Climate Change Advisory Council Secretariat

Carbon Budgets Working Group

Meeting No. 16
25th July 2024
13:30 – 16:30

SEAI Head Office, Dublin

NEW Agenda

Time	Agenda Item
13:30	1. Opening of Meeting
13:35	2. Biodiversity Report – Assessment of Considerations for Carbon Budgets
~~14:15~~	~~3. Follow on discussion on CDR and Carbon Budgets~~
~~14:55~~ 14:35	4. Energy and Transport additional modelling (NTA & SEAI)
15:35	5. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling
16:15	6. Carbon Budget Work Plan
16:20	7. Next Steps and Agenda for next meeting
16:25	8. AOB
17:00	Meeting Close

1. Opening of Meeting

Action Number	Date Raised	Description	Owner	Due	Status
19	22/03/24	Secretariat to schedule trilateral discussion with NTA, TIM and SEAI CBWG members.	CCAC Secretariat	May 2024	***Closed*** Trilateral discussion with NTA, UCC and SEAI CBWG members on Monday the 27th of May Follow up discussion with NTA & UCC on 22nd of July
22	28/06/24	DS to provide guidance to JW for the 3rd iteration of analysis and ST to facilitate a bilateral call with the EPA inventories team regarding the revised soil emissions factor.	CBWG Members	Aug 2024	***Open*** ST facilitated a discussion on the latest update to the inventory with DS, CD, the Secretariat, and the EPA inventories and projections teams. DS to provide guidance to JW regarding the incorporation of the latest inventory refinement to the 3rd iteration of GOBLIN analysis.
23	28/06/24	Secretariat to follow up with potential sources on assumptions regarding the required grid investment for NMcI to consider as part of the next iteration of COSMO analysis	Secretariat	July 2024	***Propose to Close*** Secretariat followed up to flag EU Reference Scenarios information on likely scale of investments in power grids required at EU27 level along with relevant EirGrid publications on grid investment projects.
24	28/06/24	JF to follow up with NMcI regarding comments on the macro analysis	CBWG Members	July 2024	***Propose to Close*** JF followed up to provide a note outlining his comments on the macroeconomic analysis.

1. Opening of Meeting

Action Number	Date Raised	Description	Owner	Due	Status
25	28/06/24	Secretariat to circulate the supplementary brief on the factors influencing power generation technology deployment in Ireland that was prepared by SEAI.	Secretariat	July 2024	***Propose to Close*** Supplementary brief provided to Secretariat and circulated to CBWG members via Sharepoint
26	28/06/24	Each member was asked to fill at least one scenario in the dialogue tool before the July 25th meeting. The Secretariat will set up a call with each member to walk through the tool in more detail and address any questions the members might have.	CBWG members and Secretariat	July 2024	***Propose to Close*** Secretariat had calls with individual CBWG members to discuss the approach to the scenario dialogue tool. The CBWG members were asked to fill one scenario and to report any user issues with the tool by the 25th of July meeting.
27	28/06/24	Secretariat will schedule a call with KH and TD to discuss FAPRI scenario results the week of 8th of July.	Secretariat	July 2024	***Propose to Close*** Secretariat had a call with KH and TD to discuss the next steps for the FAPRI analysis on the 11th of July.

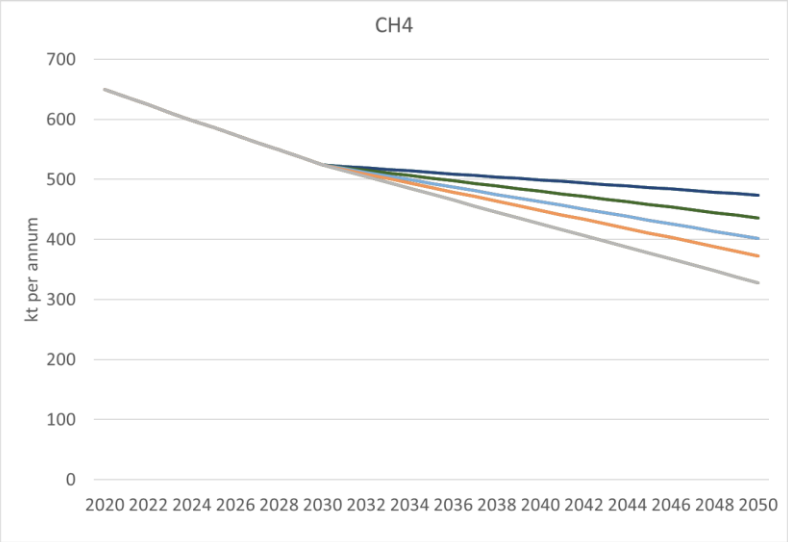
NEW Agenda

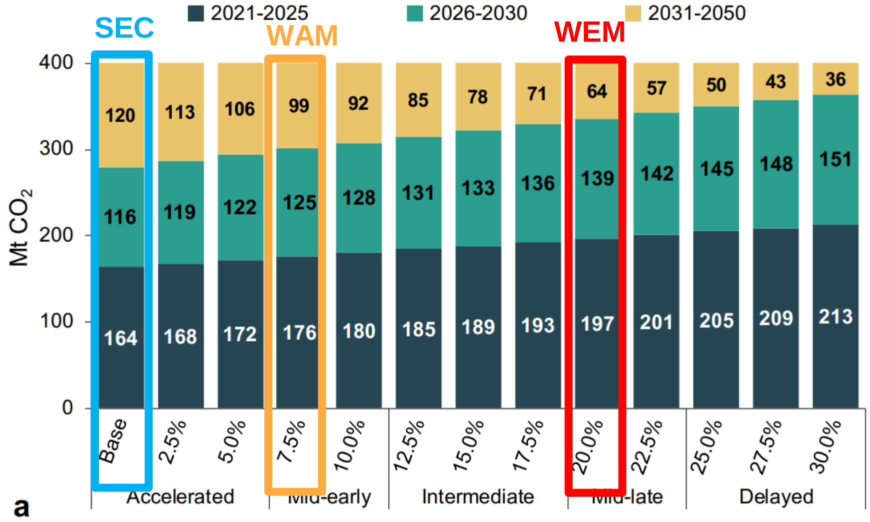
Time	Agenda Item
13:30	1. Opening of Meeting
13:35	2. Biodiversity Report – Assessment of Considerations for Carbon Budgets
~~14:15~~	~~3. Follow on discussion on CDR and Carbon Budgets~~
~~14:55~~ 14:35	4. Energy and Transport additional modelling (NTA & SEAI)
15:35	5. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling
16:15	6. Carbon Budget Work Plan
16:20	7. Next Steps and Agenda for next meeting
16:25	8. AOB
17:00	Meeting Close

4. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling

1. **Inventory Refinements:** Request for the 3rd iteration of modelling to incorporate the latest EPA inventory refinements (GOBLIN, FAPRI & MAGICC7)

2. **Sensitivity Analysis:** Request for further detail regarding the implications for CB3 & CB4 if CB1 & CB2 are not met, with 2030 exceedance in line with WEM & WAM modelled for a subset of scenarios (TIM, GOBLIN & FAPRI)





4. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling

3. **Accompanying Report:** Request for more detail regarding rewetting and peatland assumptions under the 15 GOBLIN scenarios (GOBLIN, Scenario Dialogue Tool and Report on Biodiversity considerations)

4. **Accompanying Report:** Request for more detail regarding the implications for imported biomass and international biodiversity under the 8 TIM scenarios (TIM)

5. **Warming Impact Analysis:** Explore using the EU27 Waste and F-Gases pathway to 2050 under the EU Reference Scenarios (MAGICC7)

6. **Co-ordination of Assumptions:** Request for co-ordination of assumptions or a commentary on the overlap of assumptions **where possible**:

    - on technical abatement, animal productivity and animal numbers (FAPRI & GOBLIN)

    - on land use requirements for biofuels (TIM & GOBLIN)

4. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling

Next Steps

- The 3rd and final iteration of modelling and analysis to commence following the 25th July CBWG meeting
- Presentation of 3rd iteration core modelling results and accompanying data due at the 29th August CBWG meeting

NEW Agenda

Time	Agenda Item
13:30	1. Opening of Meeting
13:35	2. Biodiversity Report – Assessment of Considerations for Carbon Budgets
~~14:15~~	~~3. Follow on discussion on CDR and Carbon Budgets~~
~~14:55~~ 14:35	4. Energy and Transport additional modelling (NTA & SEAI)
15:35	5. Agree inputs, parameters and assumptions for 3rd Iteration of Modelling
16:15	6. Carbon Budget Work Plan
16:20	7. Next Steps and Agenda for next meeting
16:25	8. AOB
17:00	Meeting Close

6. Carbon Budgets Workplan

CB WG Meeting No.	Proposed Date and Time	Topic(s) for Consideration
16	Thursday 25th July 2024, 13:30 – 16:30 ***In person: SEAI Head Office, 3 Park Place, Hatch Street, D02 FX65***	*SEAI & NTA Additional Analysis Results (based on 1st and 2nd iteration)* Follow on discussion on CDR and Carbon Budgets (Oliver Geden) Agree inputs, parameters and assumptions for 3rd Iteration of Modelling Biodiversity Report – Assessment of Considerations for Carbon Budgets
17	Thursday 29th August 2024, 13:30 – 16:30 ***In person: SEAI Head Office, 3 Park Place, Hatch Street, D02 FX65***	3rd *Iteration of Core Modelling Results* *Follow on discussion on Biodiversity Considerations (James Moran)*
18	Wed 18th September 2024, 13:30 – 16:30	*Additional Analysis & Macroeconomic Modelling Results (based on the 3rd iteration)* Analysis of warming impact of selected core scenarios (3rd iteration) Economic assessment of climate change impacts and adaptation options (ESRI)

Carbon Budgets Workplan: Key Deliverables Q3 – Q4 2024

Description	2024					
	Jul	Aug	Sep	Oct	Nov	Dec
Modelling / Analysis Iteration 3						
Agree inputs, parameters and assumptions						
Core pathways development and modelling						
Paris Test Assessment						
Additional modelling and testing of results						
Post-hoc analysis						
Key Deliverables						
Modelling / Analysis Iteration 2 Results						
Modelling / Analysis Iteration 3 Results						
Carbon Budgets Working Group Outputs Report						
CCAC 2024 Carbon Budget Proposals						

7. Next Steps

Scenario Dialogue Tool

- Approach and format of the tool will be locked down after today's meeting
- Dialogue tool will be updated to reflect additional scenario results from the 3rd and final iteration of modelling and analysis after the 29th August CBWG meeting
- After the August 29th meeting the tool will be re-circulated and open to all CBWG members to populate
- Please populate the tool in the shared version on SharePoint and take note of the 300 characters per cell limit
- Scenario Dialogue Tool to be completed and finalized by the 30th of September
- A reminder email will be circulated closer to the time

8. AOB

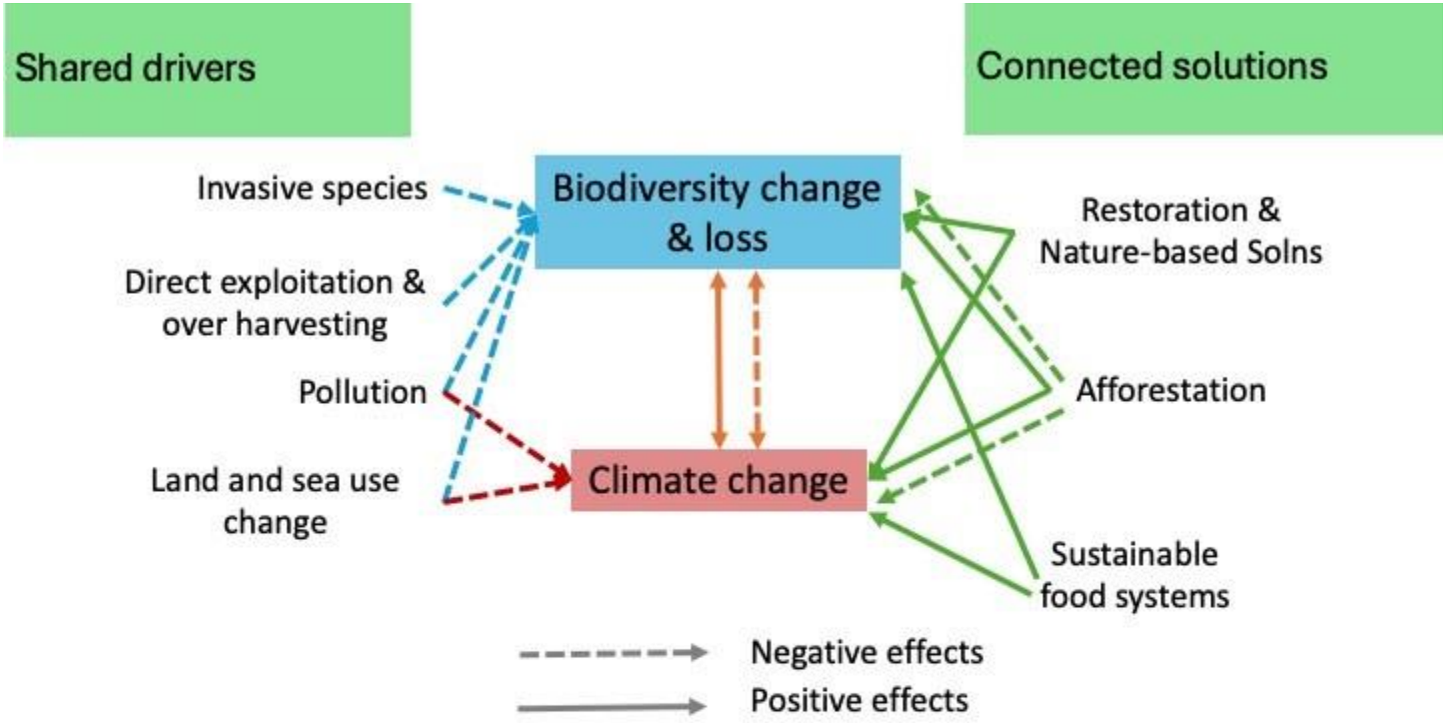
Assessment of biodiversity considerations in the carbon budgets process

Aoife Molloy, Caren Jarmain, Kenneth A. Byrne, Hannah Daly, Mark Emmerson, Caroline McKeon, James Moran, Róisín Moriarty, David Styles and Yvonne M. Buckley

25 July 2024, Presentation to the Carbon Budgets Working Group, Dublin

Biodiversity & carbon budgets

- Biodiversity and climate change interconnected
- Separate targets in policy
- Limited consideration of biodiversity in carbon budgets



Aims

- Assess alignment of existing national climate and biodiversity policy targets
- Assess impacts of climate mitigation measures on biodiversity
- Recommend ways to:
  - *Include biodiversity and ecosystem service considerations for the carbon budget process*
  - *Maximise win-wins for climate action and biodiversity in carbon budget process*

Defining "biodiversity-rich"

- By law under National Climate Objective by 2050
- Biodiversity unevenly spatially distributed – monitoring and measuring required
- 85% of Protected Areas in unfavourable status, potentially worse in wider countryside
- Nature Restoration Law useful in absence of definition

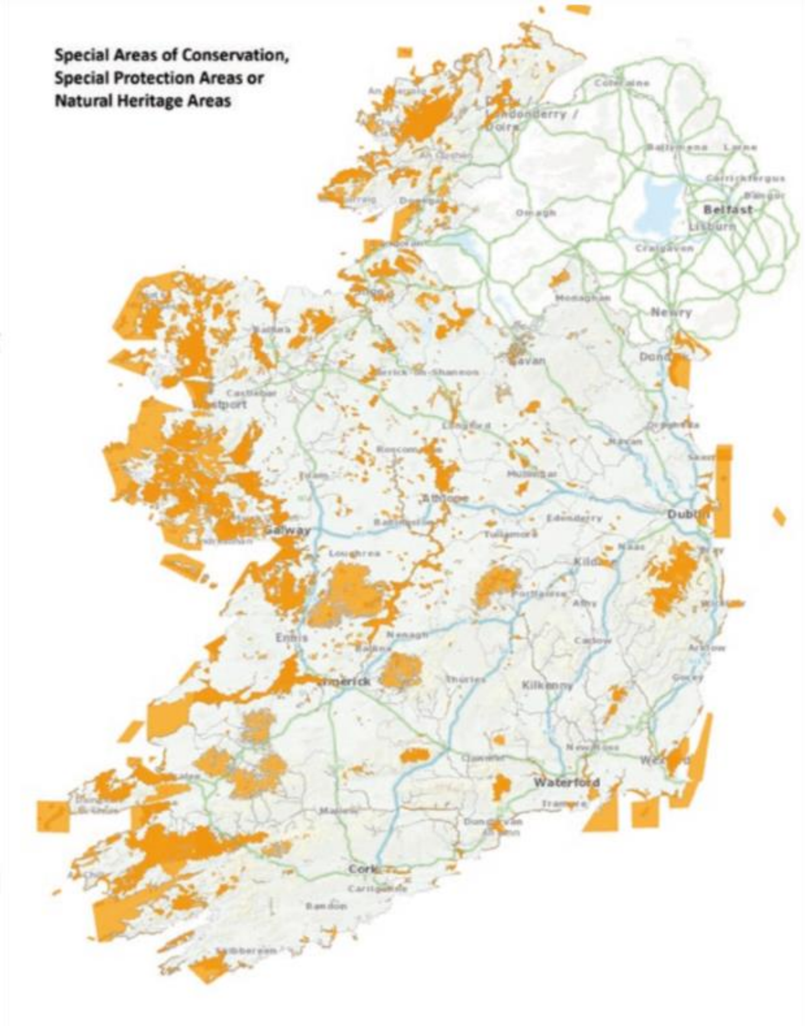
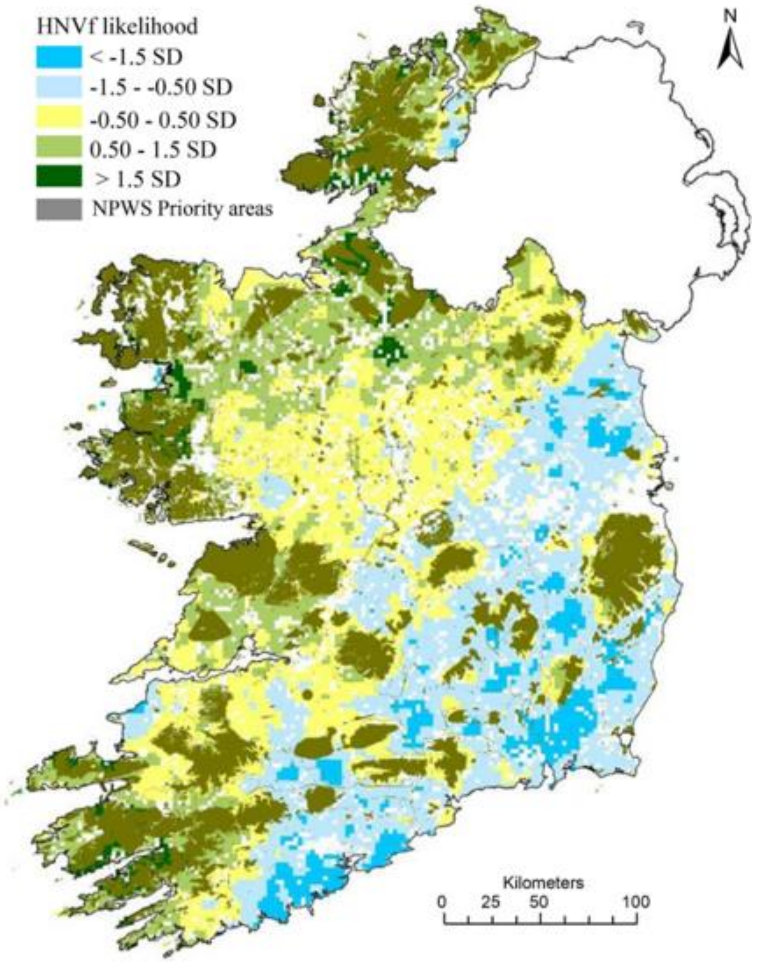


Figure 3.1: Areas protected under legislation

O'Rourke et al. 2023



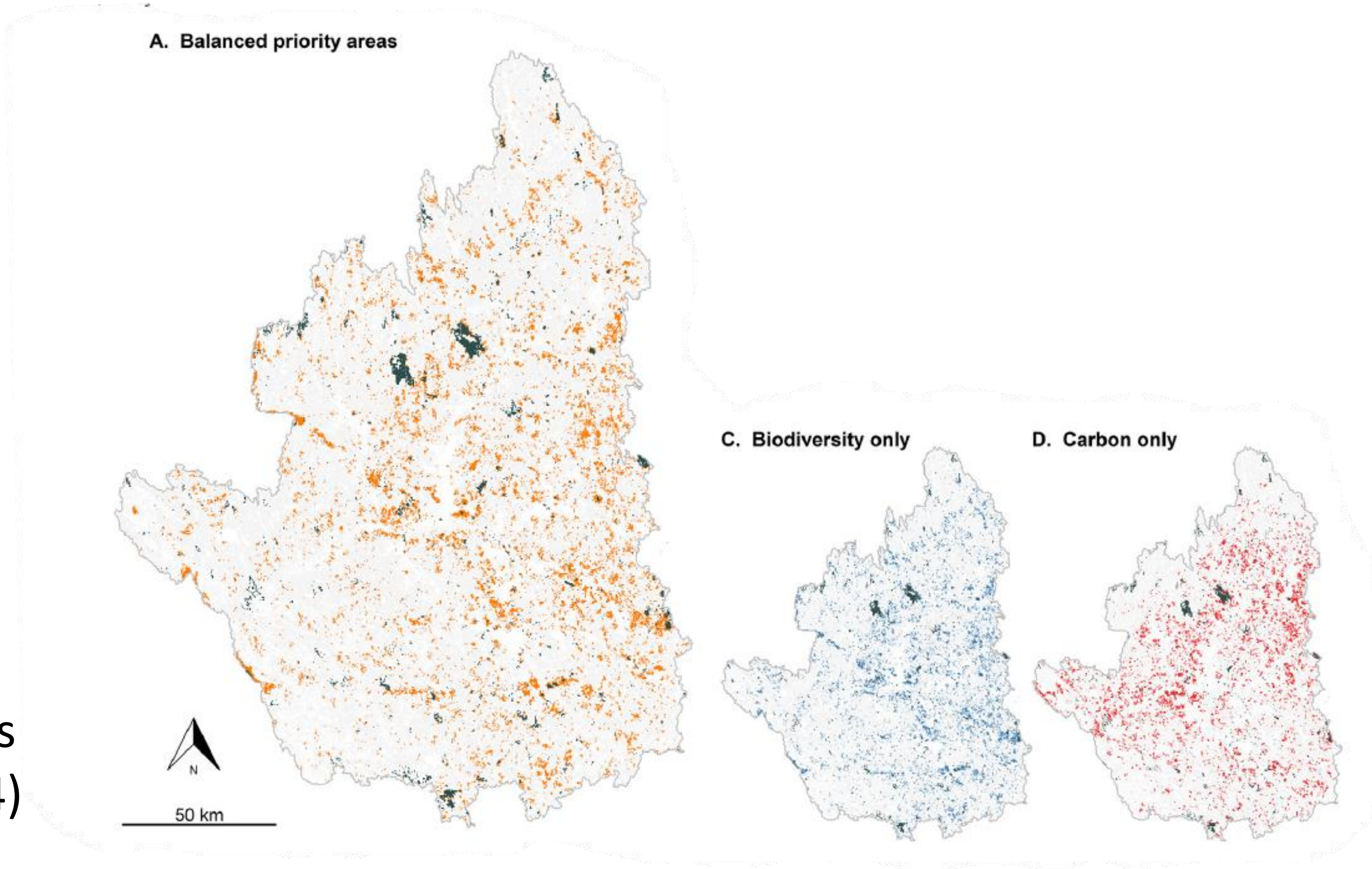
Matin et al. 2020

International jurisdictions

-General lack of biodiversity and climate mitigation policy integration-

Finland some alignment of policies

- National Climate Act requires impact assessment
- Focus on Conservation and Sustainable Use of Biodiversity
- Spatial, dynamic modelling and optimization to support sustainable resources management (Forsius et al. 2023)
- Spatial prioritization considers trade-offs of mitigation measures (Lane et al. 2024)



Synergies and trade-offs

CODE	Biodiversity impact potential	Climate mitigation potential
	Positive (or neutral) impacts on biodiversity	Greenhouse gas emission reductions or active carbon sequestration
	Negative impacts on biodiversity that can be controlled/mitigated to maintain biodiversity	Maintain greenhouse gas emission sinks (no change in carbon stock)
	Negative impacts on biodiversity that cannot be reasonably controlled/mitigated to maintain biodiversity	Reduce carbon store

Biodiversity objectives (NBAP)

Objective	Biodiversity impact potential	Climate mitigation potential	tradeoff ≠ lose-lose -- win-win ++
2A: Protection of existing designated areas, and protection of species is strengthened; conservation and restoration within the existing protected area network are enhanced		**/***	≠
2B: Biodiversity, ecosystem services in the wider countryside are conserved and restored (agriculture & forestry)		*/**/***	≠
2C: Biodiversity, ecosystem services in the wider countryside conserved and restored –(peatlands & climate action)		*/**/***	≠
2D: Biodiversity, ecosystem services in marine, freshwater environment conserved and restored		***	≠
2H: Invasive alien species (IAS) controlled, managed on all-island basis to reduce harmful impact on biodiversity; measures undertaken to tackle introduction, spread of new IAS to environment		***	≠

* Greenhouse gas emissions reductions

** Carbon sequestration

*** Carbon stocks

Energy mitigation measure impacts

Intervention	Risk to biodiversity	Climate mitigation potential	tradeoff ≠ lose-lose-- win-win ++
Energy			
Onshore wind	Protected Areas	*	≠
	Peatland (pristine)	*	--
	Improved grassland	*	++
	Semi-natural grassland	*	≠
	Plantation forest (conifer)	*	++
	Native woodland	*	--
Solar PV	Protected Areas	*	≠
	Peatland (pristine)	*	--
	Improved grassland	*	++
	Semi-natural grassland	*	≠
	Plantation forest (conifer)	*	≠
	Native woodland	*	--
Offshore wind	Marine Protected Areas	*	≠
	Migration paths	*	≠
	Sublittoral down to 60 m	*	≠
Biofuel	Protected Areas	*	≠
	Improved grassland	*	++
	Semi-natural grassland	*	≠

climate mitigation potential is distinguished in terms of greenhouse gas emissions reductions (*), carbon emissions through sequestration (**) or carbon stocks (***)

LULUCF mitigation measure impacts

Intervention	Biodiversity Risk	Climate mitigation potential	tradeoff ≠, lose-lose --, win-win ++
Afforestation (Conifer dominated)	Organic-rich soils	**/***	≠
	Improved grassland	*/**	≠
	Protected areas	*/**	≠
	Semi-natural grassland	*/**	≠
Afforestation (Broadleaf)	Protected areas / Organic-rich soils / Semi-natural grassland	*/**/***	--
	Improved grassland	**	≠
Agroforestry	Protected areas / Organic-rich soils /Semi-natural grassland	*/**/***	--
	Improved grassland	**/***	≠
Extend forestry rotation (conifer)	Organic-rich soils	*/**/***	--
	Mineral soil	*/**	≠
Prevent deforestation	Protected areas / Organic-rich soils	*/**/***	≠
	Mineral soils	*/**/***	≠
Convert (replant) existing organic soil forests to birch	Protected areas / Organic-rich soils	*/**/***	≠
	Mineral soils	*/**/***	≠
Plant, improve hedgerows	Protected areas / Organic-rich soils / Semi-natural grassland	*/**/***	++
	Improved grassland	*/**/***	++
Increase cover crops	Tillage land	*/**	++ / ≠
Increase straw incorporation	Cereal crop area	*/**	++ / ≠
Increase manure use on cropland	Cropland	*/**	++ / ≠
Improve grassland management# (mineral soil)	Improved grassland / Semi-natural grassland	*/**	++
Reduce grassland management (drained organic soil)	Improved grassland / Semi-natural grassland	*/**/***	++
Rehabilitate peatlands	Bord na Mona extraction peatlands	*/***	++
Rewet additional peatlands	Protected areas / Grassland (improved, semi-natural) /Organic-rich soil	*/***	++

Agriculture mitigation measure impacts

	Intervention	Biodiversity Risk	Climate mitigation potential	tradeoff ≠, lose-lose --, win-win ++
LIVESTOCK	Reduced Finishing Age (Bovine)	Semi-natural grassland	*	≠, --
		Improved grassland	*	≠, --
		Protected areas	*/***	≠, --
	Extend grazing season	Semi-natural grassland	*/***	≠
		Improved grassland	*/***	++, ≠
		Protected areas	*/***	≠
	Change in livestock diet		*	++
	Reduce Livestock numbers (bovine: ovine)	Semi-natural grassland, Improved grassland	*	++
		Protected areas	*	≠
GRASSLAND, CROPLAND	Apply (Use of) Digestate		*/**	≠
	Clover, multi-species swards, legumes**	Protected areas	*	≠
		Improved grassland	*/**	≠
		Semi-natural grassland	*/**	≠
	Fertilizer formulation (protected urea, low nitrate compounds)	Semi-natural grassland, Protected areas	*	≠
		Improved grassland	*	≠
		Croplands	*	≠, ++
	Changes in slurry application	Semi-natural grasslands	*	≠
		Improved grassland, Cropland	*	++
	Organic farming	Semi-natural grassland	*/**/***	≠
		Improved grassland	*	++
		Cropland	*	++
		Livestock	*	≠, ++

Landscape diversity

Trade-off and synergies

Multiple uses of land parcel

Recommendations

Recommendation	Priority
Implement statutory obligations	1
National land use strategy to consider climate actions, biodiversity protection and restoration and align with obligations	2
Changes in land use practices are needed (nature friendly)	3
Clarify definitions for “climate neutrality” and “biodiversity-rich”	4
Continued increased knowledge generation and sharing	5
Avoid “off-shoring” climate and biodiversity impact	6

Modelling analysis to support the development of the second programme of Carbon Budgets

Requested by Climate Change Advisory Council

11th July 2024

Údarás Náisiúnta Iompair
National Transport Authority

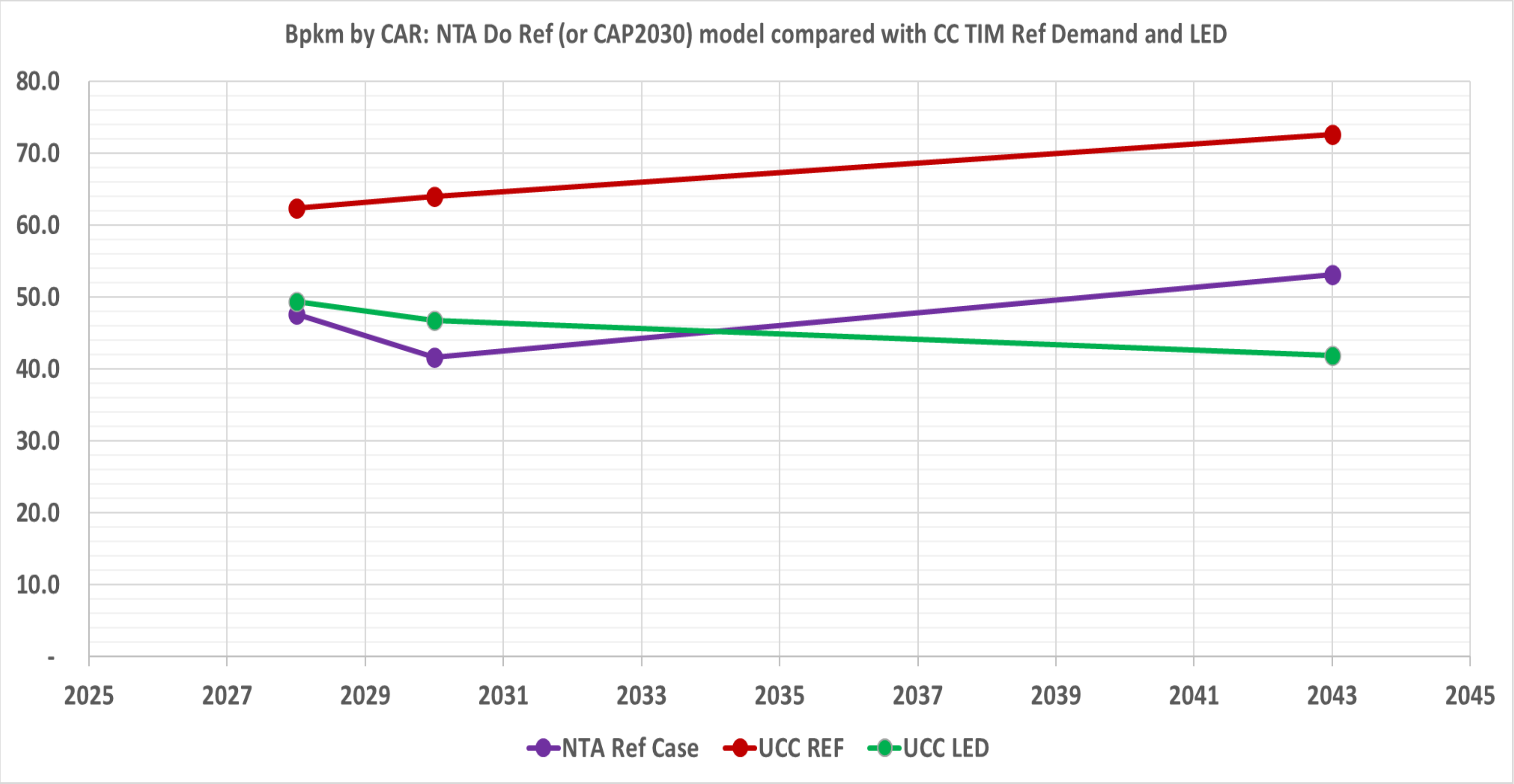
Passenger Kilometre Comparisons

Assumptions

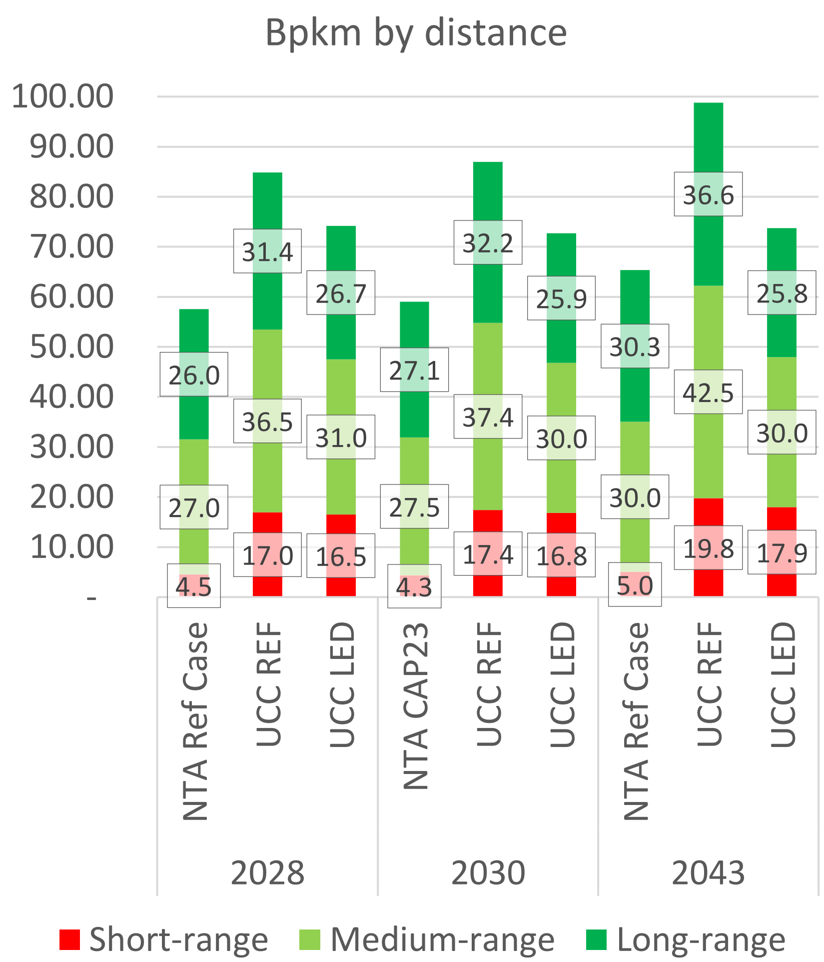
- NTA model is for 24-hour weekday, then:
- Annualised by x357 taking account of weekends, reduced travel at weekends.
  - but no summer seasonality or tourist trips, for example.
- Ratio of Bpkm **NTA : UCC** models approximately **0.7** in absolute values;
- The NTA models have quite a lot fewer short trips < 5km
- NTA models don't include motorcycle, and taxi output was not produced for this analysis
- Short: < 5km, Medium: 5-30 km, Long: >30 km

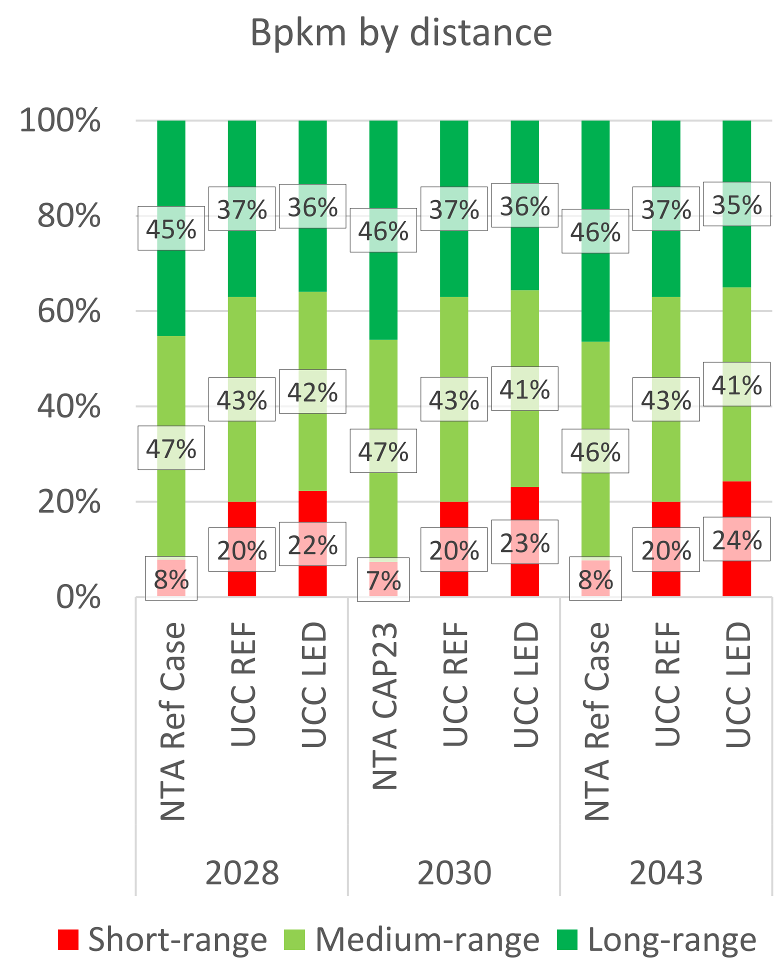
Bpkm Mode Comparison	TIM output	RMS output
Car	CAR	CAR
PT	BUS, HPT, LPT	PUBLIC TRANSPORT (BUS, HPT, LPT)
Active	ACTIVE	WALK, CYCLE

Car Person-kilometres (per year, as estimated in each model) in Billions, Bpkm

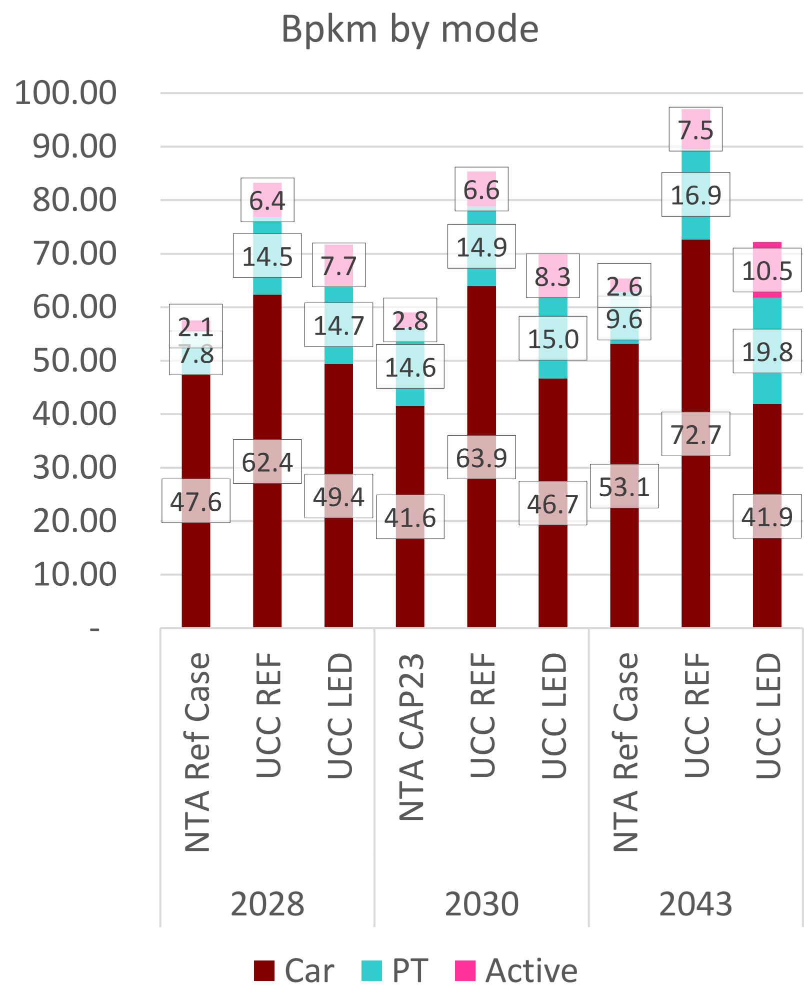


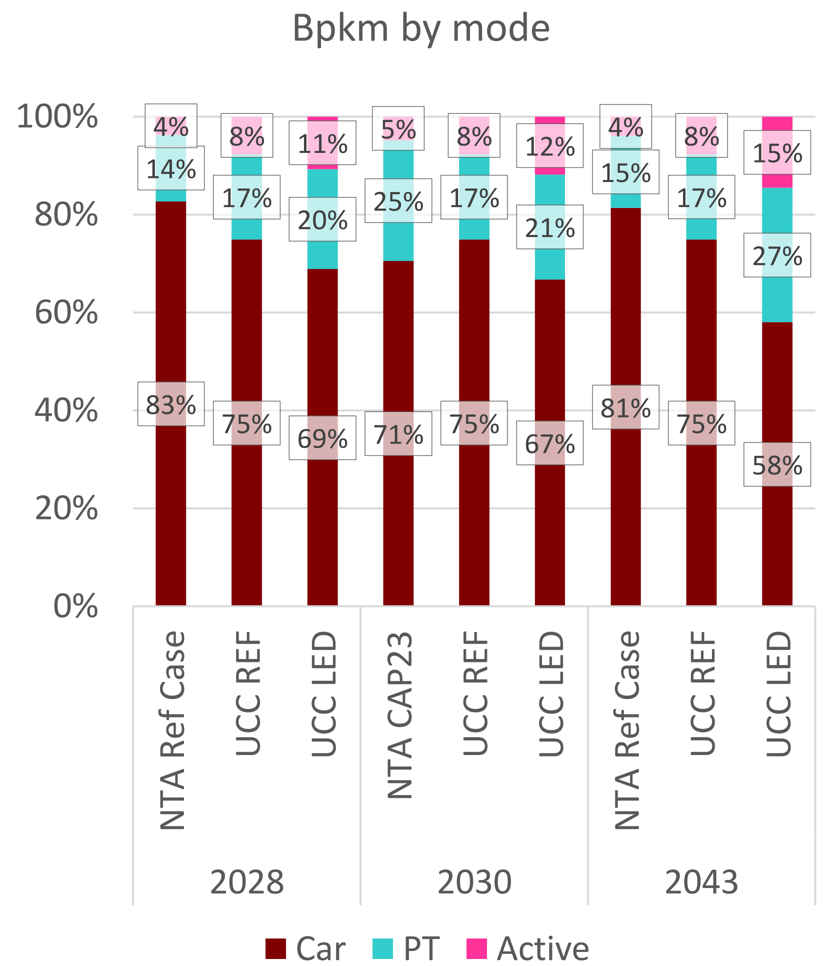
Person-kilometres (per year, as estimated in each model) in Billions, Bpkm





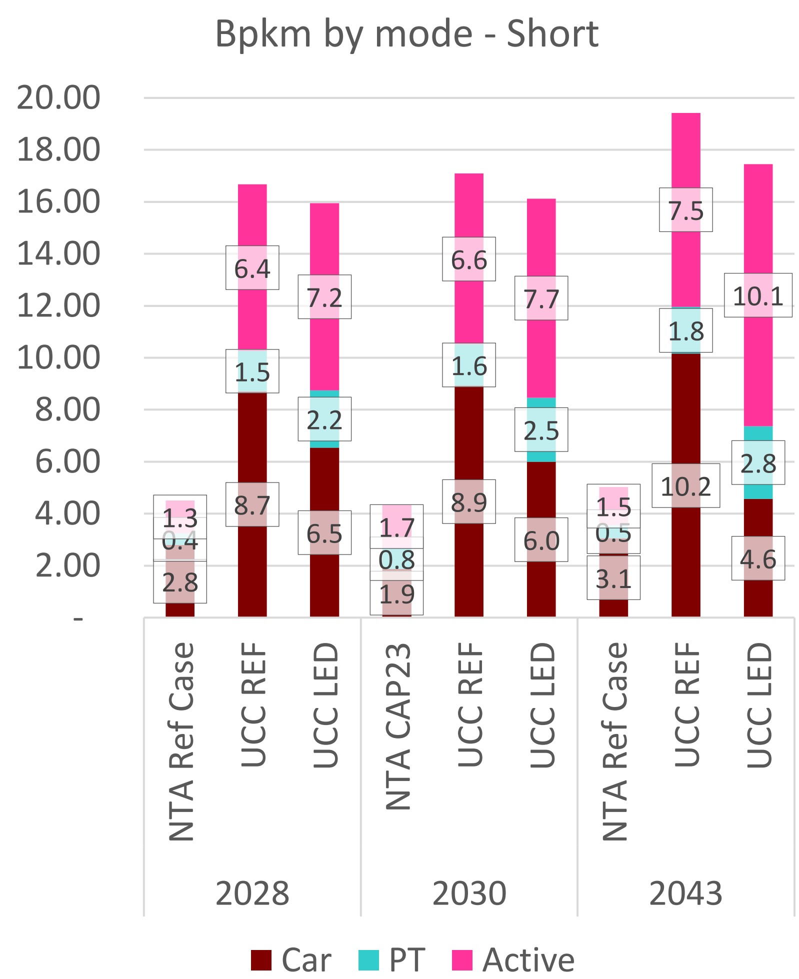
Bpkm by Mode of Transport
(per year, as estimated in each model)

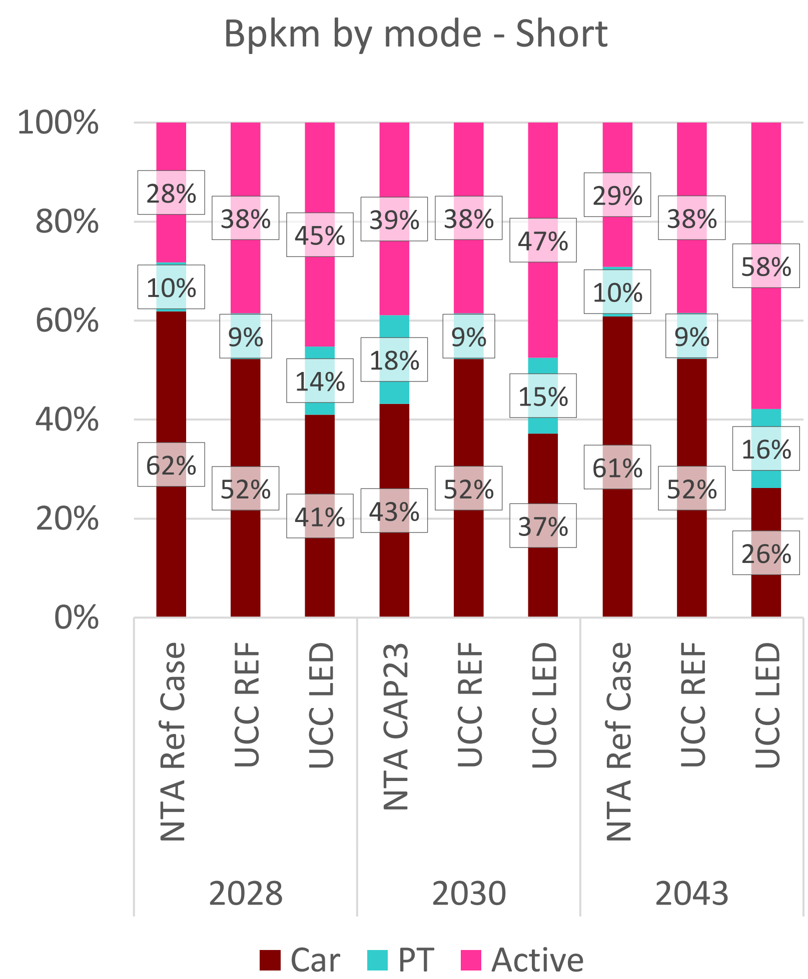




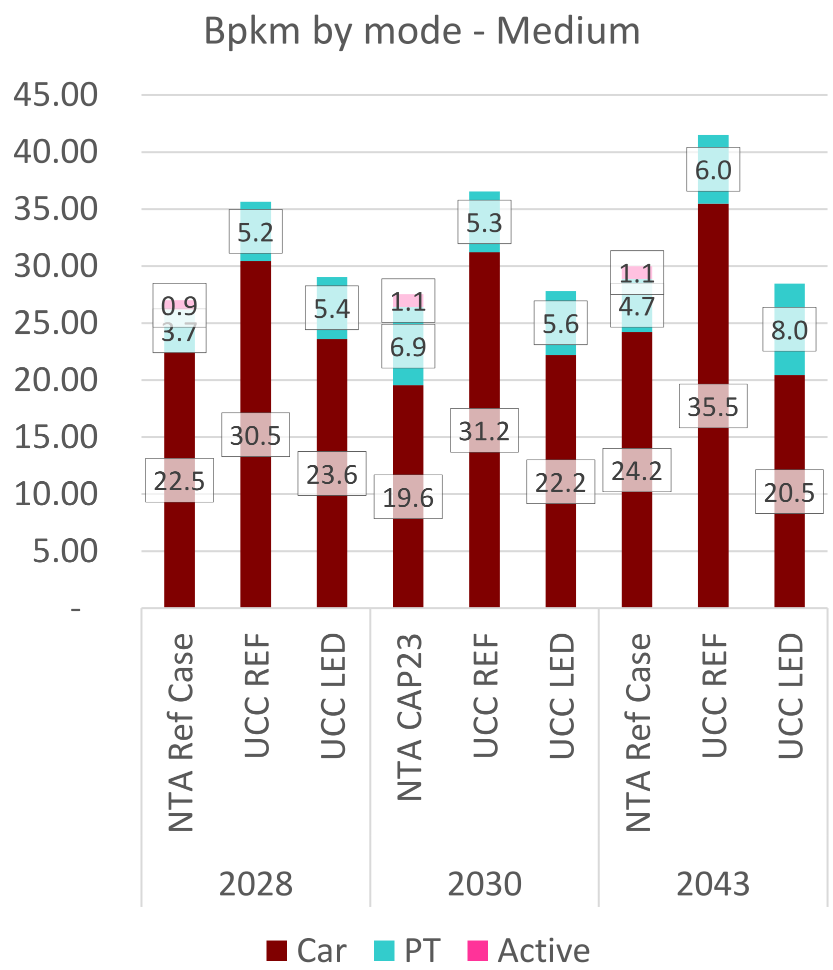
Bpkm by Mode of Transport
(per year, as estimated in each model) – short distance

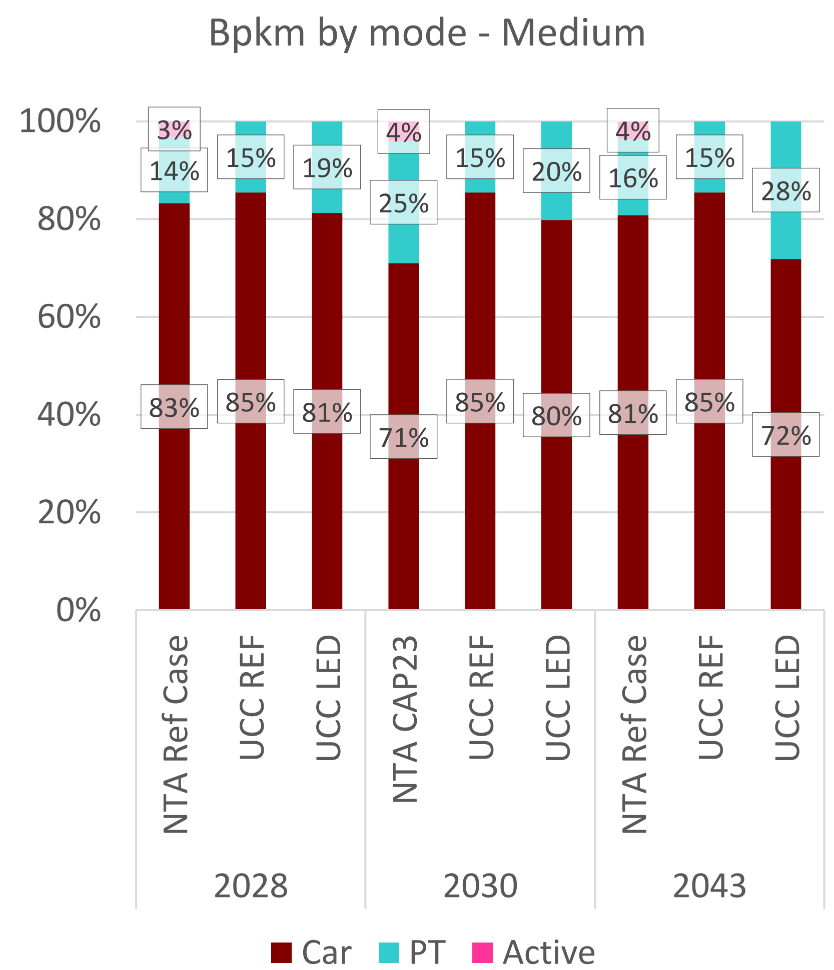
Údarás Náisiúnta Iompair
National Transport Authority





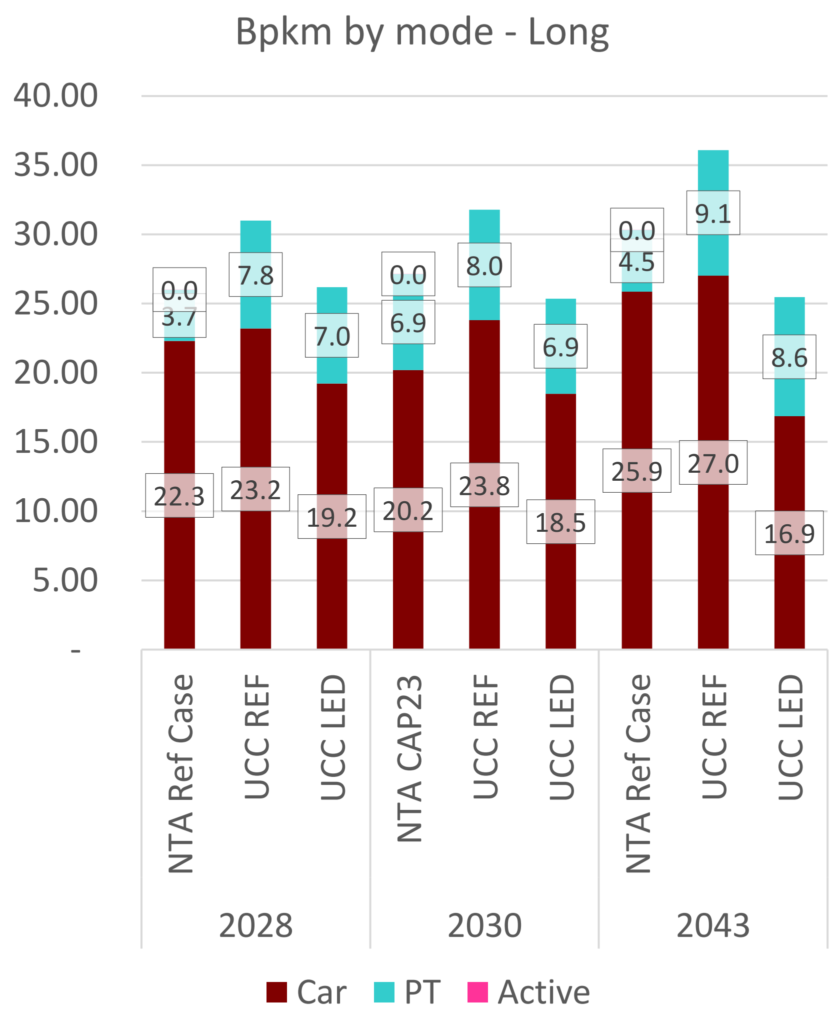
Bpkm by Mode of Transport
(per year, as estimated in each model) – medium distance

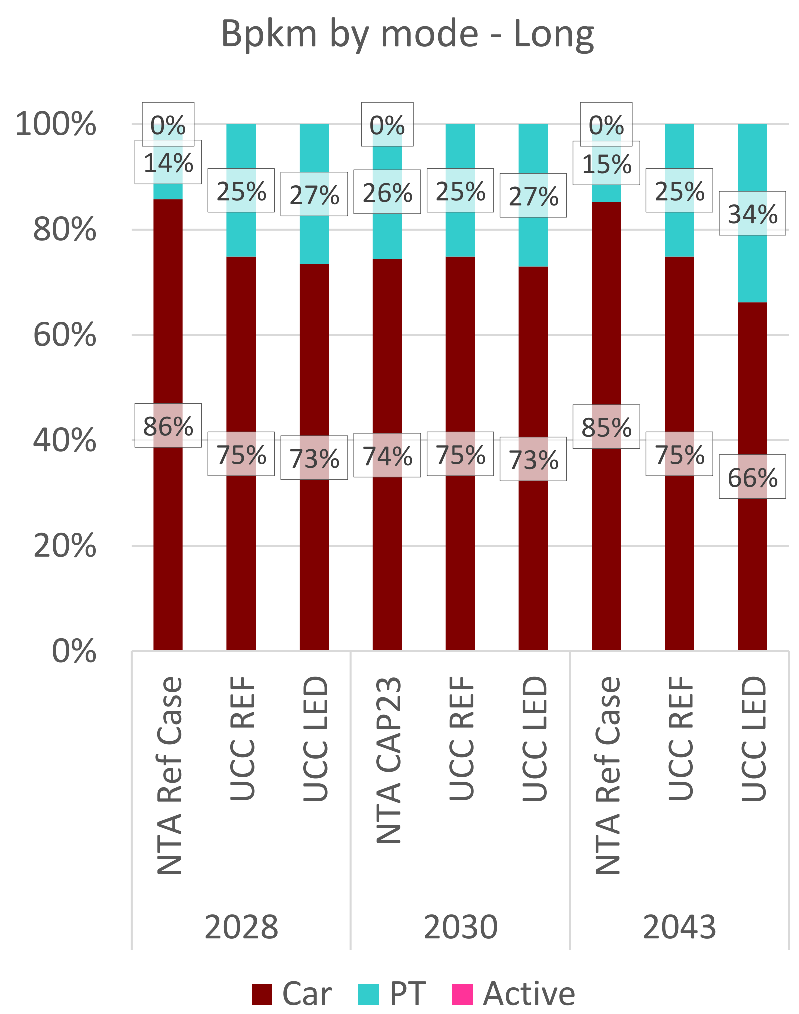




Bpkm by Mode of Transport
(per year, as estimated in each model) – long distance

NTA
Údarás Náisiúnta Iompair
National Transport Authority





Person-kilometres (per year, as estimated in each model), Bpkm – NTA/UCC ratios

Údarás Náisiúnta Iompair
National Transport Authority

	2028	2030	2043
Ratio Car NTA Ref/UCC Ref	0.76	0.65	0.73
Ratio Long-Distance NTA Ref/UCC Ref	0.83	0.84	0.83
Ratio Short Distance by Car NTA Ref/UCC Ref	0.32	0.21	0.30
Ratio Medium Distance by Car NTA Ref/UCC Ref	0.74	0.63	0.68
Ratio Long Distance by Car NTA Ref/UCC Ref	0.96	0.85	0.96

Freight Tonne Kilometre Comparisons

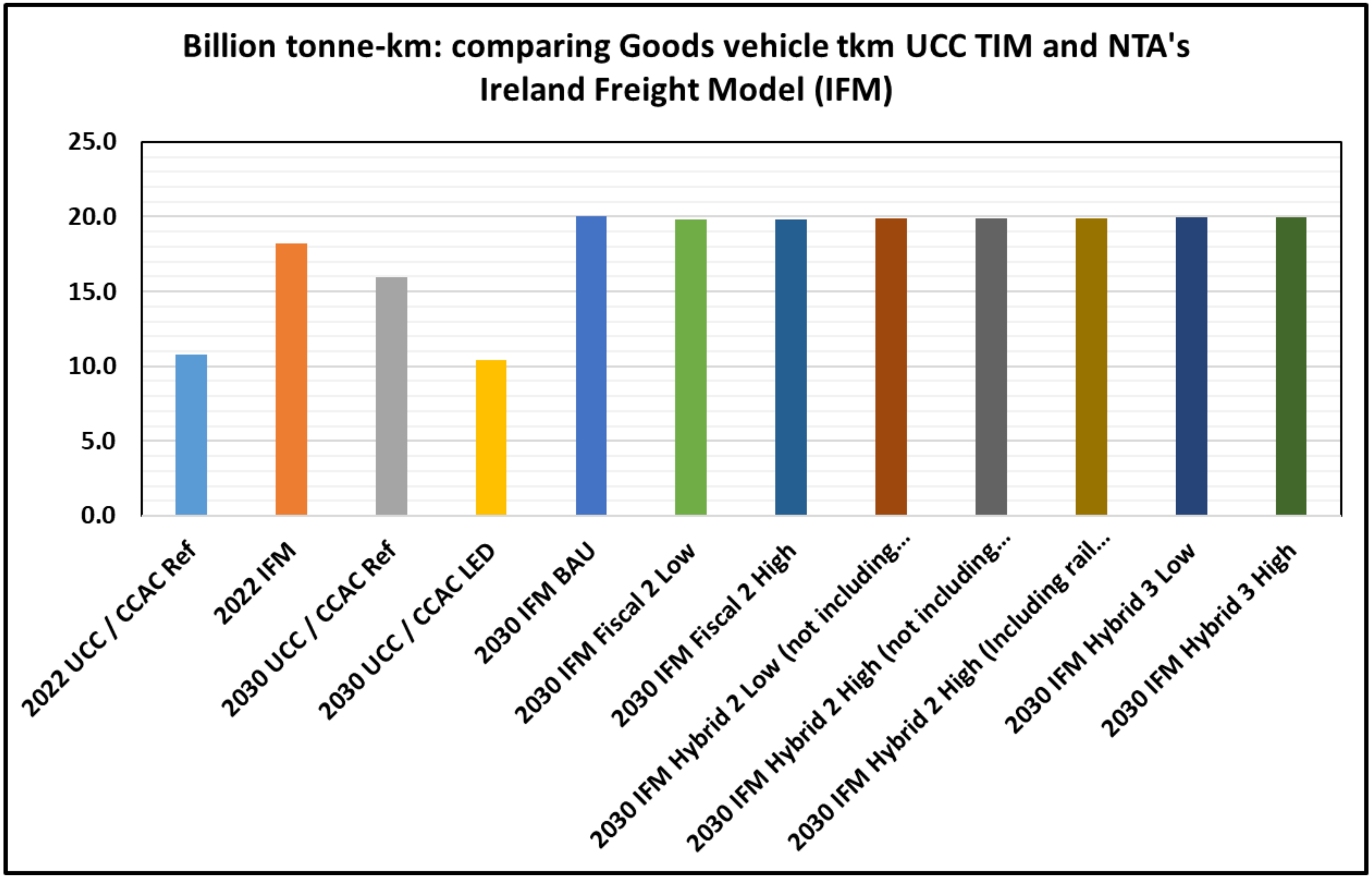
Goods Vehicle tonne-kilometres: caveats

Údarás Náisiúnta Iompair
National Transport Authority

Note the following re IFM:

- An all-island model (not just State)
    - At present, difficult to separate out t-km data for State alone
- Still under development at present (July 2024)
- 2030 the only future year currently available
    - Various scenarios exist for 2030, but overall t-km doesn't vary a lot between them

Goods Vehicle tonne-kilometres



Please also see notes on next slide

Car/LGV/HGV Stock Comparisons

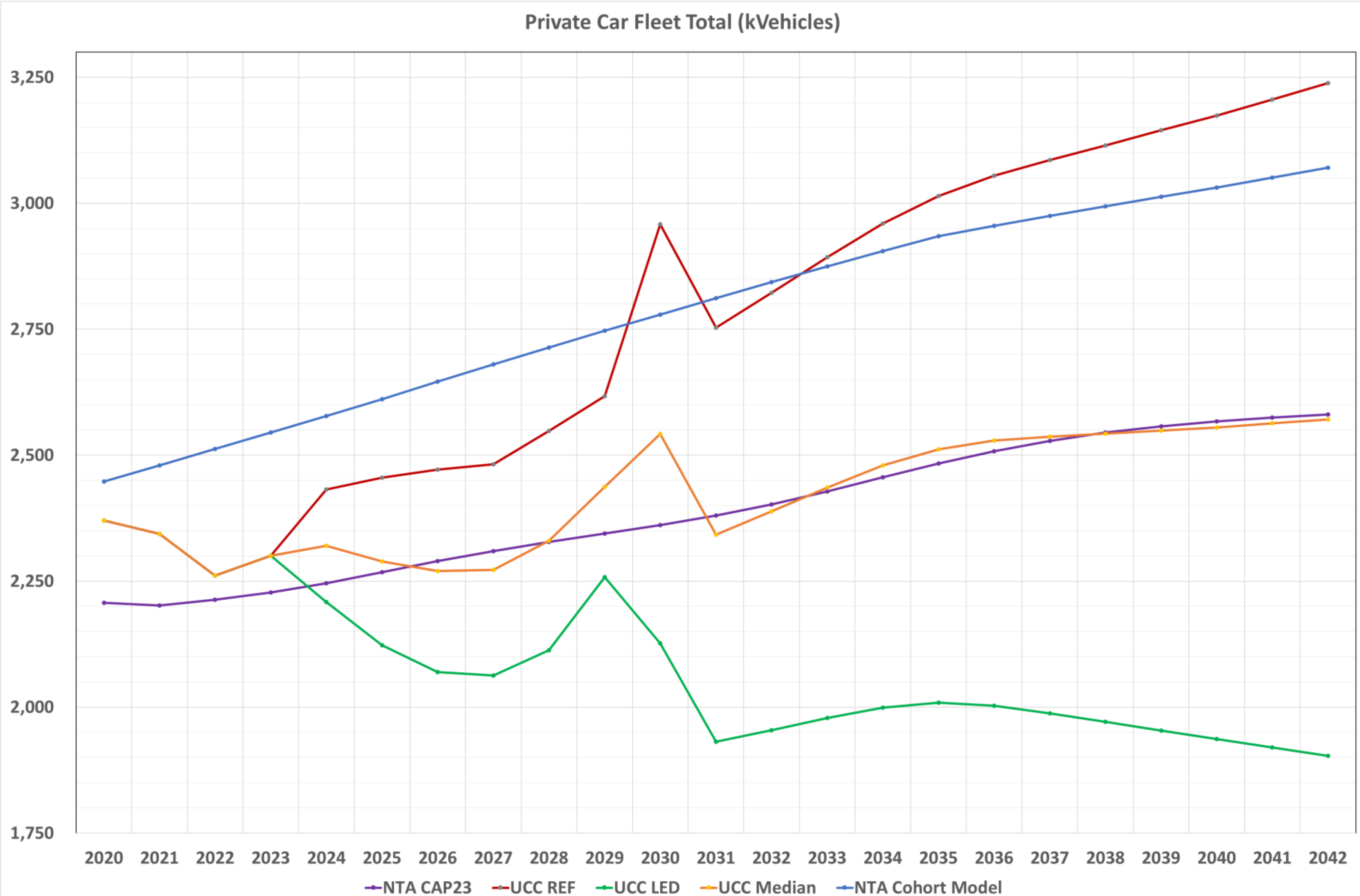
The Private Car Fleet CAP23 (*NTA CAP23*) scenario assumptions

Údarás Náisiúnta Iompair
National Transport Authority

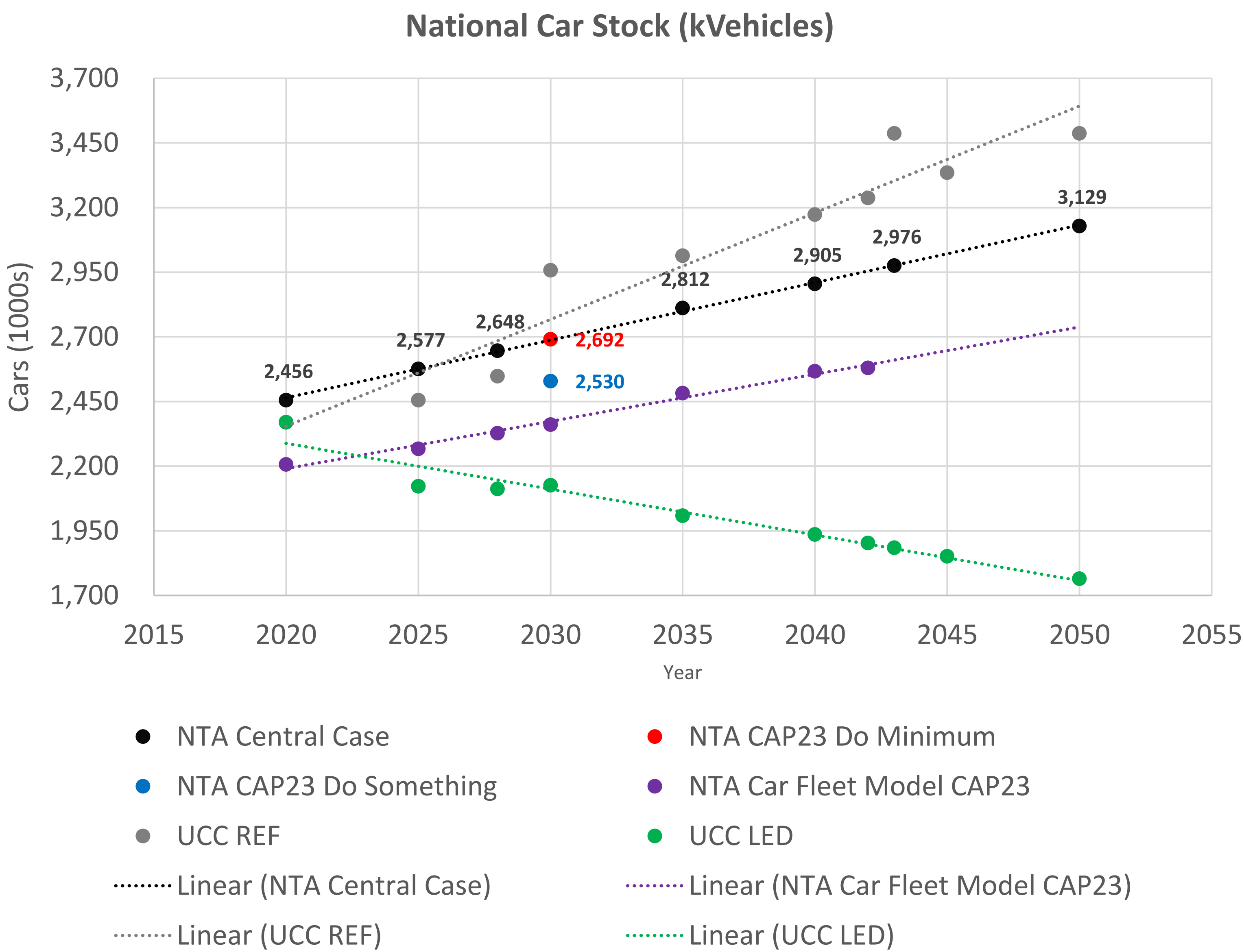
The Car fleet is from the CAP23 transport modelling work.

- Version starts from 31 Dec 2019 profile (NVDF), plus new registrations for 2020 and 2021 (CSO)
- Default scrappage rates estimated; no change to these rates between years
- No link to population or economy
- Sales of new vehicles assumed to be 143,000 per annum from 2023 onwards, plus 43,000 2nd-hand imports
- Electric = 100% of new sales by 2029

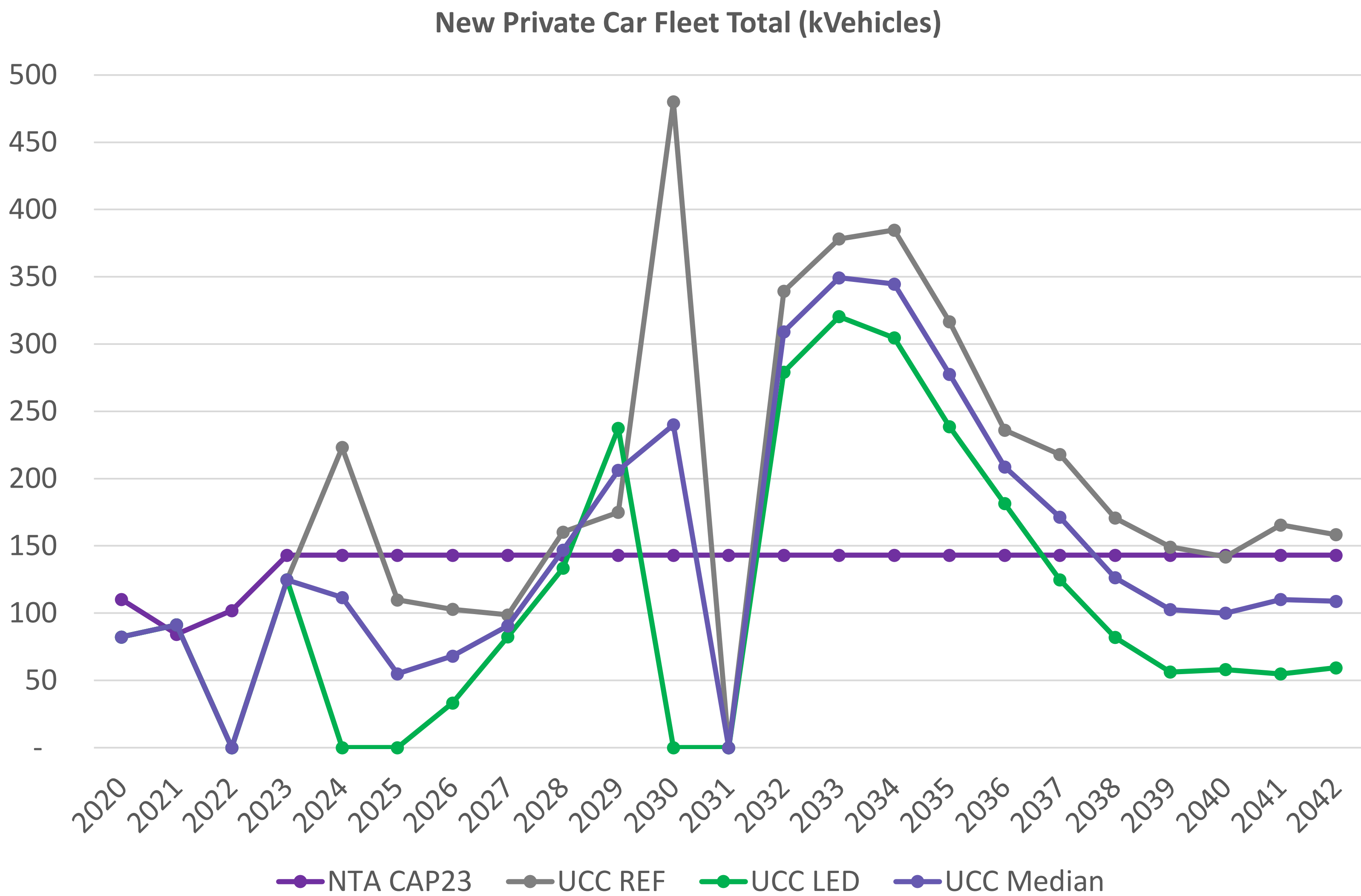
Comparing estimates of future Private Car Fleet (1,000s)



Comparing estimates of future Private Car Fleet (1,000s)



Comparing estimates of future Private Car Fleet (new cars, 1,000s)



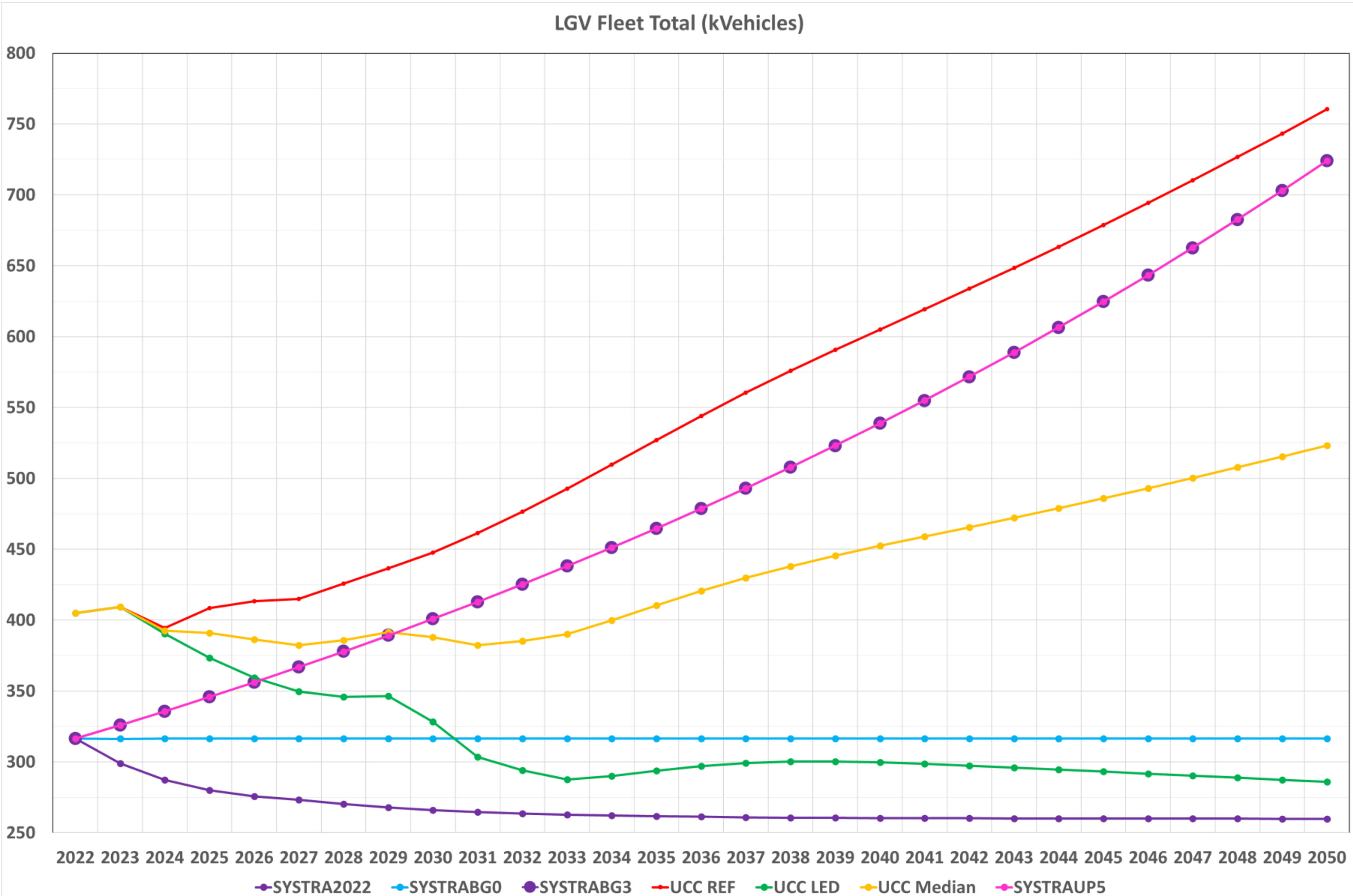
Preliminary WEM/WAM projections

Údarás Náisiúnta Iompair
National Transport Authority

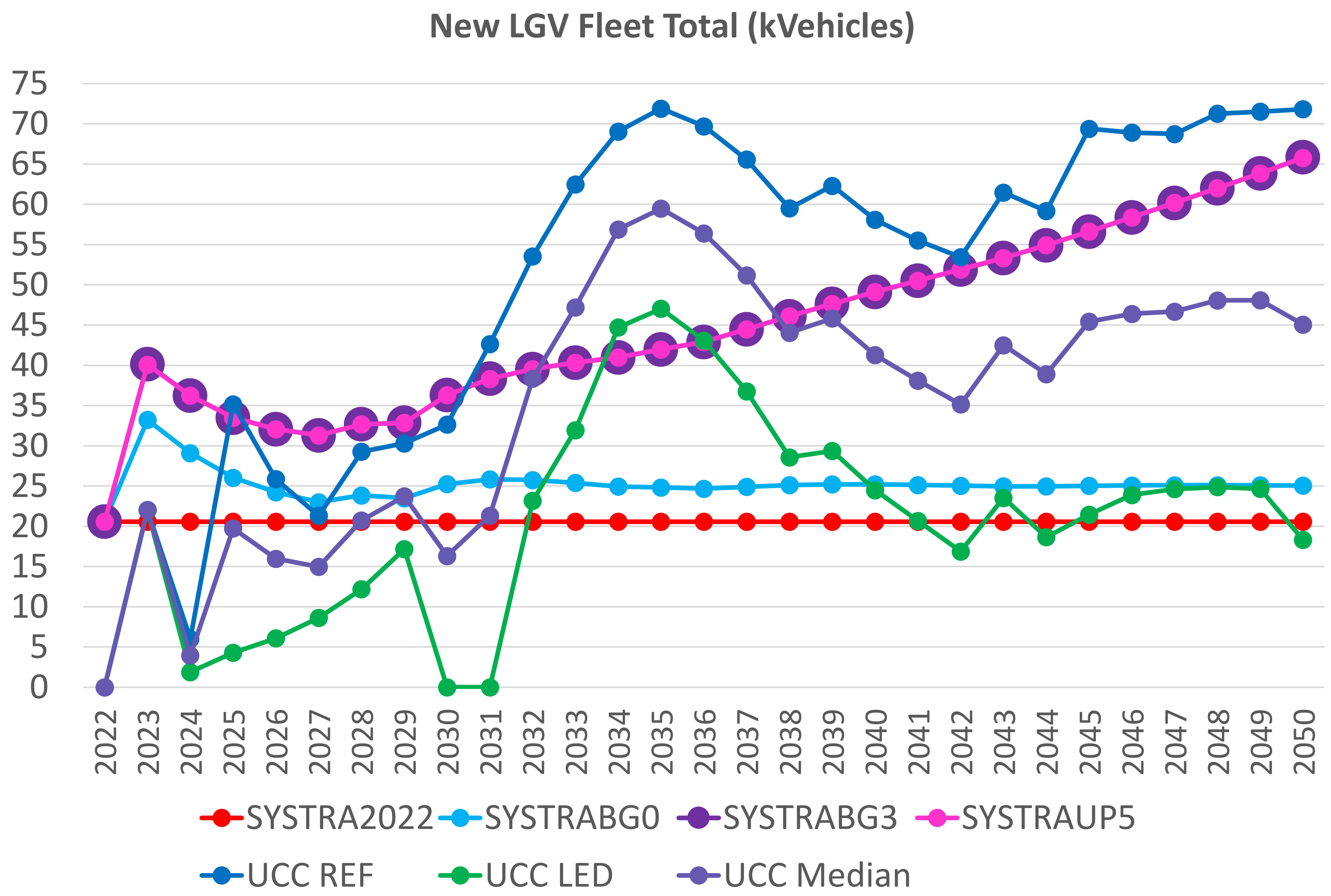
The LGV and HGV stock totals and fleet mixes are preliminary scenarios prepared to support WEM/WAM projections work.

- **2022_:** New registrations (new and 2nd-hand imports) fixed at 2022 levels, no change to EU Mandate targets
- **BG0_:** SYSTRA's 'Best Guess' with 0% growth, no change to EU Mandate targets
- **BG3_:** SYSTRA's 'Best Guess' with 3% pa growth, no change to EU Mandate targets
- **UP5_:** SYSTRA's 'Best Guess' with 3% pa growth and an extra 5% added to EU Mandate targets
- No new ICE LGV sales post 2035 in all scenarios

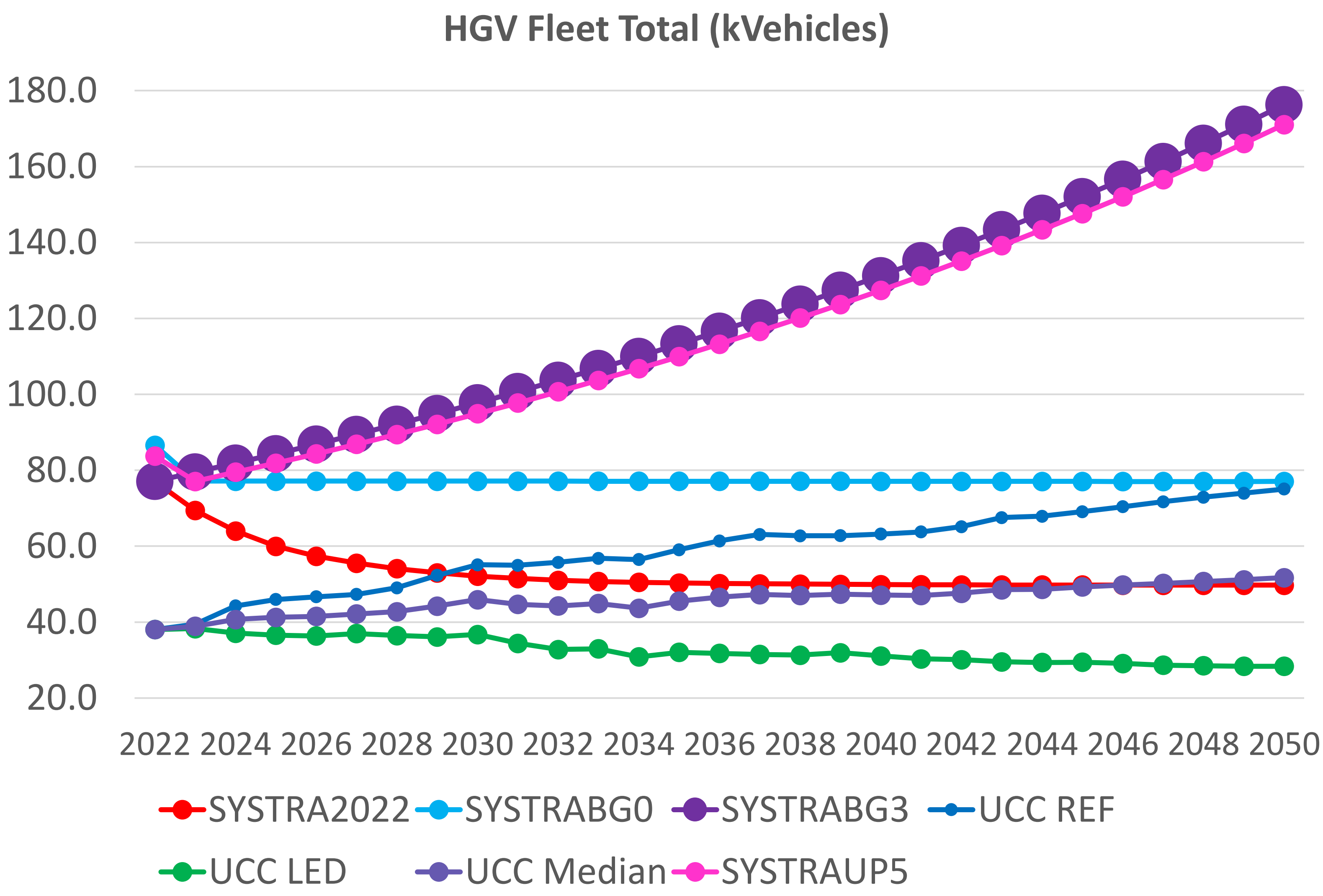
Comparing estimates of future LGV Fleet (1,000s)



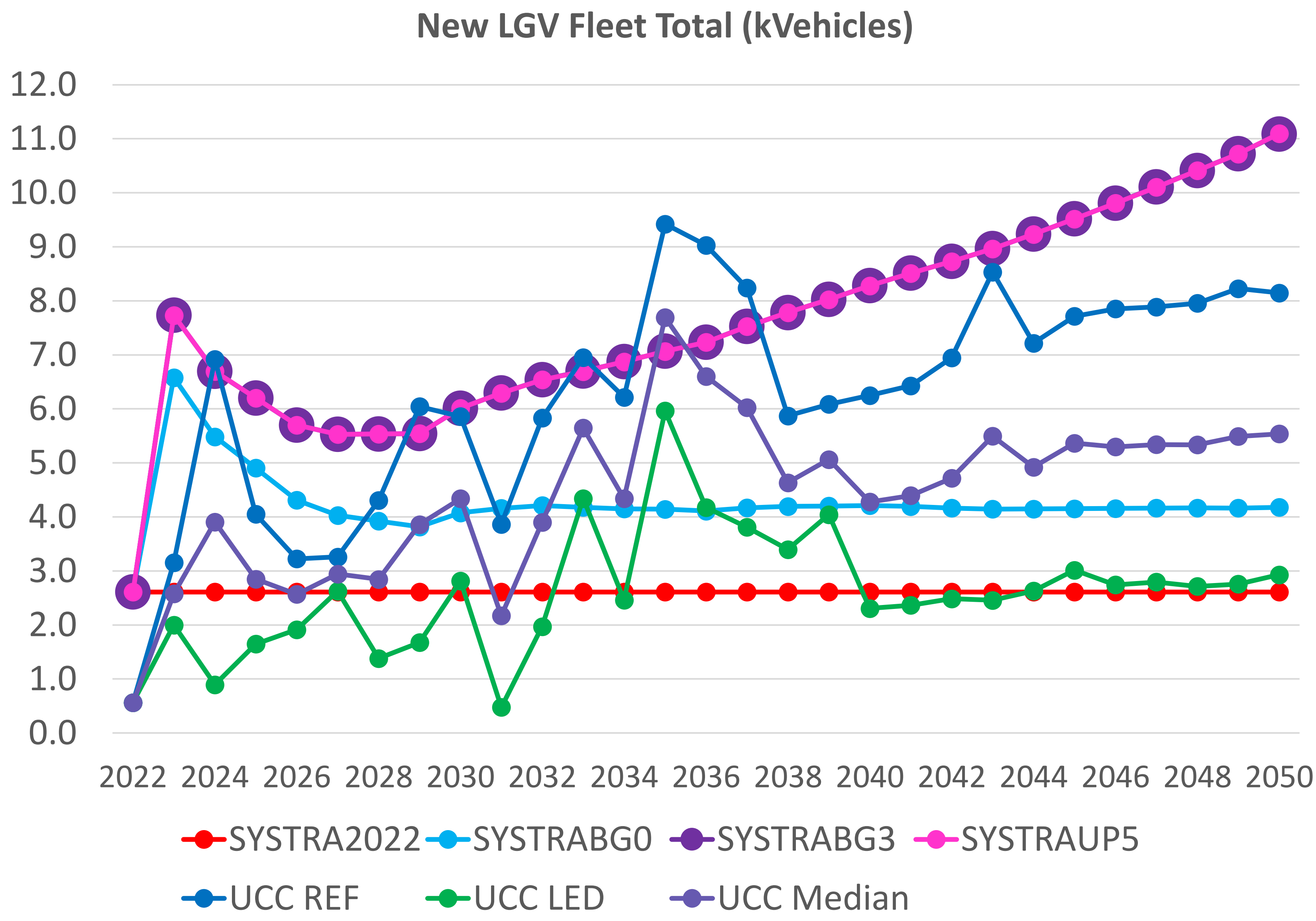
Comparing estimates of future LGV Fleet (new LGVs, 1,000s)



Comparing estimates of future HGV Fleet (1,000s)



Comparing estimates of future HGV Fleet (new HGVs, 1,000s)



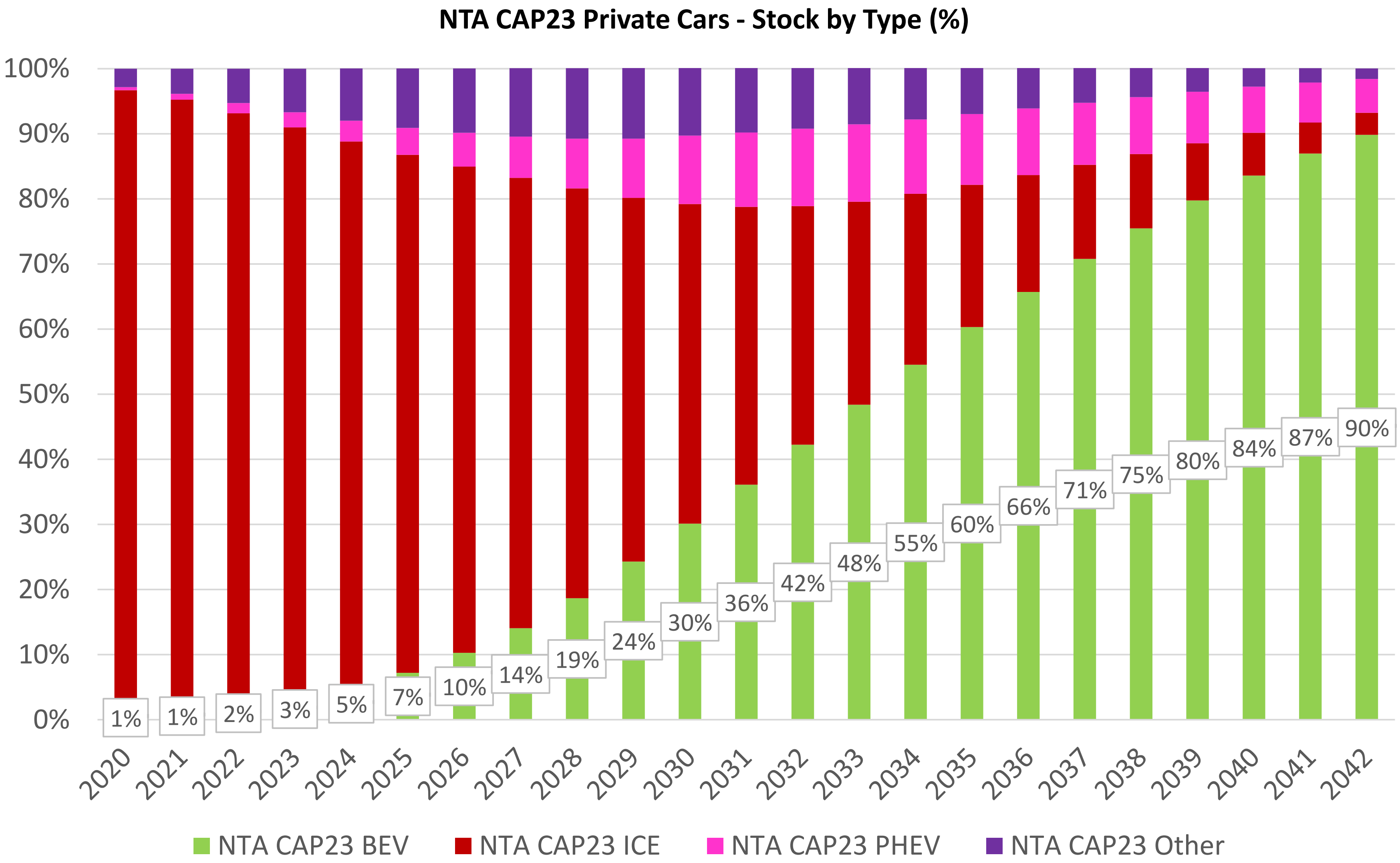
Fleet Mix Comparisons

The Private Car Fleet CAP23 (*NTA CAP23*) assumptions
Fuel types defined

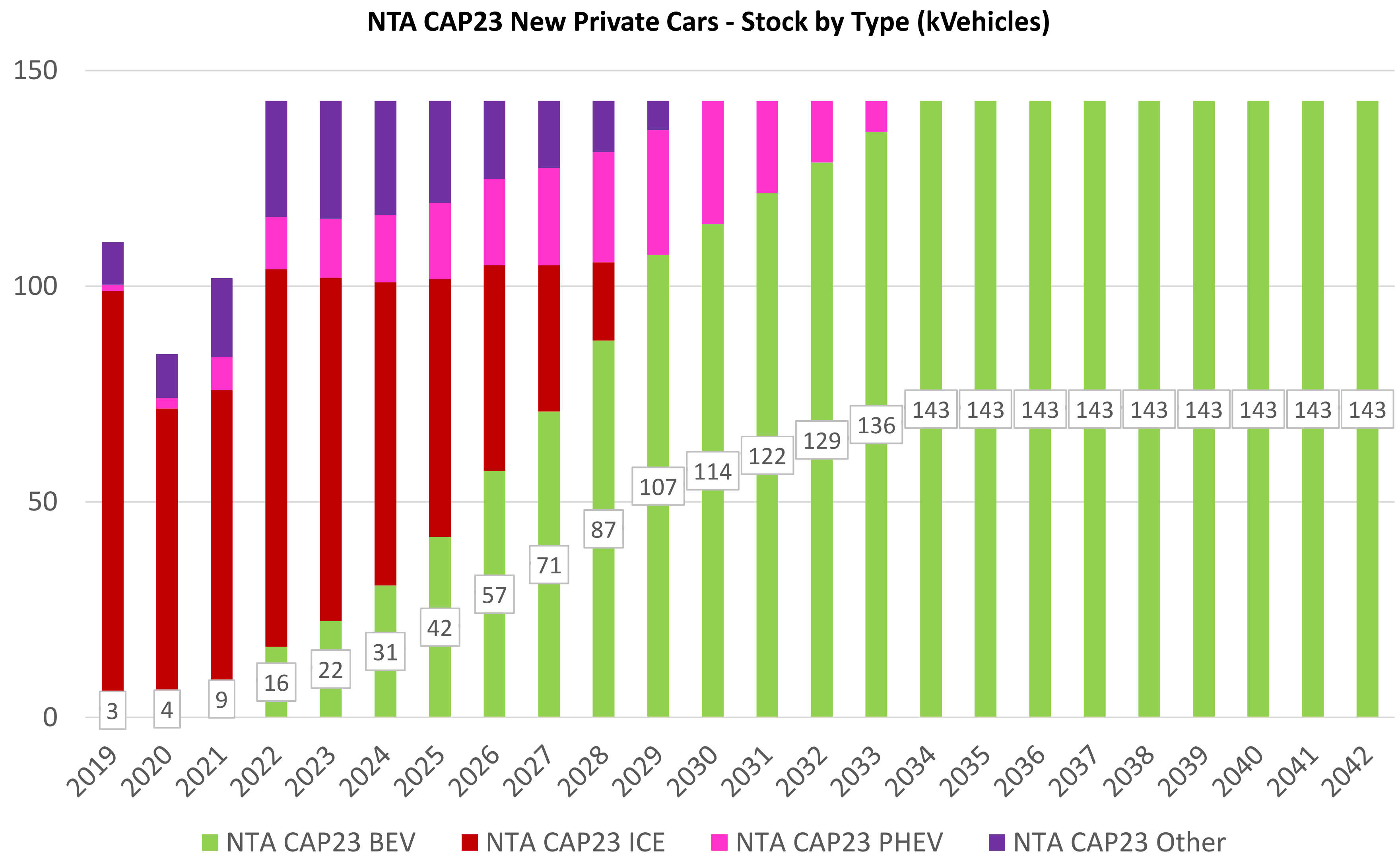
Údarás Náisiúnta Iompair
National Transport Authority

Fuel type as presented	Fuel type definition
BEV	Zero
ICE	Petrol, Diesel
PHEV	PHEV
Other	Other

NTA CAP23 estimates of future Private Car Fleet (% fuel type)



NTA CAP23 estimates of future Private Car Fleet (new cars by fuel type)



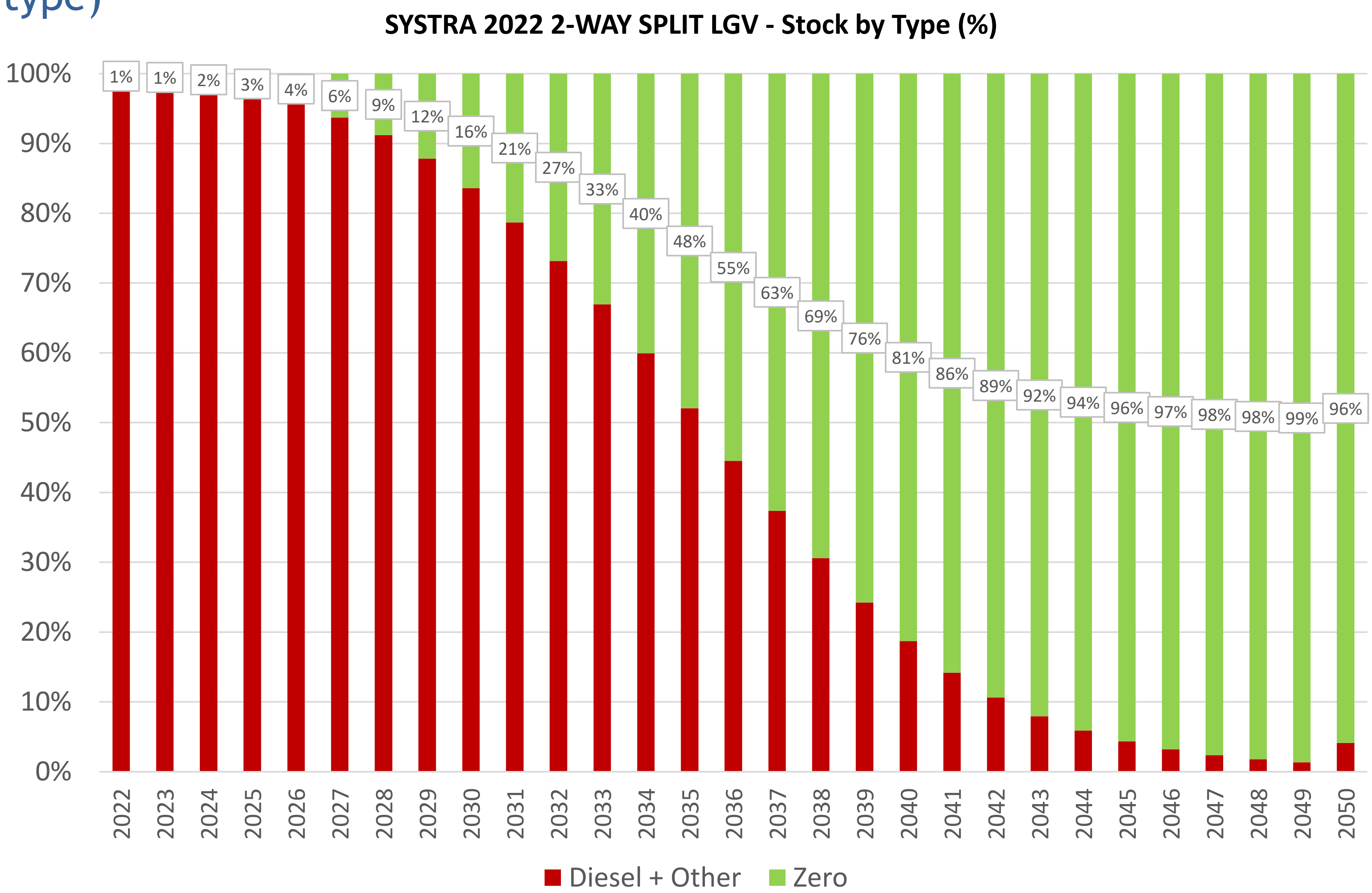
NTA-to-TIM outputs correspondence

Údarás Náisiúnta Iompair
National Transport Authority

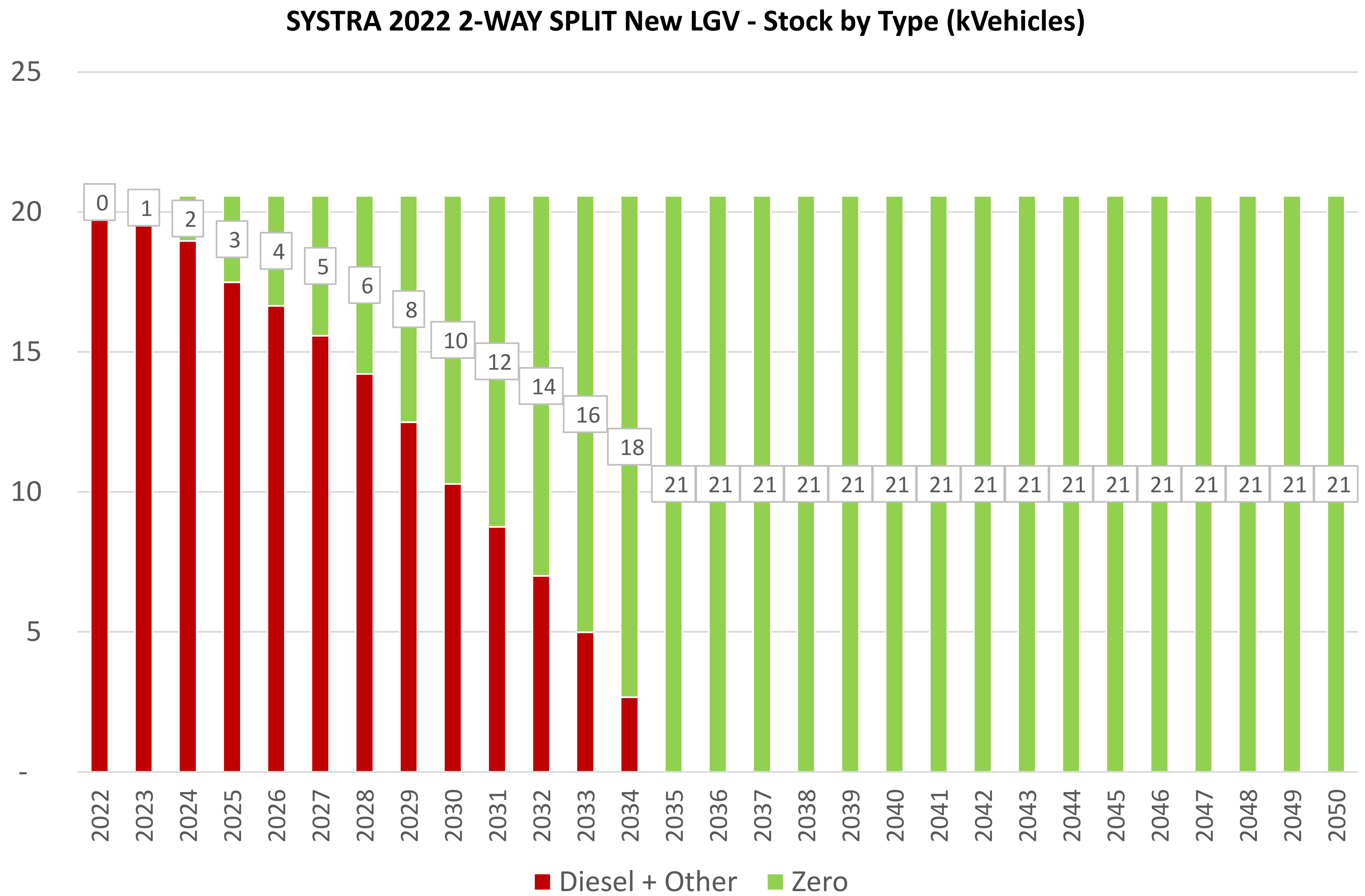
Vehicle Class Comparison	NTA vehicle class	TIM vehicle class
HGV	OGV1 + OGV2	MGV + HGV

NTA LGV/HGV fuel type	TIM fuel type
Diesel + Other	ICE + HEV + PHEV + FCV
Zero	BEV

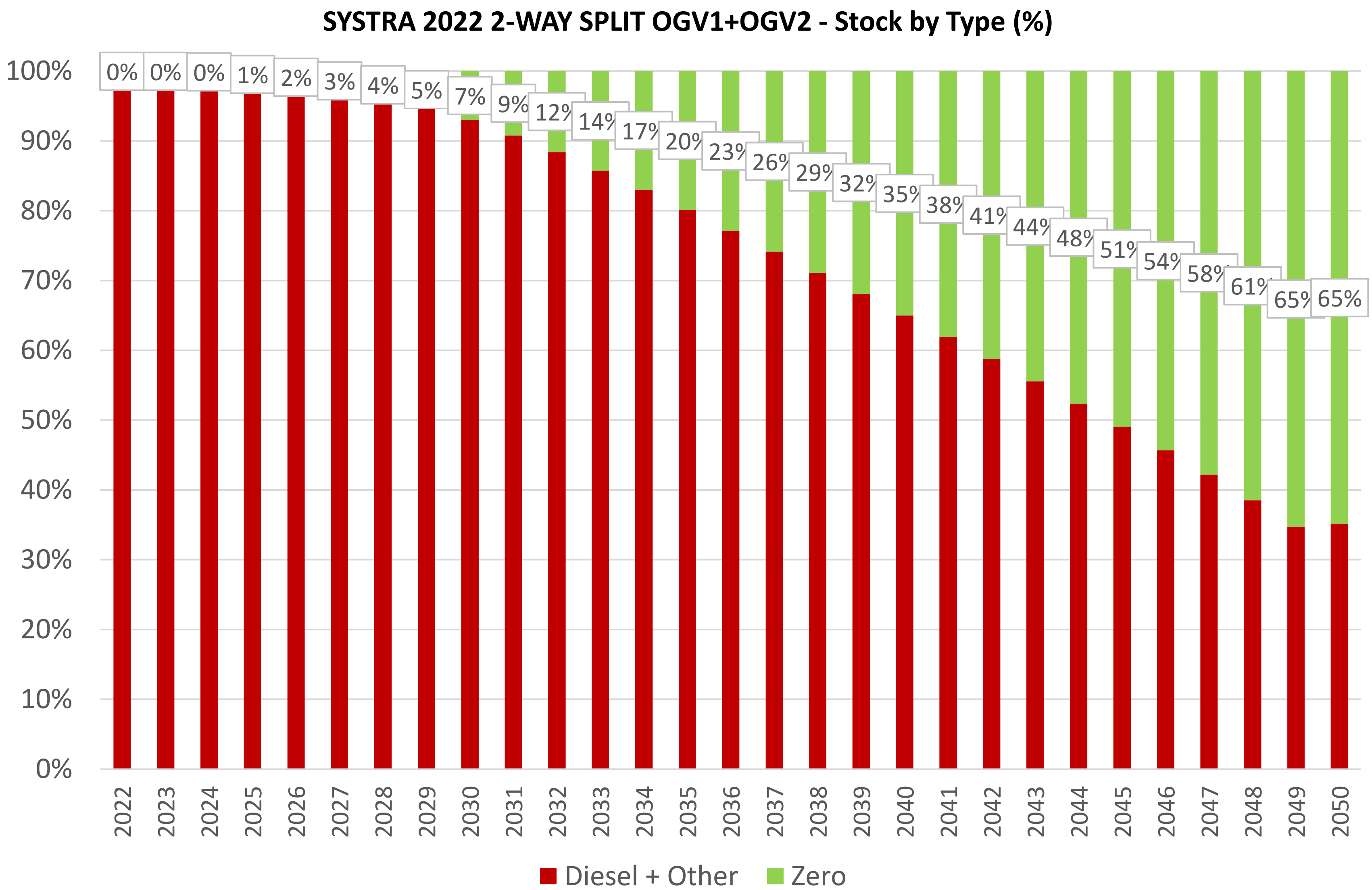
SYSTRA 2022 scenario estimates of future LGV Fleet (% fuel type)



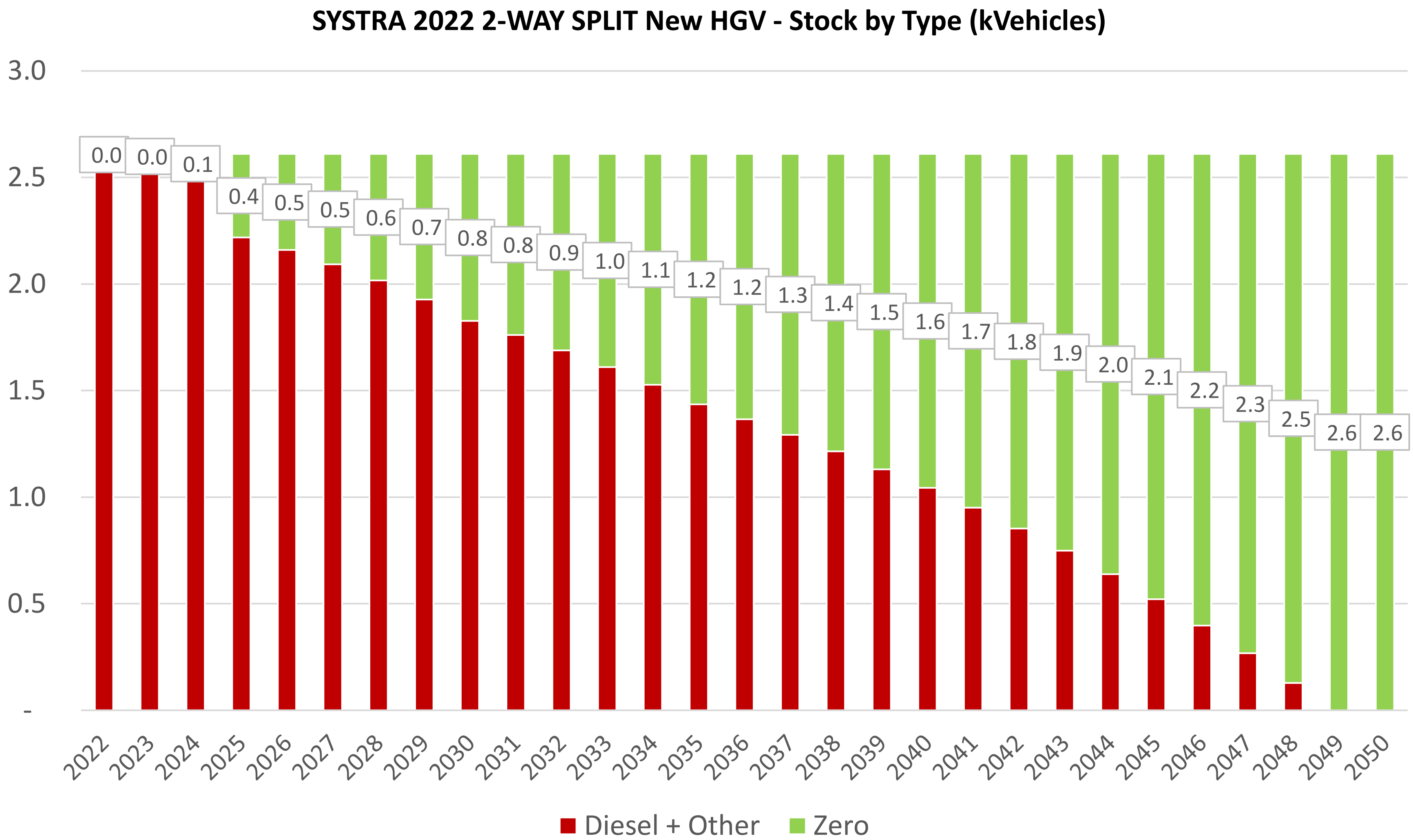
SYSTRA 2022 scenario estimates of future LGV Fleet (new LGVs by fuel type)



SYSTRA 2022 scenario estimates of future HGV Fleet (% fuel type)



SYSTRA 2022 scenario estimates of future HGV Fleet (new HGVs by fuel type)



Carbon Budgets Modelling Second Iteration – NEMF Additional Testing

Carbon Budgets Working Group 16

Emma Lynch - SEAI Energy Modelling - July 2024

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

NEMF Additional Testing – Approach for Second Iteration

- Reviewed outputs from TIM scenarios on web portal – data by scenario, sector, fuel and compared to NEMF assumptions and outputs

- Prepared review document for engagement with UCC before final iteration – observations and questions across all energy sectors for consideration with UCC team
  - As in first iteration, suggestions on calibration or potential areas of alignment, further exploration

- Reviewed latest energy projections from May 2024 GHG emissions projections
  - assessed projected annual and cumulative emissions out to 2040 against potential reduction trajectory from TIM scenarios
  - reviewed impact of risk scenarios for potential delays from WAM achievement

- Conducted additional sense check on power generation
  - Starting from 2024 WAM scenario, adjusted VRE installed capacities to match TIM 400Mt BAU scenario

NEMF Additional Testing – Notes on Limiting Factors

- The National Energy Modelling Framework has a policy focus and scenarios are primarily defined to reflect policies that are being implemented or discussed and their impact is assessed against targets
  - NEMF not typically used to solve for a carbon budget
  - Can be used to test outputs of optimisation approach as input assumptions to sense-check outcomes

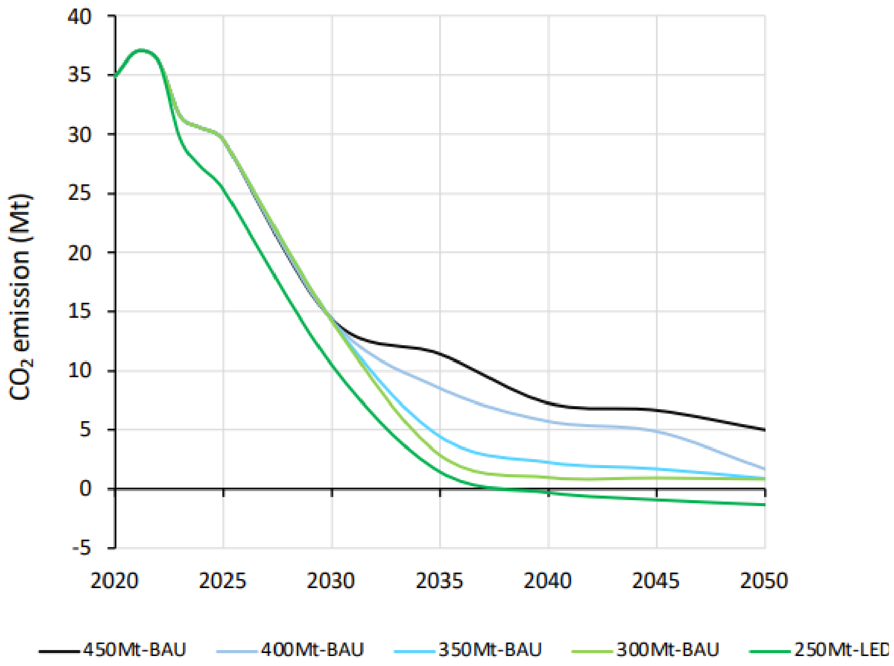
- Power module is at hourly granularity but is a day-ahead market model using unit commitment and economic dispatch
  - Does not account for some of the complexities of managing or expanding the grid etc.

- Hydrogen and CCS not currently included in the current projections modelled scenarios due to uncertainty over implementation pathway in policy

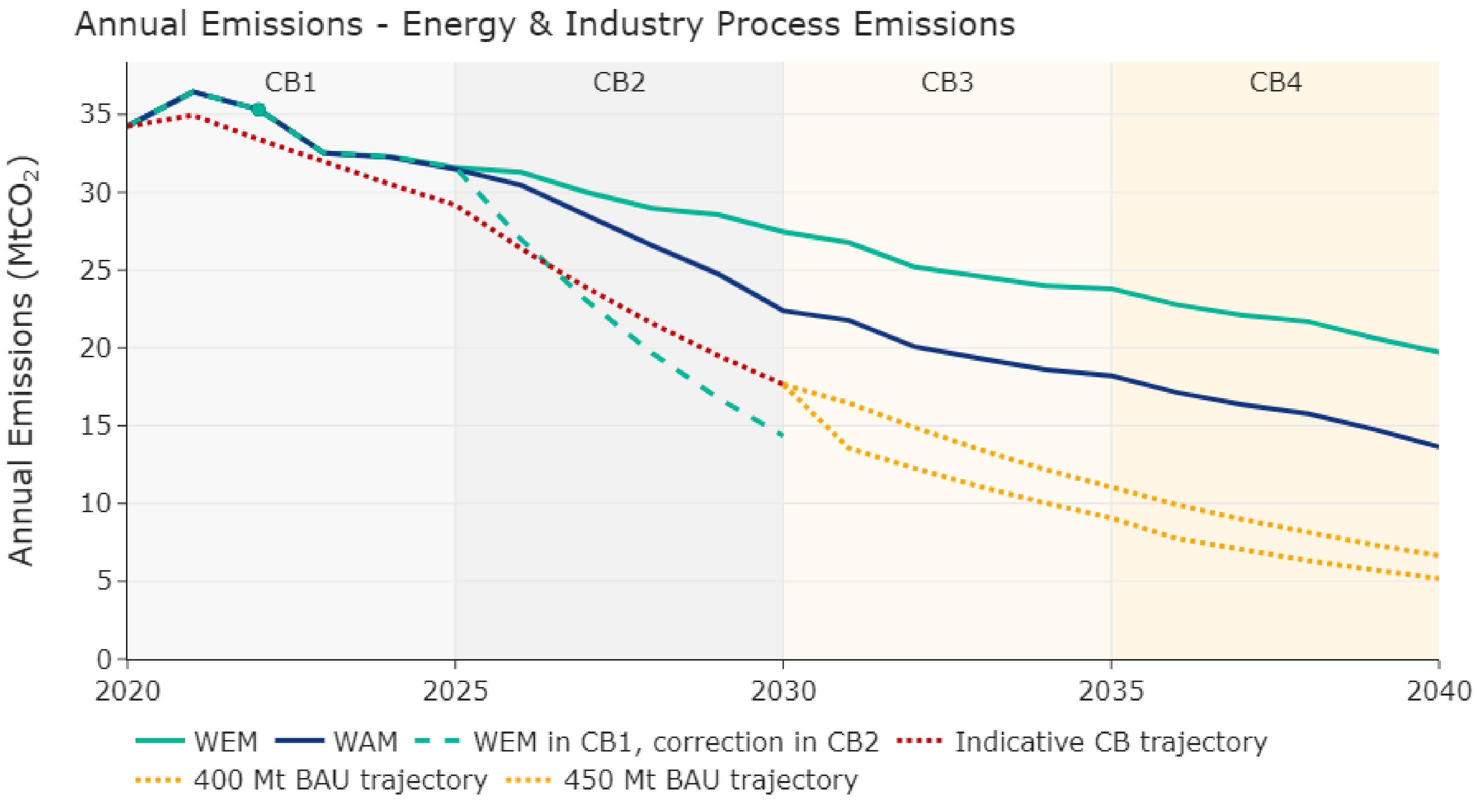
- Vaguer or limited policy assumptions especially post-2030 limit the robust representation of potential acceleration in policy later in time horizon

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

NEMF Additional Testing – Energy Emissions Reductions to 2030

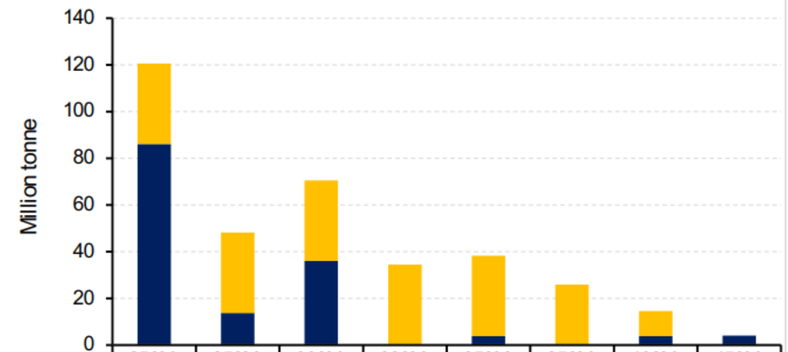


Source: UCC TIM CBWG 15 - 2nd Iteration Slides



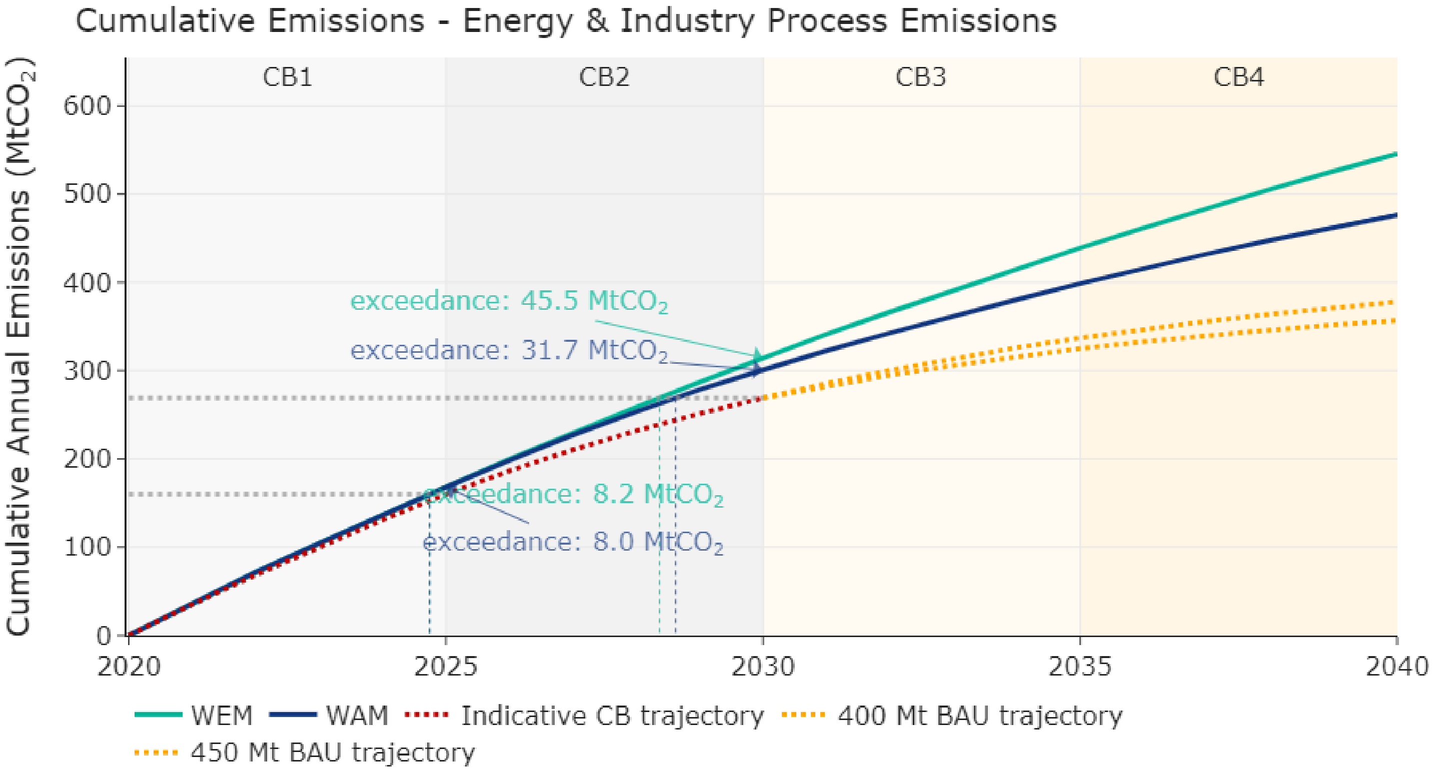
Source: SEAI NEMF – NEP 24 Annual Emissions

NEMF Additional Testing – Energy Emissions Reductions to 2030



	250Mt BAU	250Mt LED	300Mt BAU	300Mt LED	350Mt BAU	350Mt LED	400Mt BAU	450Mt BAU
BECCS	34	34	34	34	34	26	11	0
Unabated	86	14	36	0	4	0	4	4

Source: UCC TIM CBWG 15 - 2nd Iteration Slides



Source: SEAI NEMF – NEP 24 Cumulative Emissions

- For trajectories from400 and 450 Mt scenarios vs WEM and WAM:
  - Pre-2030 overshoot between 32 and 46 Mt
  - 2035 overshoot between 62 and 114 Mt
  - 2040 overshoot between 98 and 189 Mt

Risk Scenario Assumptions – Delayed Achievement Risk

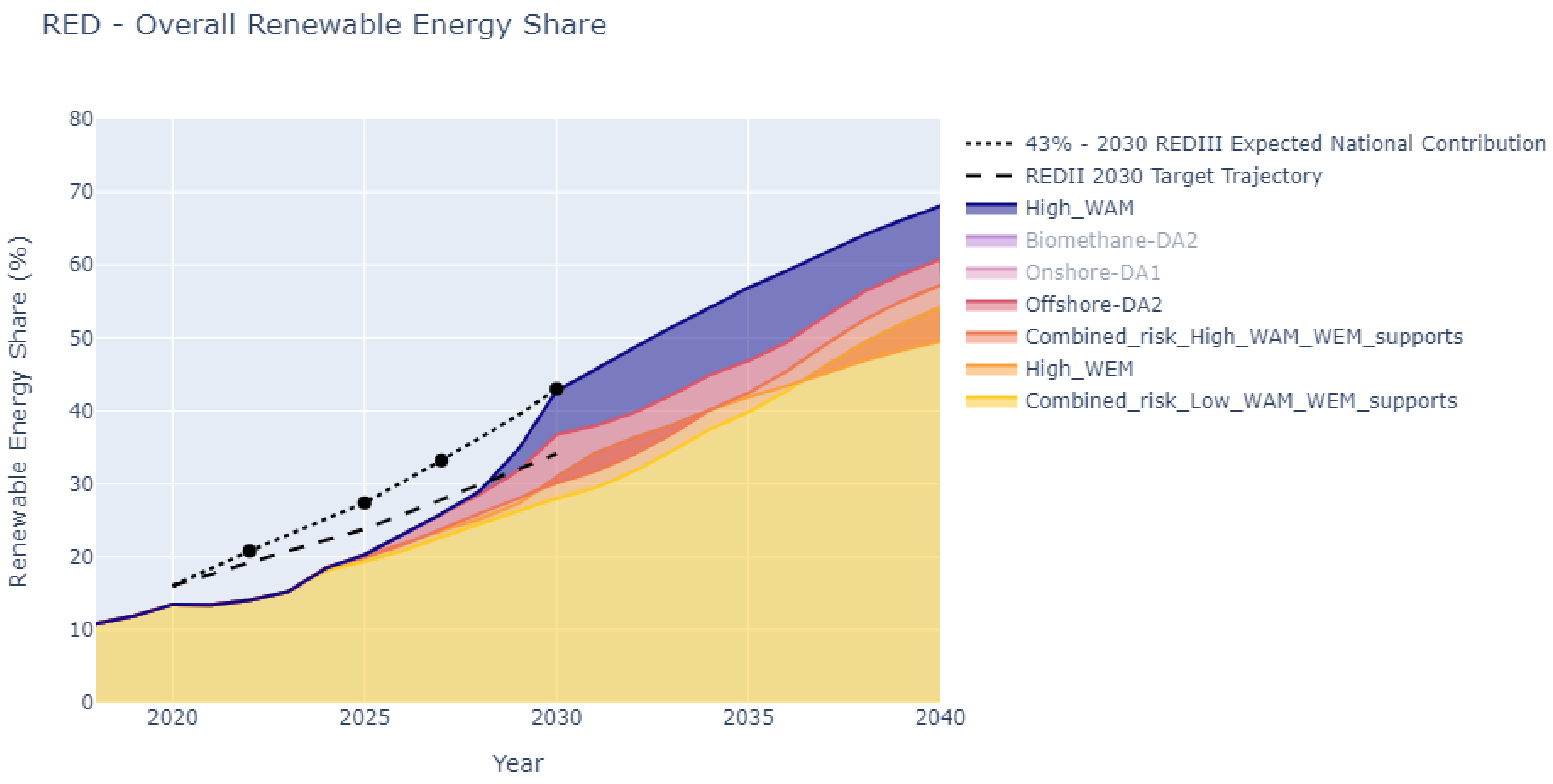
- WEM / WAM projections outputs showed need for additional scenarios to assess impact of risk in gap and highlight where accelerators and enablers are needed to ensure WAM achieved
  - Select key assumptions with high ambition assumed in WAM and credible risk to implementation pathway for 2030 target achievement: Biomethane, District Heating, Transport Demand Reduction, Offshore Wind
  - List of individual risks illustrative rather than comprehensive. Other risks evaluated by looking at WEM vs WAM (e.g. heat pumps, retrofits, EVs etc.)
- Risk scenarios were evaluated both individually relative to WAM and combined to show potential trajectory with delays across multiple areas relative to WEM and WAM

NEMP Projections Risk Scenarios

Scenario Name	Scenario Base	Description
Biomethane-DA1	WAM (5.7 TWh)	5.7 TWh delayed (3.2 TWh by 2030)
Biomethane-DA2		5.7 TWh further delayed (1.9 TWh by 2030)
DH-DA1	WAM (2.7 TWh)	2.7 TWh delayed to 2040 (639 GWh by 2030)
DH-DA2		2.7 TWh delayed to 2040 (360 GWh by 2030)
Offshore-DA1	WAM (4 GW)	Offshore wind 1.5GW by 2030
Offshore-DA2		Offshore wind 0 GW by 2030
Onshore-DA1	WAM (7.2 GW Wind; 6.5 GW Solar)	Onshore wind 6.2 GW and Solar PV 5 GW by 2030
Transport-DA1	WAM	Activity reduction as per CAP21 (-10% private car vkm from 2019) Eurocontrol Irish high aviation activity forecast
Transport-DA2	Transport DA1	Transport-DA1, with WEM number of new EVs
Combined Risk High_WAM	WAM	WAM + Biomethane DA2 + DH DA2 + Offshore DA2 + Onshore DA 1 + Transport DA2
Combined Risk High_WAM, WEM supports	Combined Risk High_WAM	Combined Risk High_WAM + grant support for retrofits and heat pumps set at WEM levels (current supports continue)
Combined Risk Low_WAM, WEM supports	Combined Risk High_WAM, WEM supports	Combined Risk High_WAM, WEM supports + macroeconomic activity from low price sensitivity

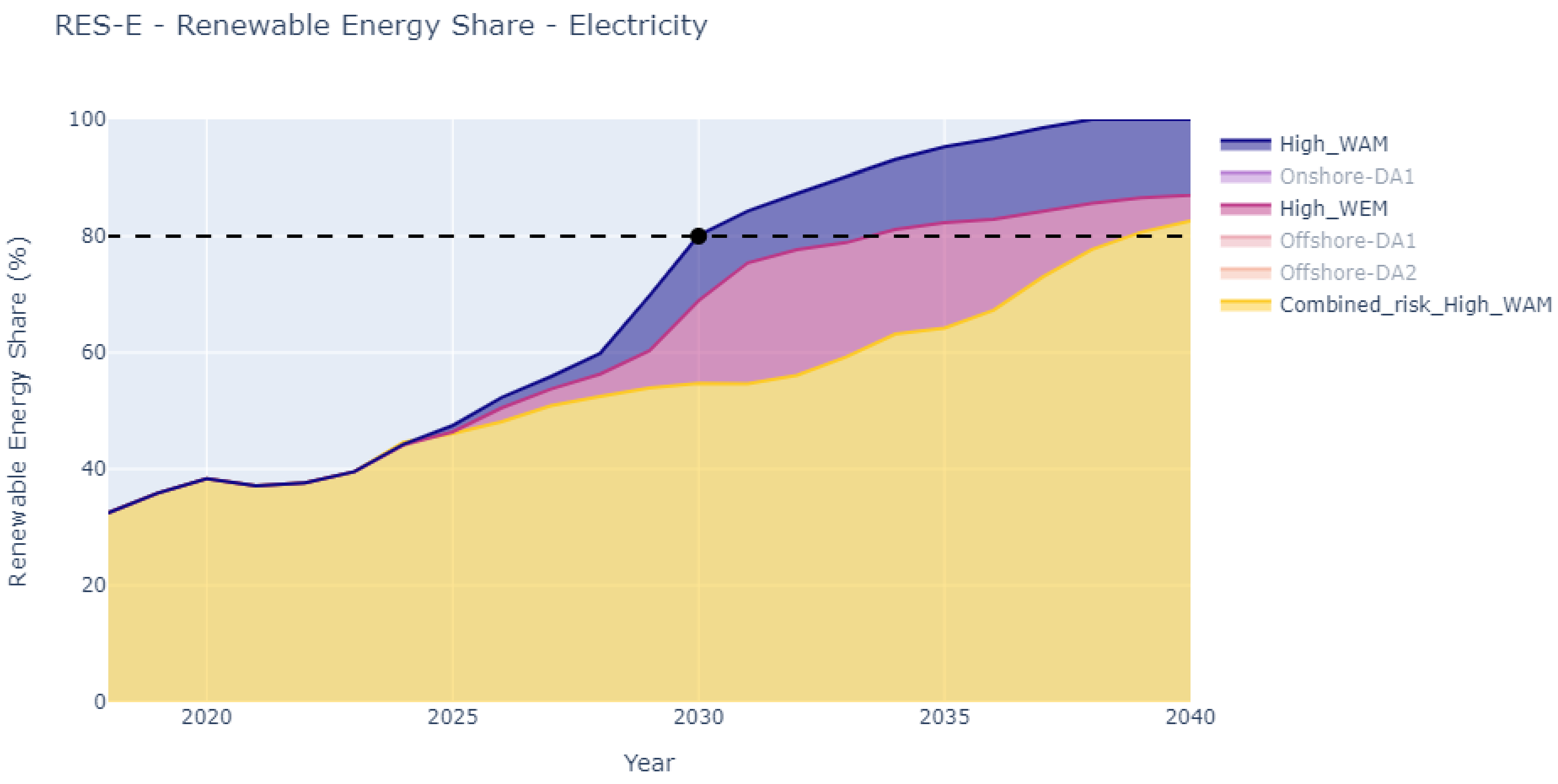
SEAI SUSTAINABLE ENERGY AUTHORITY OF IRELAND

NEMF Additional Testing – Power Generation

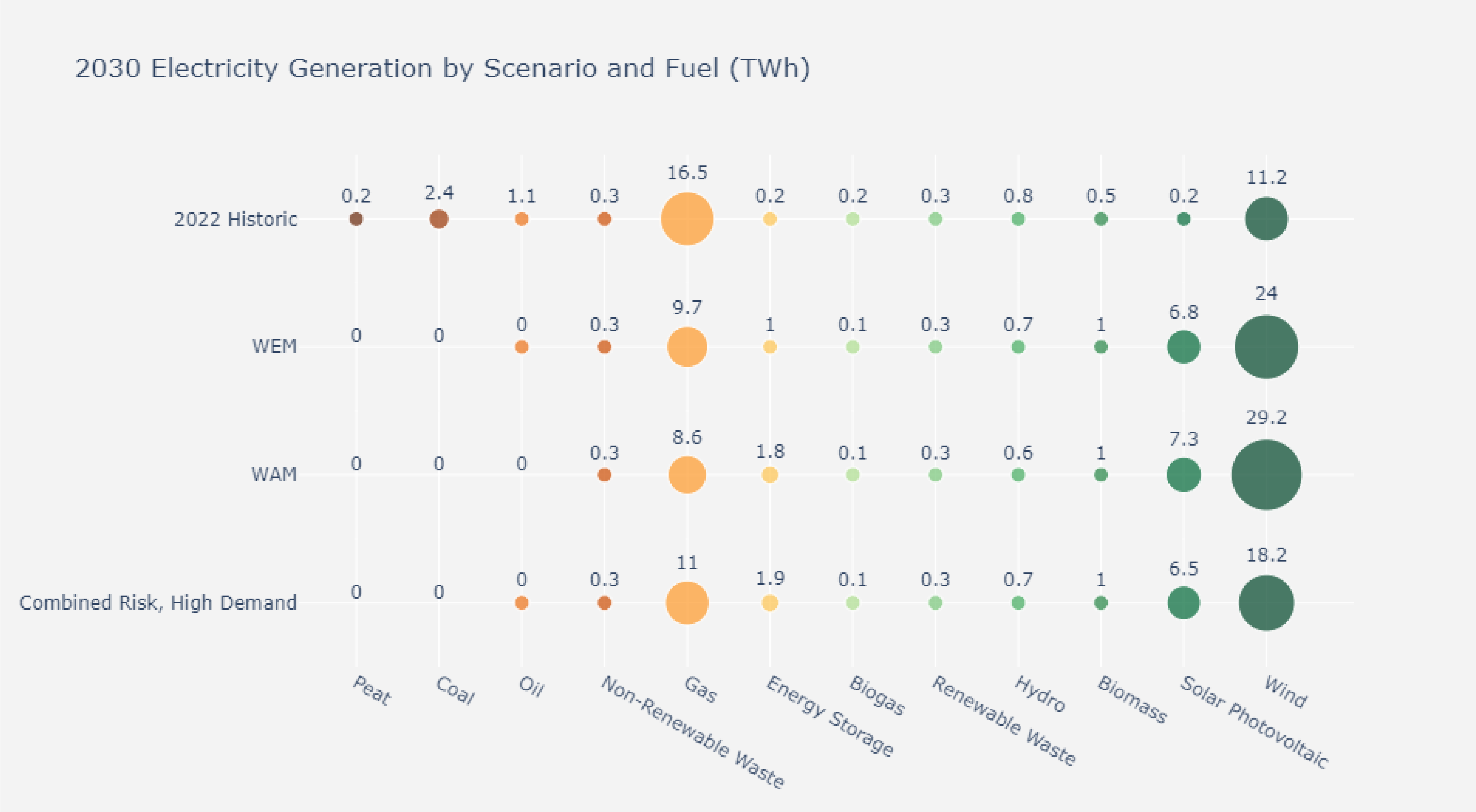


SUSTAINABLE ENERGY AUTHORITY OF IRELAND

NEMF Additional Testing – Power Generation



NEMF Additional Testing – Power Generation



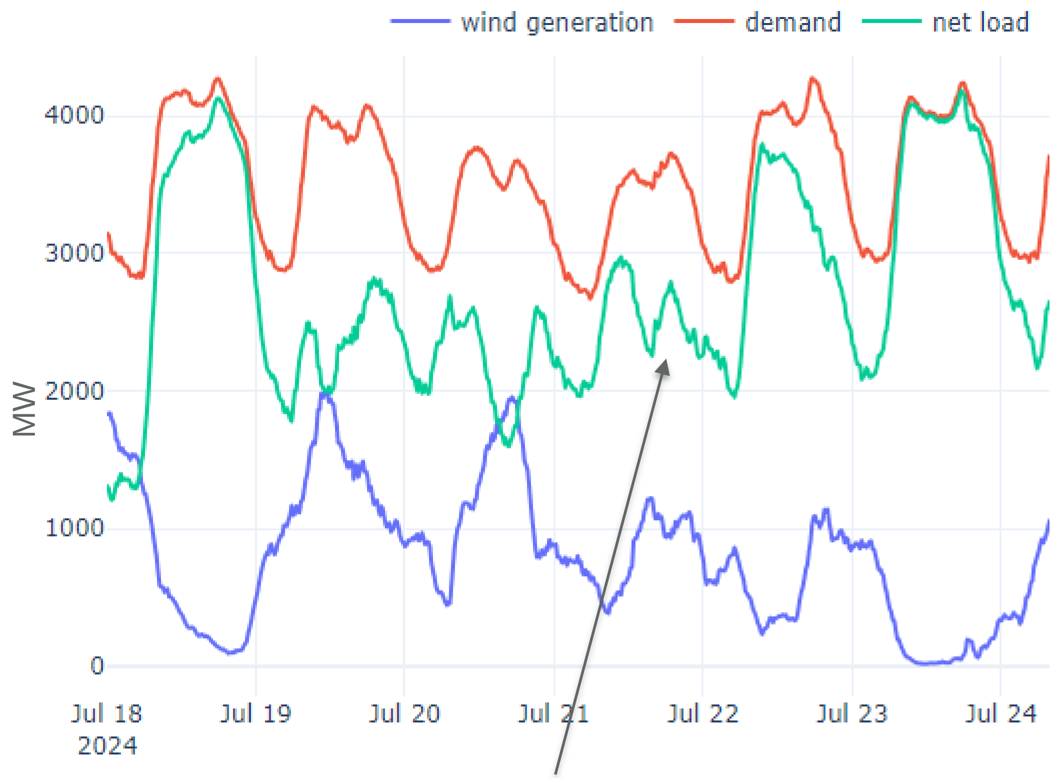
SUSTAINABLE ENERGY AUTHORITY OF IRELAND

NEMF Additional Testing – Power Generation and Net Load

Net Load

- Net load refers to electricity demand minus the output from variable renewable energy (VRE) generators, e.g. wind, wave, solar photovoltaics. It therefore depends on:
  - The methodology used to construct electricity demand (historical electricity demand, electrification of heat and transport, new housing demand, etc.)
  - The methodology used for constructing availability profiles for offshore wind, onshore wind, and solar photovoltaics.
  - The level of dispatch-down exhibited in the modelled scenario, which depends on many other assumptions.

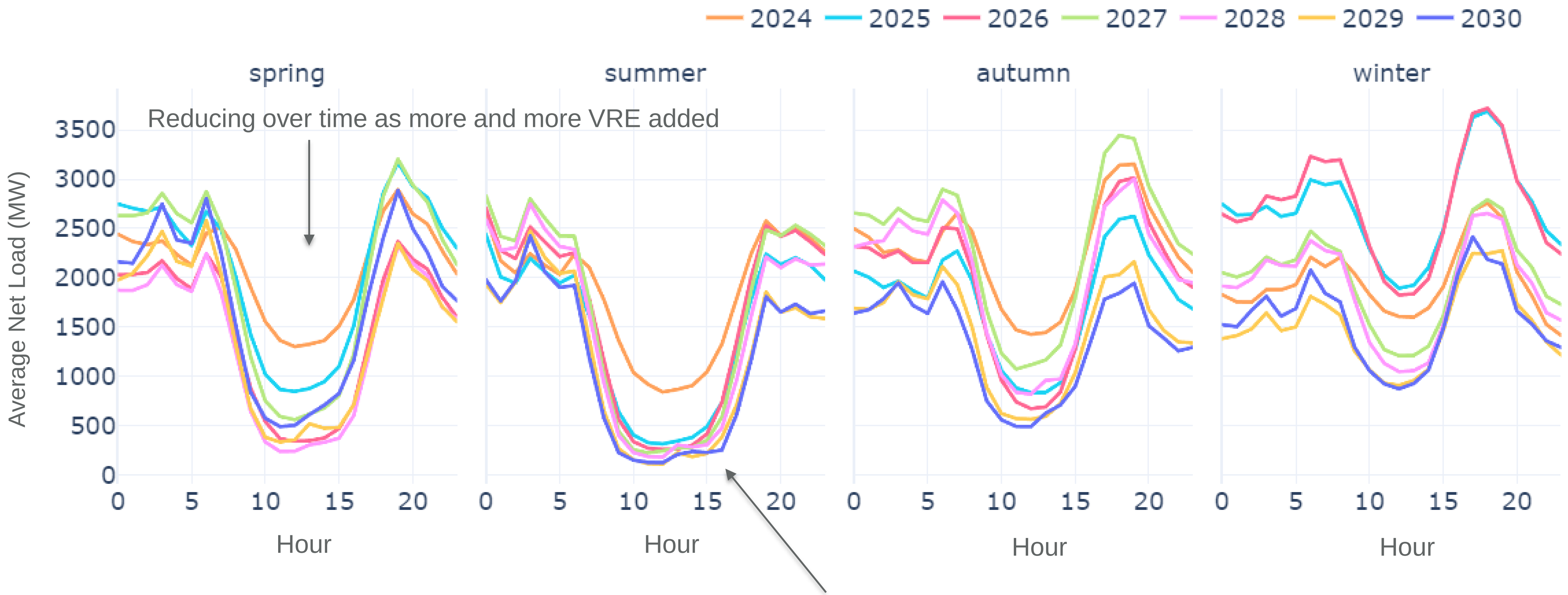
Illustrative example (*no solar PV yet on EirGrid dashboard) [2]



VRE variability propagates into net load variability

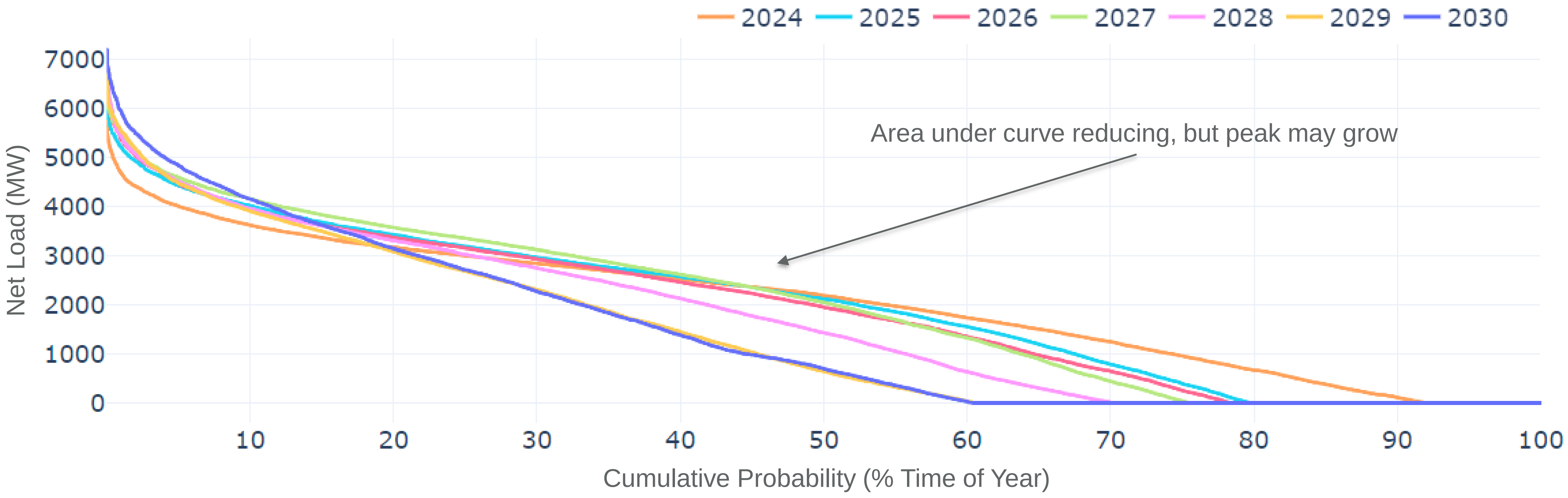
[1] NREL, *Western Wind and Solar Integration Study Phase 1*, URL.
[2] *EirGrid, Smart Grid Dashboard*, URL.

Net Load Change Over Time - 400 Mt BAU Iteration 2 VRE Installed Capacities changed from WAM



Lowest net load arrive when solar output is added to the wind output, and when demand naturally lower in summer (less lighting, heating)

Net Load Change Over Time - 400 Mt BAU Iteration 2 VRE Installed Capacities changed from WAM

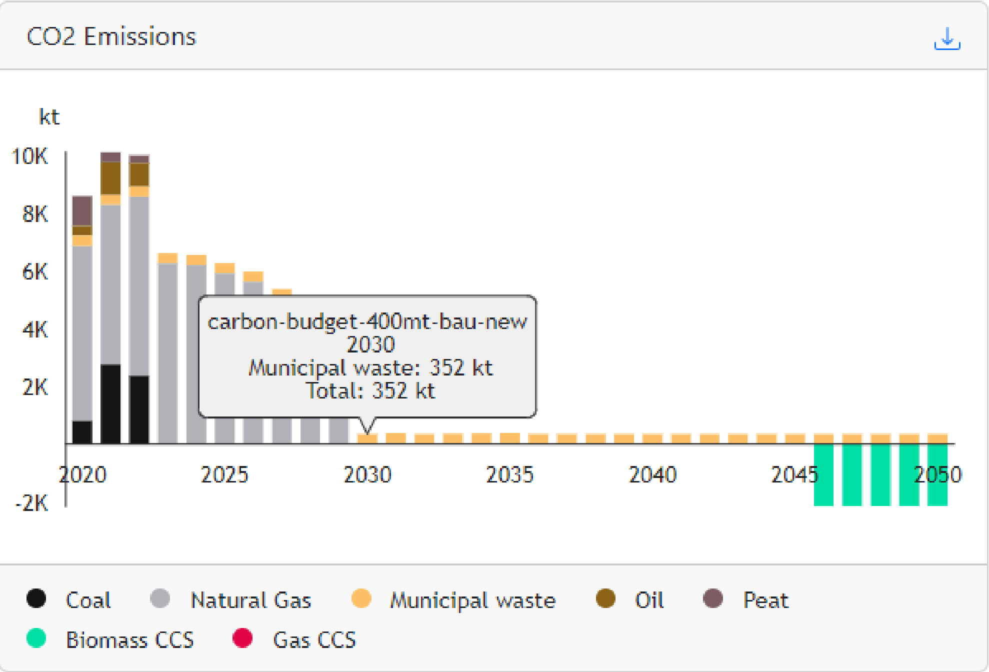


SUSTAINABLE ENERGY AUTHORITY OF IRELAND

What Does it Mean for Emissions?

TIM Iteration 2 Power Sector Emissions

- Scenarios show gas generation dropping out in 2030s

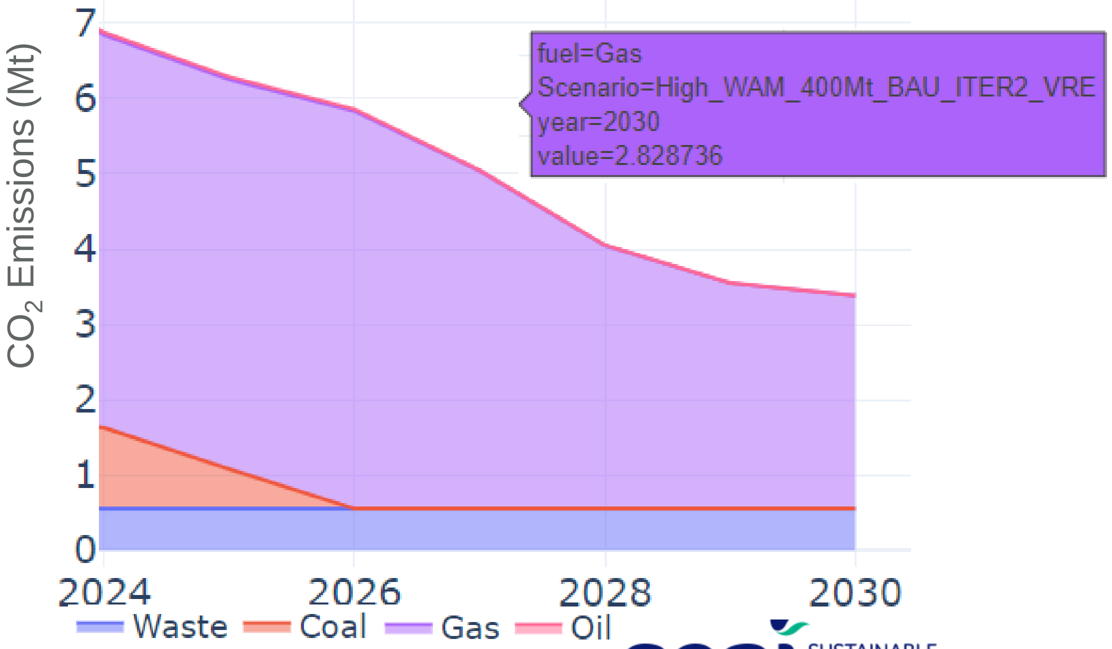


[4] UCC, *TIM Carbon Budget 2024*, URL.

[4]

SEAI Testing

- Even if energy (MWh) could be covered by imports, rating of interconnectors not high enough to meet highest net load periods (MW).
- SEAI modelling shows ~3 Mt of emissions from gas-fired generation in 2030. This would be reduced if outturn net load peaks were lower and/or interconnector imports higher, though unlikely to be zero.



SEAI SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Note: Non-Modelled Sources of Emissions

Other aspects of power system operation that can drive emissions we are not accounting for in our modelling, for example:

- VRE uncertainty: forecast errors on the magnitude and/or timing of a weather front can lead to additional generators being switched on.
- Constraints: when the schedule from the day-ahead market cannot be physically realised due to congestion on transmission lines or the need for other system security reasons, conventional generator or storage need to be dispatched to fill the mismatch left by VRE dispatch-down. It is not economic to invest in enough infrastructure to irradicate all congestion.
- Outages: outages of generators and transmission lines can mean that other generators in the network need to be switched on to maintain system security [5]. These are dynamic and vary week to week during outage season.

- In most cases, interconnectors do not help with these balancing aspects, as they have been set day-ahead (Celtic) and intra-day (EWIC and Greenlink post-Brexit arrangements)

- If TSO does not invest in sufficient volumes of new technologies in the correct location, then these power system operational reliability/security requirements will drive more emissions than that captured in long-term models.

[5] SEMO, *TSO Responsibilities*, URL.

Key Points for Consideration from SEAI Modelling Outputs

- Current policy quite 2030-focused, limiting the potential for additional acceleration post 2030 to be included in projections scenarios
- Demand reduction is a necessary step but policy is limited here at the moment, making the early assumption of immediate lower demand assumed in carbon budgets is challenging
- Credible risk scenarios on projections with CAP24 VRE targets not being reached by 2030
- Other risk scenarios run across all sectors for potential delays
- Bioenergy and BECCs, Hydrogen implementation pathway not yet clear
- Significant growth in electricity demand will likely mean meeting net load with conventional generation at times throughout the year
- Next Steps:
  - Review questions and observations across sectors with UCC team
  - Meet with UCC team on detailed power assumptions to align where appropriate
  - Add key findings from additional testing to scenario dialogue tool