender: means a vehicle wholly powered by an electric motor but the power for the motor may come from another source as well as the battery e.g. a hydrogen fuel cell or a small petrol engine generator. A BMW i3 REX is an example

RHD: Right hand drive

SEAI: Sustainable Energy Agency Ireland

SIMI: Society of Irish Motor Industry

TCO: Total cost of ownership

UCO: Used cooking oil

Cumann Lucht Bainistíochta Contae agus Cathrach
County and City Management Association

LGMA
Local Government
Management Agency

CARO