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ECRN Energy & Climate Research Network

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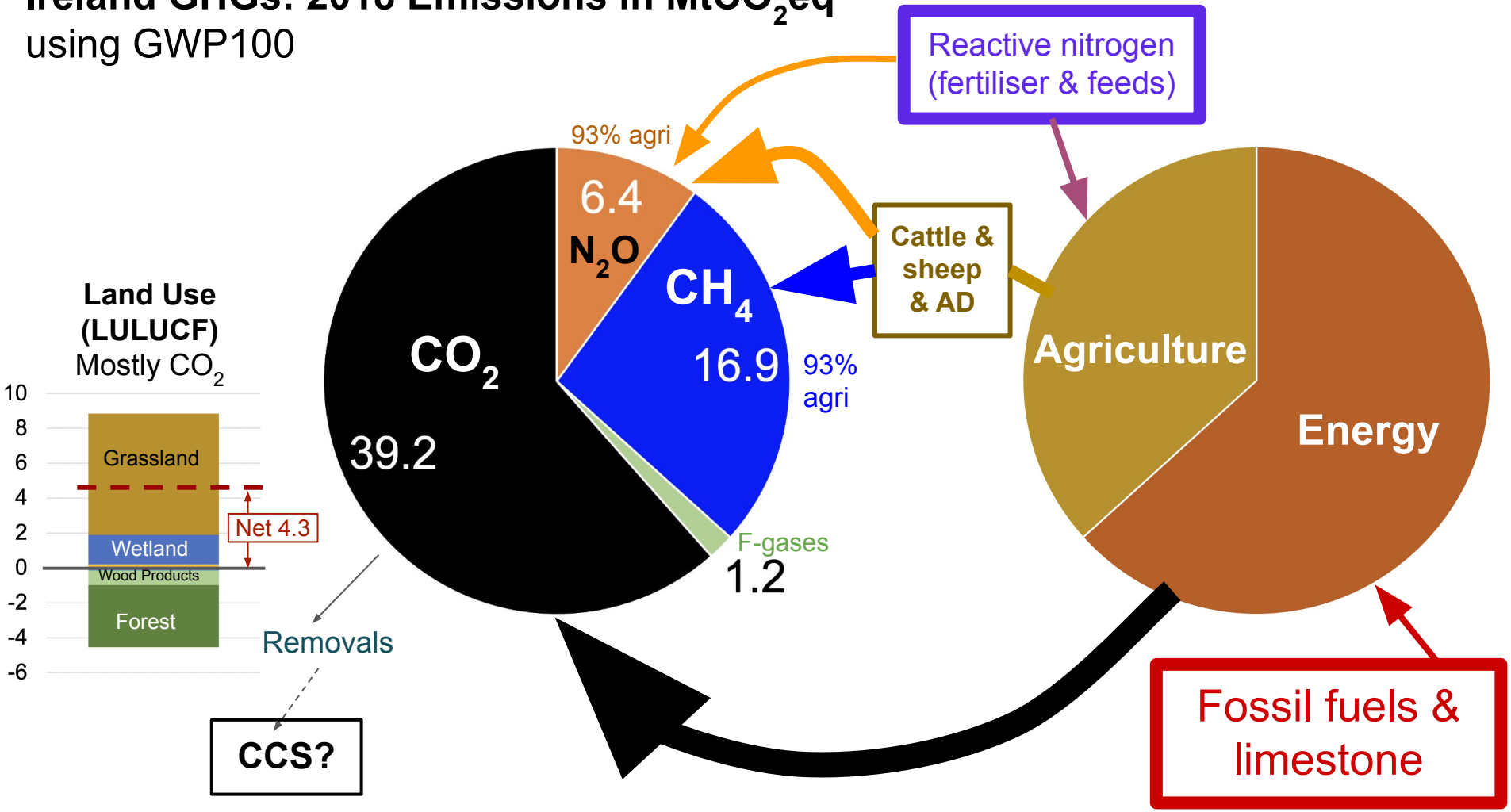
Implications of Agriculture scenarios for post 2030 efforts

Slides presented 30 April 2021

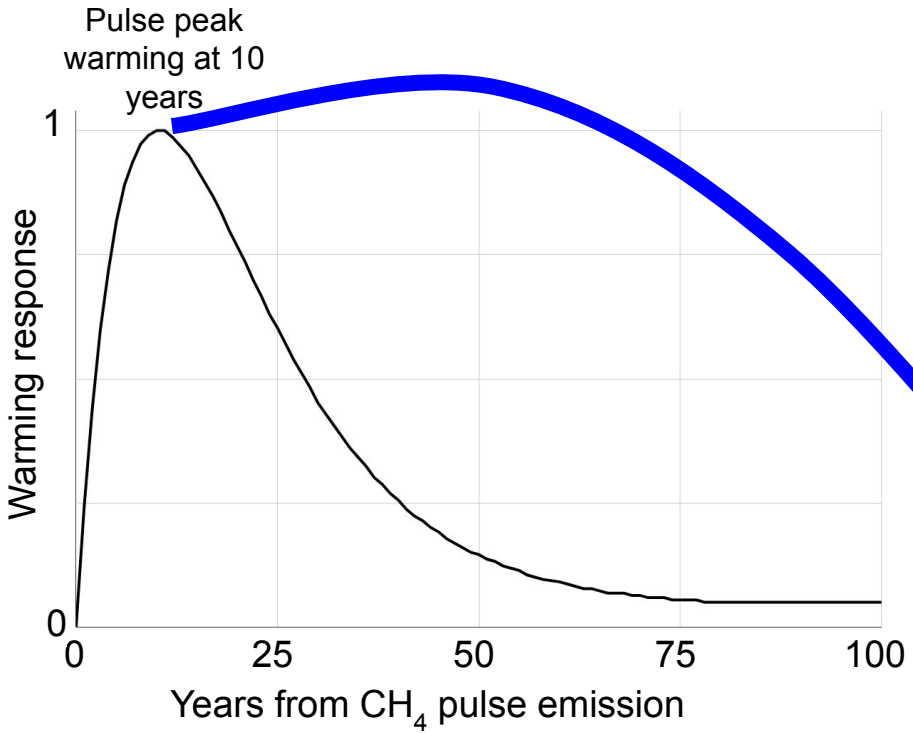
Key points:

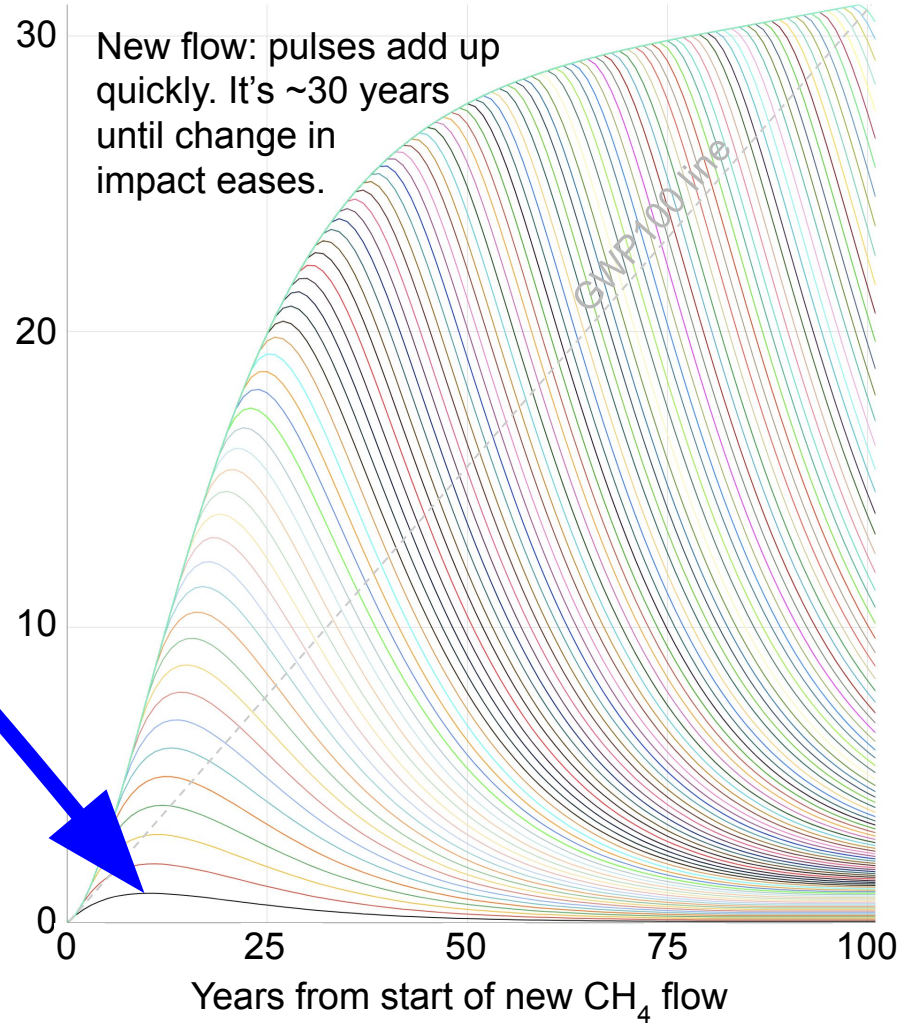
1. **Ongoing, substantial and permanent reduction in methane emissions is important in achieving Paris-aligned climate action for Ireland.**
2. **New GHG equivalence metrics are superior to conventional GWP100 *<u>if</u> used in the context of Paris temperature goals* –** informing any separate methane target.
3. **Limiting nitrous oxide emissions is important** as *<u>additional</u>* CDR is needed to balance N_2O in addition to residual CO2 emissions.
4. **Dependence on land carbon (carbon farming) could undermine climate action** due to large uncertainties and storage unreliability compared to emission reduction.

Ireland GHGs: 2018 Emissions in $MtCO_2eq$
using GWP100



Yes, methane is a “short-lived gas”
BUT a single year pulse **cannot** be used to model a sustained methane flow (=continued pulses) <u>or</u> changes in flow.





New metrics like GWP* are superior to GWP100 in showing carbon budget consistency with the Paris Agreement Art. 2 temperature goals

*"Although there is no perfect, universal way of comparing forcing agents across all variables and time horizons, these papers show that **the conventional use of GWP is clearly not suitable for comparing the contributions of short and long-lived climate agents towards the Paris temperature goals**."*

"[GWP and CGWP] step-pulse metrics are all more appropriate than the conventional GWP for comparing the relative contributions of different species to future temperature targets"* Collins 2020

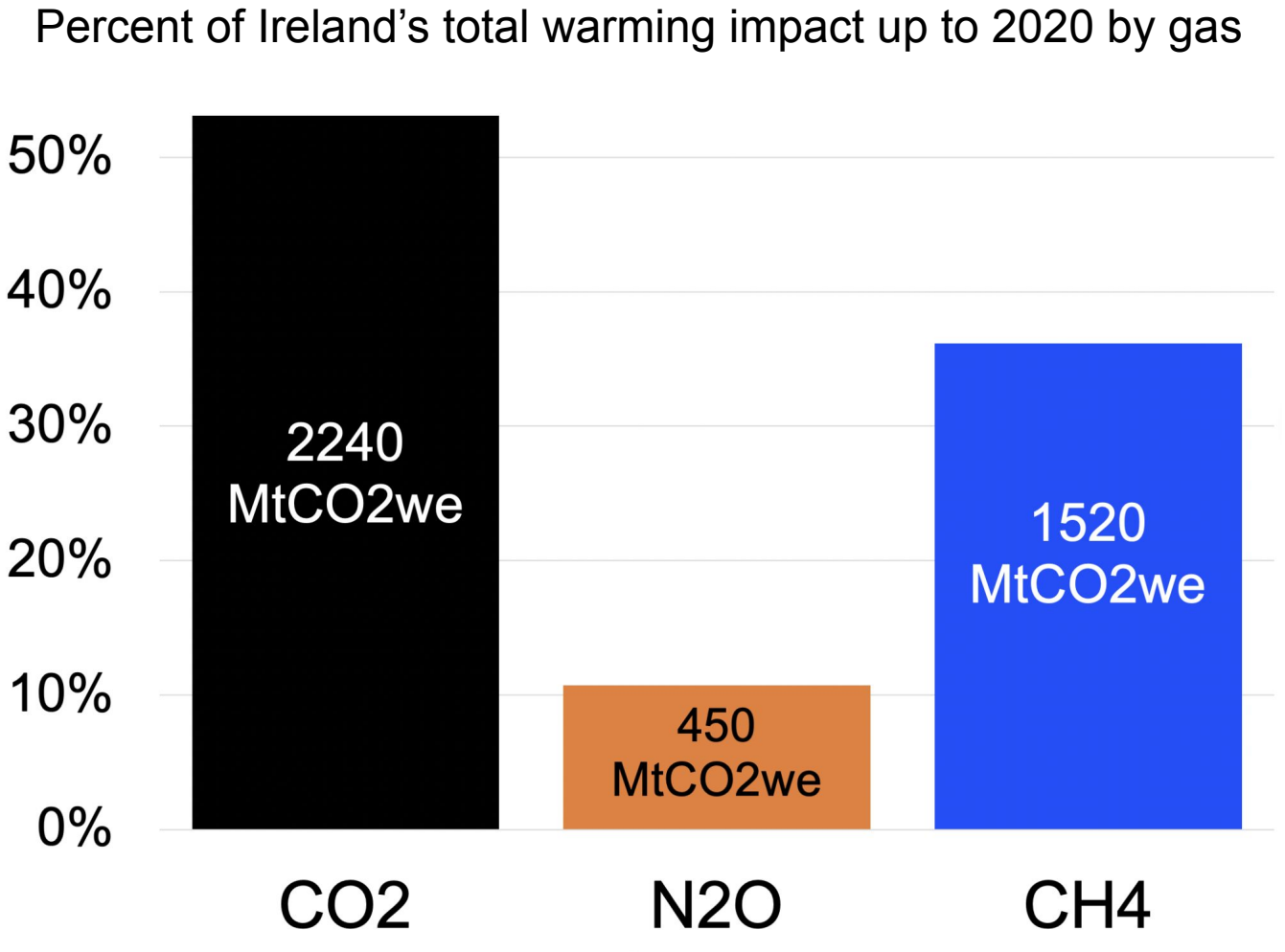
Use of GWP* or similar enables inclusion of **methane** into combined carbon budgets aggregated together with CO_2 and N_2O. This removes the need for separate methane budgets.

Recommendation to Council (and for possible inclusion in Bill):

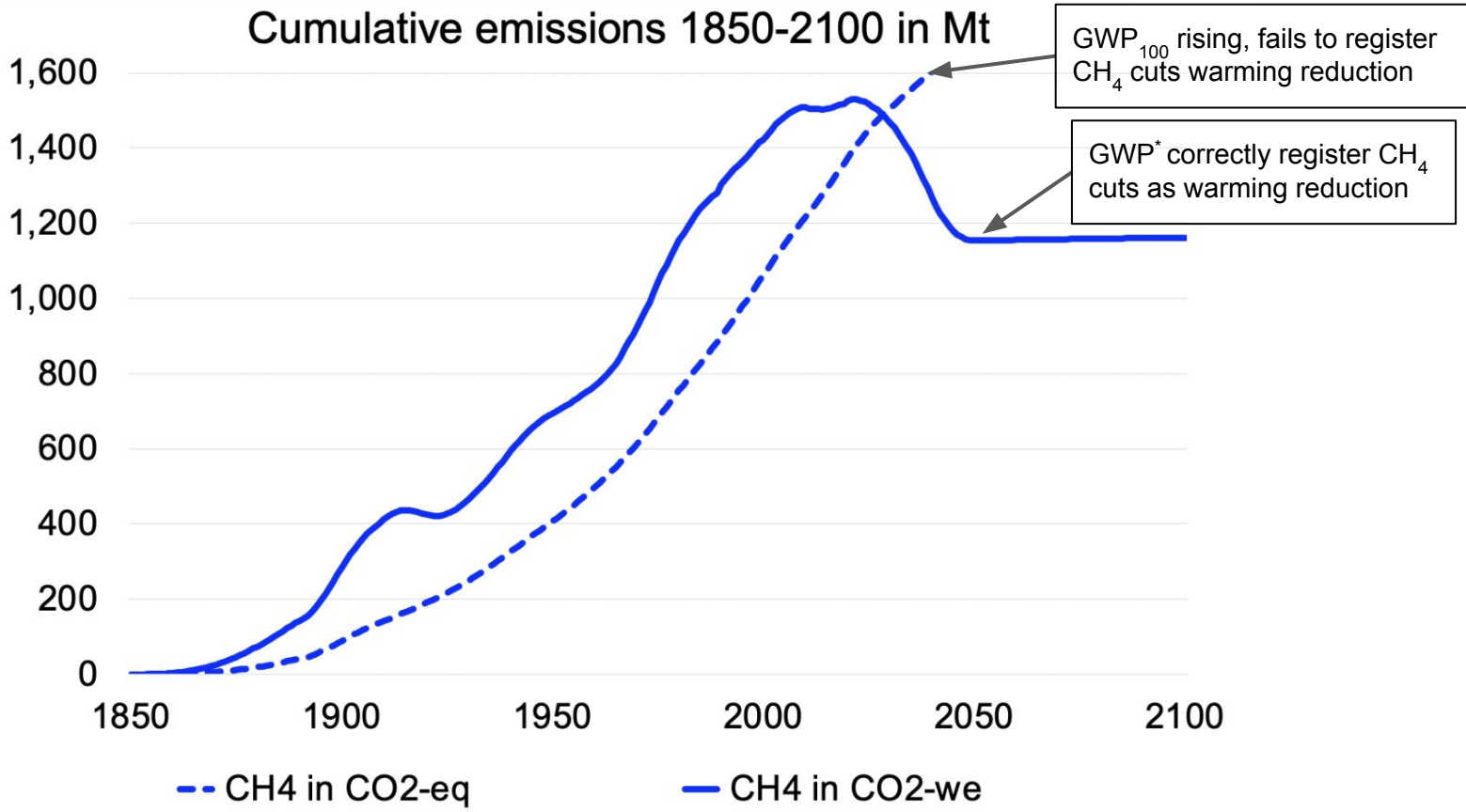
Given the large fraction of methane in Ireland's GHG emissions, analysis of Paris "fair share" and policy assessment use of GWP* or similar is advised.

Ireland's total warming impact to date from 1850

Estimated using GWP* and PRIMAP + EPA data



Ireland **methane** warming impact: historic then **2.A40E57**
historic to 2020, followed by 41% reduction by 2030, then -0.3%/yr to 2100



DCU GHG-WE tool: dashboard view

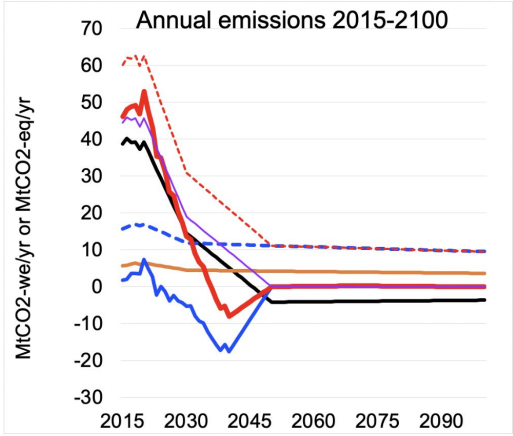
Output shows annual & cumulative emissions in both GWP100 and GWP* **relative to a Paris-aligned national carbon quota** (=”fair share” context)

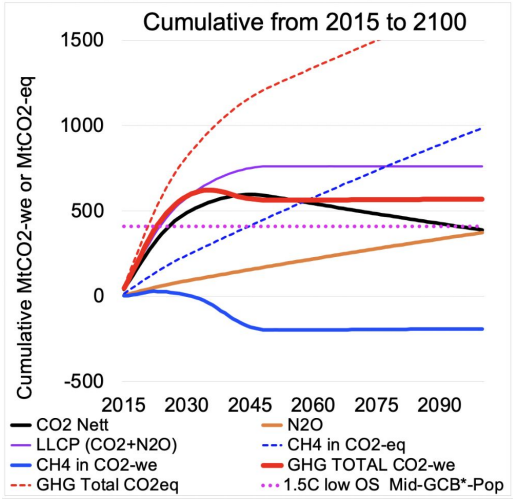
5-year budgets also shown.

Tool can show global or any country, for all or any IPCC sector.

IRL	IPCM0EL	HISTCR	LU not included
NCQ*=	1.5C low OS	Mid-GCB*-Pop	410 MtCO2we from 2015

GHG-WE model: McMullin and Price 2020. http://doi.org/10.5281/zenodo.3974485
Updated by Paul Price 2021 DCU – Funded by CCAC Fellowship and EPA Research.





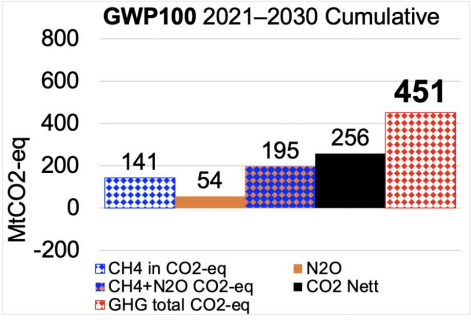
GHG linear from 2020 to:	2030	2050	2100	
CO2 Nett	-63%	-111%	-109%	N2O CDR 207
CH4 & N2O	-30%	-34%	-44%	Overshoot CDR 157
				NCQ* Total CDR 364

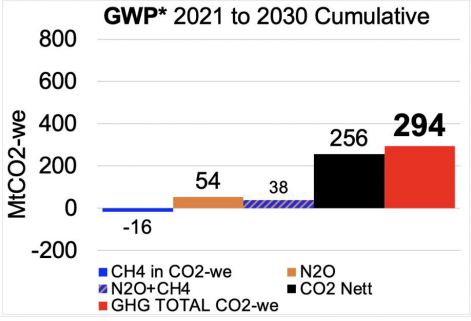
GWP100 assessment error?	*GWP100*	GWP*
Constant annual mass emissions at baseline (2018) level for 2021–2030 in Mt	*626*	552
2021–2030 emissions in this scenario	*451*	294
Relative (%) reduction in cumulative emissions	*28%*	47%

Difference in GWP100 vs. GWP* % values indicates "error" in GWP-100 warming assessment of scenario

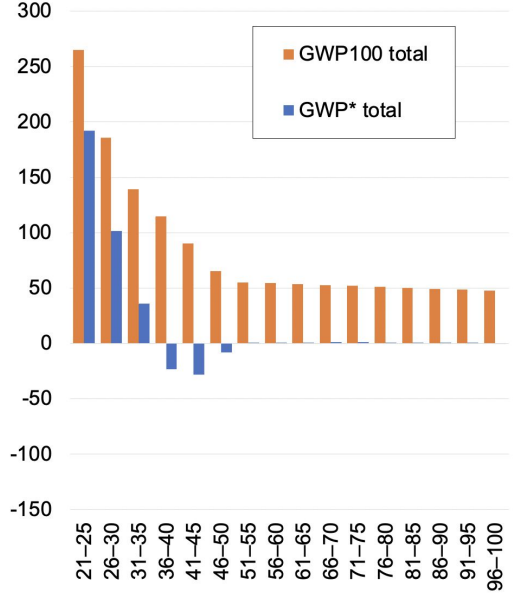
Ireland

Difference indicates “error” in GWP_{100} assessment

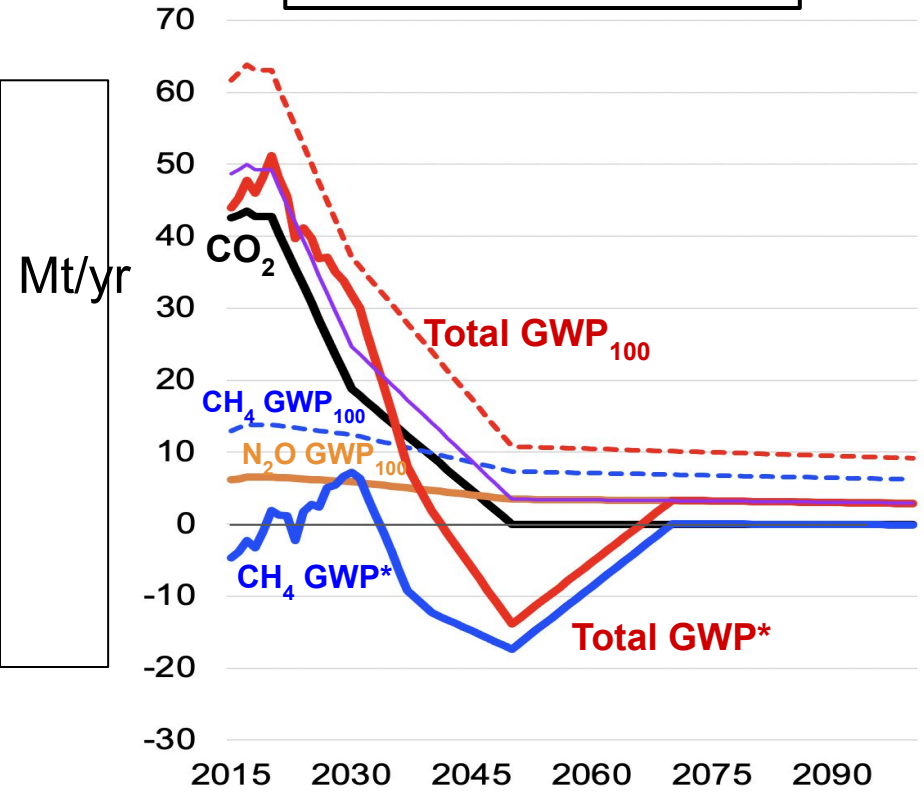




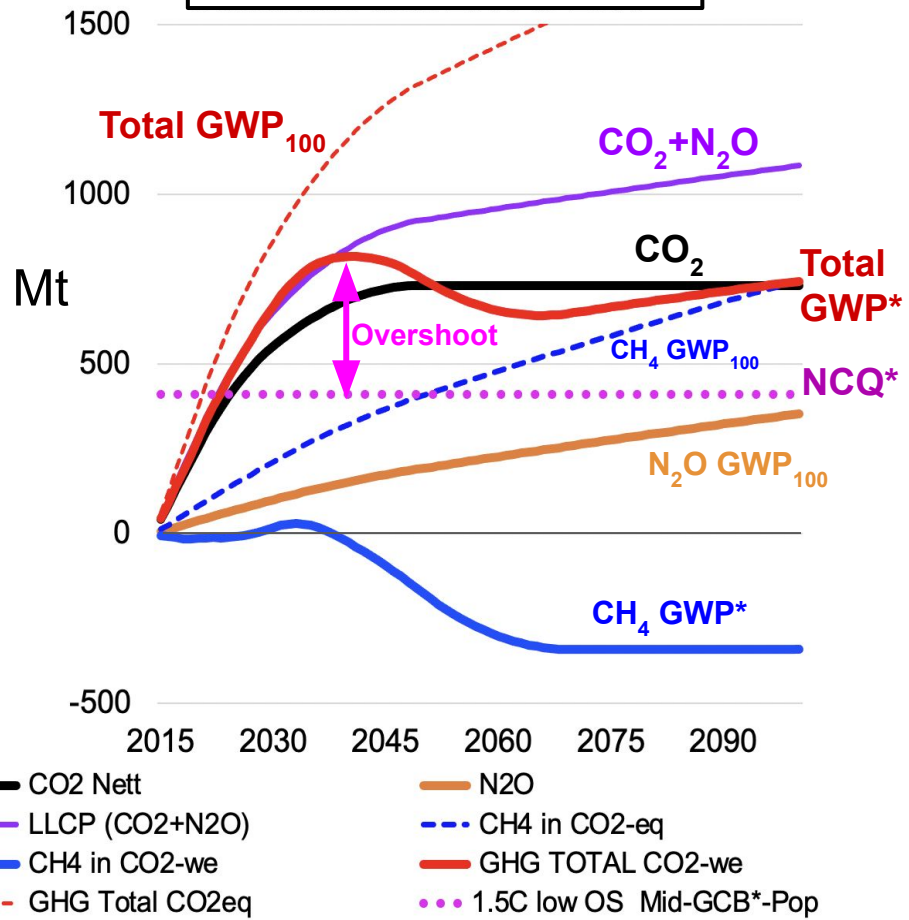
Scenario 5-year budgets in Mt 2021–2100



Annual emissions
2015–2100



Cumulative emissions
2015–2100



1.A33E61

IRL	IPCM0EL	HISTCR	LU not included
NCQ*=	1.5C low OS	Mid-GCB*-Pop	410 MtCO2we from 2015

GHG-WE model: McMullin and Price 2020. http://doi.org/10.5281/zenodo.3974485
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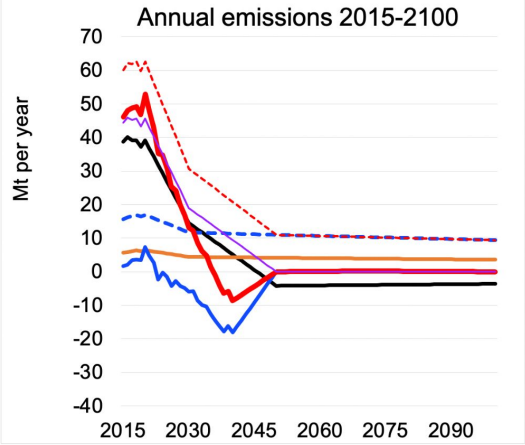
By 2030:

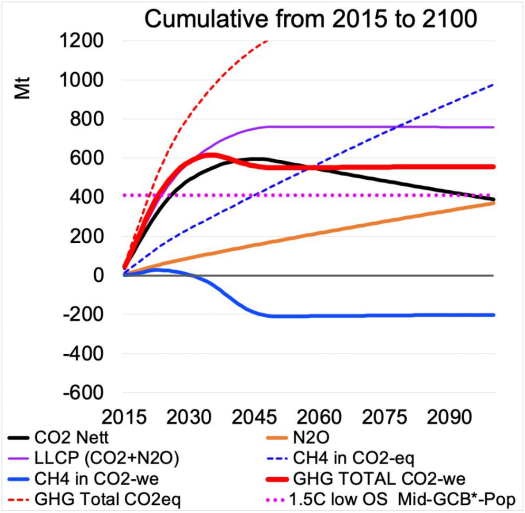
-33% cut in agriculture

-61% cut in "energy"

⇒ -31% cut in national CH_4 & N_2O

10-year cumulative 450 $MtCO_2eq$





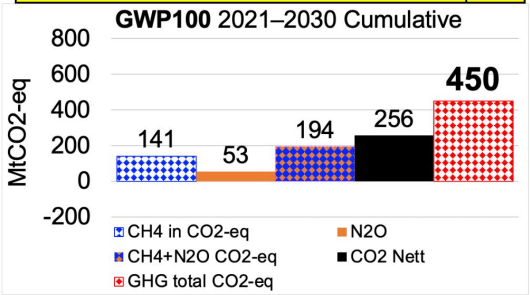
GHG linear from 2020 to:	2030	2050	2100		
CO2 Nett	-63%	-111%	-109%	N2O CDR	206
				Overshoot CDR	146
CH4 & N2O	-31%	-35%	-44%	NCQ* Total CDR	353

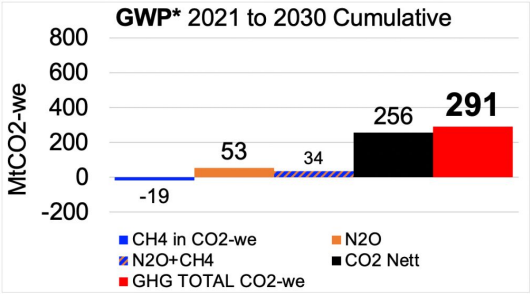
MtCO2we | Max CDR? 200

GWP100 assessment error?	*GWP100*	GWP*	
Constant annual mass emissions at baseline (2018) level for 2021–2030 in Mt	*626*	552	
2021–2030 emissions in this scenario	*450*	291	
Relative (%) reduction in cumulative emissions	*28%*	47%	0.41
Difference in GWP100 vs. GWP* % values indicates "error" in GWP-100 warming assessment of scenario			GWP100 % / GWP* %

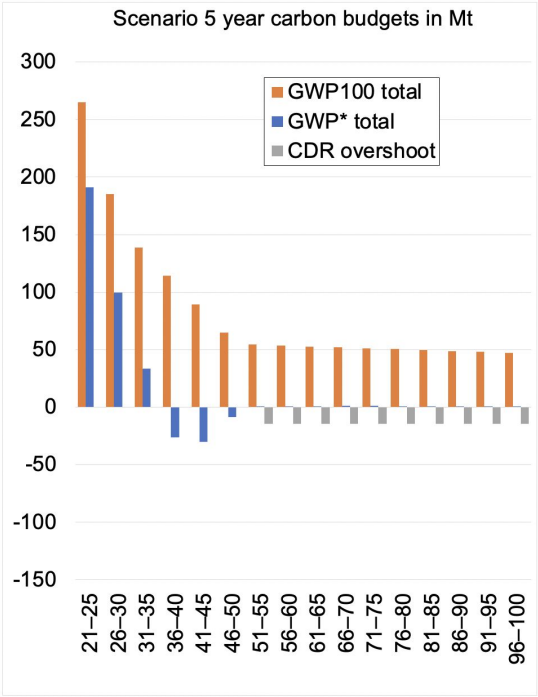
Peak NCQ* overshoot 206 MtCO2we in 2036
Annual net zero CO2we in 2046

[Non-agri CH4+N2O] Remaining budget to TIM = -63%





Ireland



CH_4 = -200 $MtCO_2we$

Total CDR = -350 $MtCO_2$

CH_4+CDR = -550 $MtCO_2$

2.A40E57

IRL	IPCM0EL	HISTCR	LU not included
NCQ*=	1.5C low OS	Mid-GCB*-Pop	410 MtCO2we from 2015

GHG-WE model: McMullin and Price 2020. http://doi.org/10.5281/zenodo.3974485
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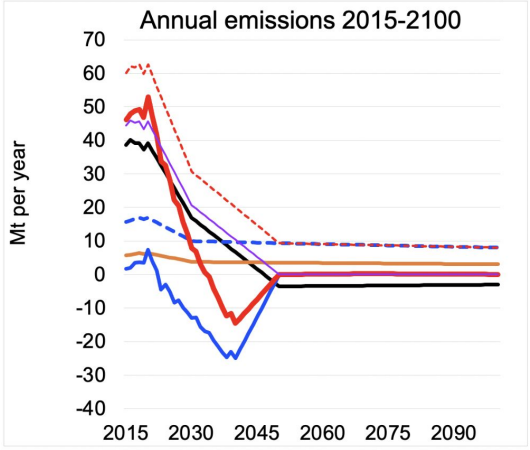
By 2030:

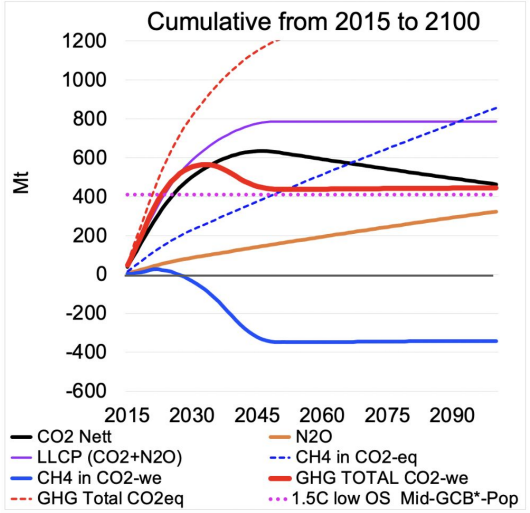
40% cut in agriculture

57% cut in "energy"

⇒ -41% cut in national CH_4 & N_2O

10-year cumulative 450 $MtCO_2eq$





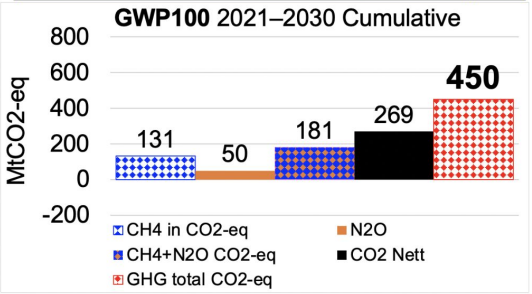
GHG linear from 2020 to:	2030	2050	2100
CO2 Nett	-57%	-109%	-108%
CH4 & N2O	-41%	-45%	-53%

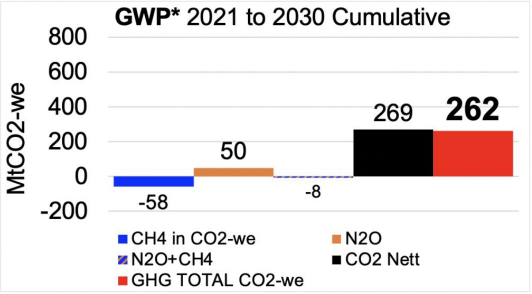
N2O CDR 171
Overshoot CDR 34
NCQ* Total CDR 206
200 MtCO2we Max CDR?

GWP100 assessment error?	*GWP100*	GWP*	
Constant annual mass emissions at baseline (2018) level for 2021–2030 in Mt	*626*	552	
2021–2030 emissions in this scenario	*450*	262	
Relative (%) reduction in cumulative emissions	*28%*	53%	0.47
Difference in GWP100 vs. GWP* % values indicates "error" in GWP-100 warming assessment of scenario			GWP100 % / GWP* %

Peak NCQ* overshoot 154 MtCO2we in 2034
Annual net zero CO2we in 2047

[Non-agri CH4+N2O] Remaining budget to TIM = -57%





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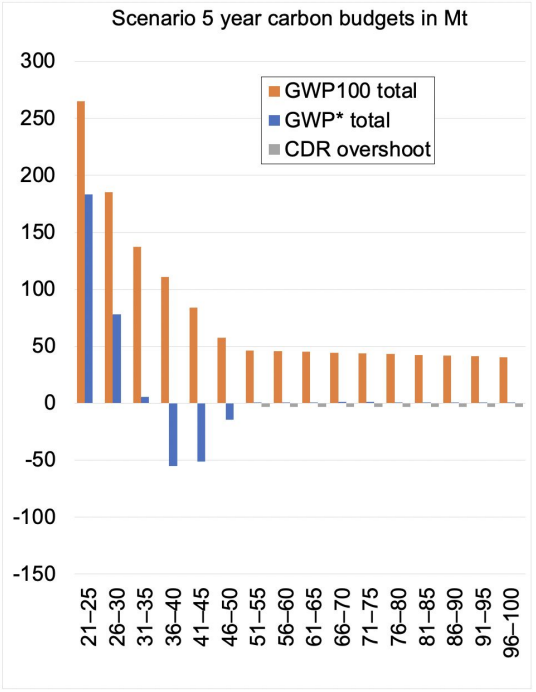

CH_4 = -350 $MtCO_2we$

Total CDR = -200 $MtCO_2$

CH_4+CDR = -550 $MtCO_2$

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IRL	IPCM0EL	HISTCR	LU not included
NCQ*= 1.5C low OS Mid-GCB*-Pop 410 MtCO2we			from 2015

GHG-WE model: McMullin and Price 2020. http://doi.org/10.5281/zenodo.3974485
Updated by Paul Price 2021 DCU – Funded by CCAC Fellowship and EPA Research.

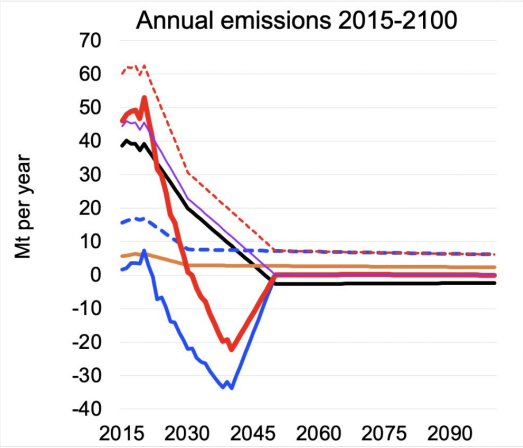
By 2030:

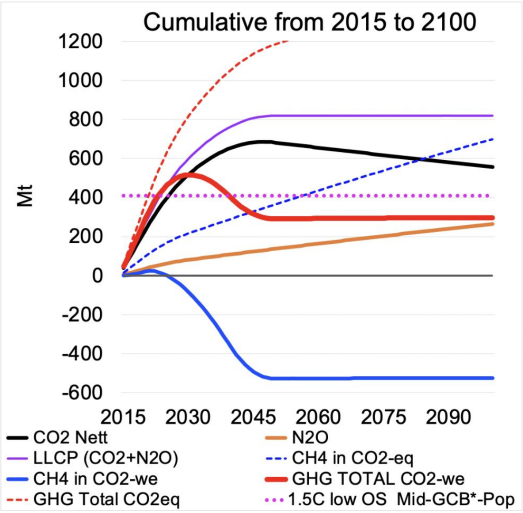
-55% cut in agriculture

-49% cut in "energy"

⇒ -55% cut in national CH_4 & N_2O

10-year cumulative 450 $MtCO_2eq$





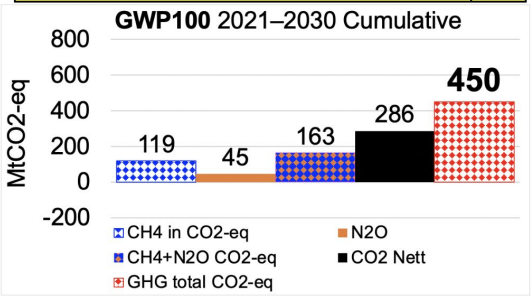
GHG linear from 2020 to:	2030	2050	2100
CO2 Nett	-49%	-107%	-106%
CH4 & N2O	-55%	-58%	-64%

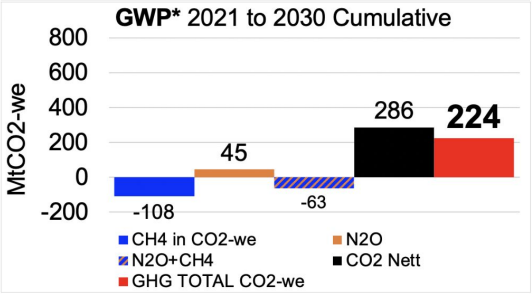
N2O CDR 130
Overshoot CDR -113
NCQ* Total CDR 17
200 MtCO2we Max CDR?

GWP100 assessment error?	*GWP100*	GWP*	
Constant annual mass emissions at baseline (2018) level for 2021–2030 in Mt	*626*	552	
2021–2030 emissions in this scenario	*450*	224	
Relative (%) reduction in cumulative emissions	*28%*	59%	0.53
Difference in GWP100 vs. GWP* % values indicates "error" in GWP-100 warming assessment of scenario			GWP100 % / GWP* %

Peak NCQ* overshoot 106 MtCO2we in 2031
Annual net zero CO2we in 2048

[Non-agri CH4+N2O] Remaining budget to TIM = -49%





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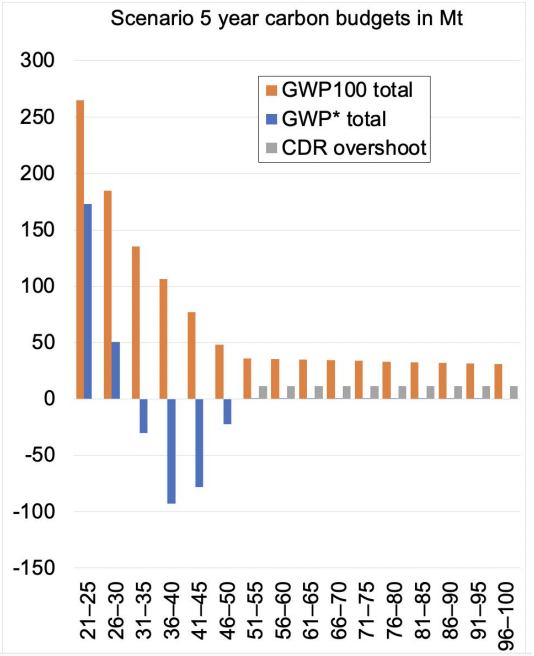


CH_4 = -530 $MtCO_2we$

TOTAL CDR excl CO2 = -20 $MtCO_2$

CH_4+CDR = -550 $MtCO_2$

Ireland's land use is losing carbon:

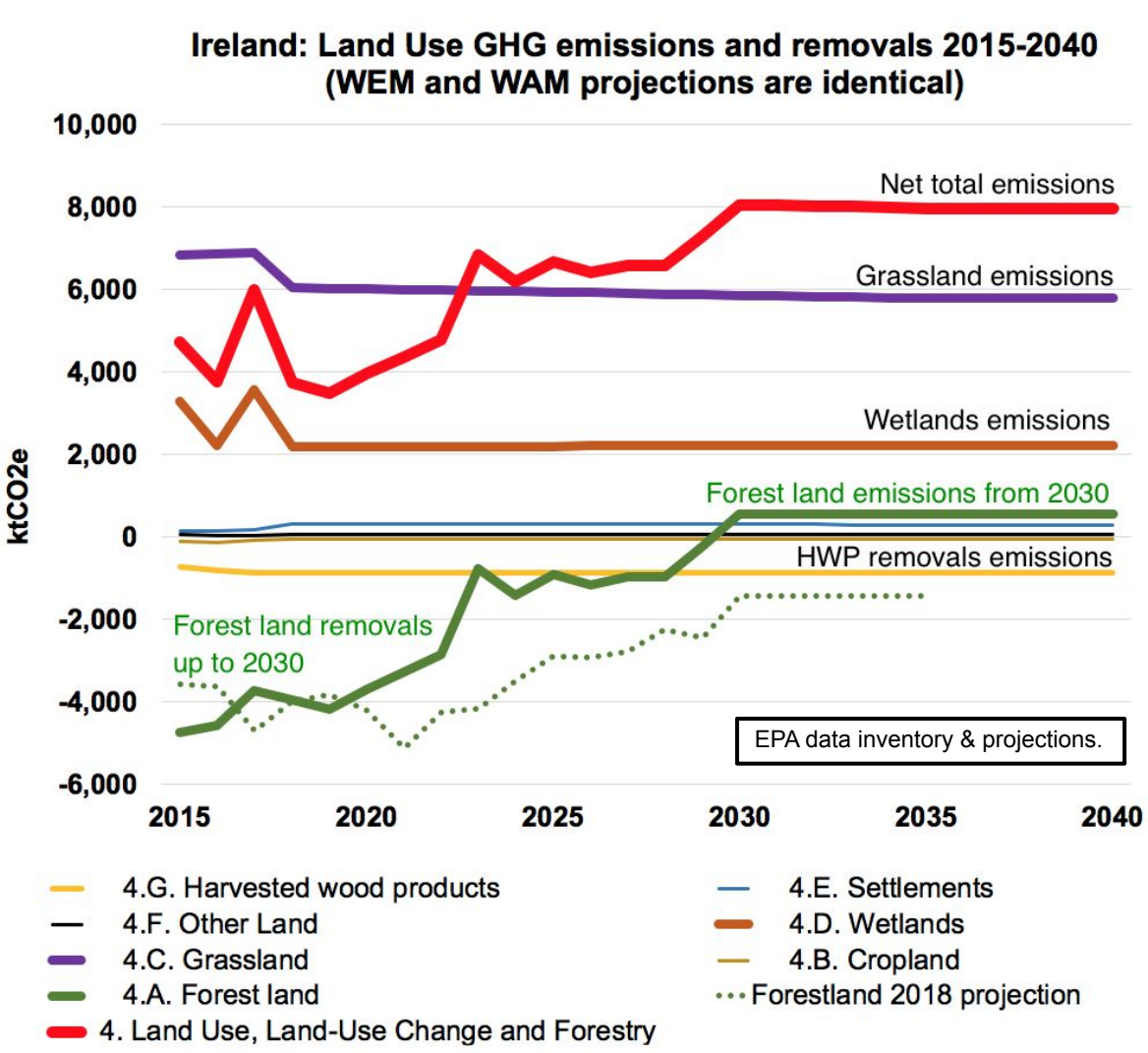
- Increasing net emissions.

Climate mitigation =

Protect land carbon stocks

- Block grassland soil drainage.
- Limit/stop peat extraction
- Limit near-term forest harvest

Slower: afforestation, rewetting etc. are slower mitigation actions than protecting existing stocks.



Implications of Agriculture scenarios for post 2030 efforts

1. **Ongoing, substantial and permanent reduction in methane emissions is important in achieving Paris-aligned climate action for Ireland.**
2. **New GHG equivalence metrics are superior to conventional GWP100** ***if used in the context of Bill's consistency Paris temperature goals*** **–** removing need for a separate methane target.
3. **Limiting nitrous oxide emissions is important** as *additional* CDR is needed to balance N_2O in addition to residual CO2 emissions.
4. **Dependence on land carbon (carbon farming) could undermine climate action** due to large uncertainties and storage unreliability compared to emission reduction.

The following two slides (not shown) give parameters for the scenarios 1, 2 & 3.

Basis for preliminary AFOLU scenario comparison

- Mitigation action assumed to begin from start 2021. Assuming 2020 = 2018 inventory, 2020 total annual = **62.6 MtCO2eq – excluding F-gases and land use emissions** (though these must be considered).
- Based on 62.6 $MtCO_2eq$ excl. F-gases & LULUCF: Target 10-yr carbon budget (GWP100) for 2021–2030 = **429 MtCO2eq** (based on 7%/year) or **451 MtCO2eq** (based on linear 2020–2030).
- Illustrative long term national carbon quota (NCQ*) shown is from 2015 – depleting from that date.
    - NCQ* derived from 2015 remaining global carbon budget for CO2+N2O+CH4 assessed using our GWP* analysis of the IPCC SR15 database: 1.5º low OverShoot and Lower 2C scenarios

Parameters for illustrative scenarios shown

- Assume CH_4 and N_2O have same % reduction by 2030 (linear pathway):
  For Agri -16%, -33%, -51% (by 2030) = Total CH_4 & N_2O -15%,-31%,-48%.
  After 2030, CH_4 0.3%/yr = no additional warming and N_2O cut at same slow rate.
- Net CO_2 is adjusted to meet 10-year CO_2eq budget total by 2030 and to balance N_2O over long-term.
  - Note: Within net CO_2 residual gross CO_2 emissions are assumed to be balanced by removals.
- Scenario **Total CDR** = [CDR to balance N_2O] + [CDR to return to Paris-aligned NCQ*]
  - Suggested max. practical IE CDR = 200 $MtCO_2$