INFO

Technical brief of Klimrek dairy climate scan

Version	Datum	Beschrijving
Version 1.0	April 2024	Technical brief of Klimrek dairy climate scan

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Klimrek dairy methodology (version april 2024)

General aspects

Application	Dairy production system
Use	Web-based tool. Data can be pre-filled by the farmer, but validation by the consultant is required before the result can be calculated. The full scan aims to provide detailed insight into the farm's climate and environmental impact with the aim to provide advice and set up an improvement pathway tailored to the farm.
Functional unit	1 kg fat-protein corrected milk
System boundaries	Cradle to farm gate
Capital goods	Infrastructure (machinery, materials, infrastructure) are not included in the foreground system. Tractors with their age and working hours are, however, requested to calculate particulate matter and NOX emissions from diesel combustion (via EMEP 2019).
Impact categories	IPCC 2021 (100a)(update from AR6) included in EF 3.1 method + all other impact categories are calculated. Currently, only acidification, eutrophication fresh and salt water, fossil resource depletion, land use and water depletion are shown on the dashboard.
Allocation	Biophysical allocation for output (farm-specific calculated). Economic allocation for input streams. Mass allocation for (parts of) crops sold or not fed to dairy cattle; in most cases estimated from standard yields.
Feed requirement	All harvest minus what is sold or not fed to dairy cattle is allocated to the farm. Additional input of purchased feed (corrected by starting and ending stocks).Feed ration (entering several periods per year is possible), as an estimate for dry matter intake, but mainly used to assess the digestibility of the annual average ration per animal category.Digestibility is calculated based on standard digestibilities (mostly from CVB feed table), unless the farmer provided own silage analyses. Enteric emissions are calculated from these (level 2 IPCC2019).
GWP factors	IPCC 2021 (100a)(update from AR6) included in the EF 3.1 method.
Soil carbon sequestration	Not yet calculated
Use of primary data	Primary data for feed production, feed stocks, feed rations, livestock management, milk production, manure management, infrastructure, energy, water.
Use of secondary data	- Feed: mainly agrifootprint v6, supplemented by agribalysis and GFLI (economic allocation). Grass silage 0.52 kg CO2eq./kg DS (agrifootprint), organic grass silage: 0.32 kg CO2eq./kg DS(agribalysis). - Fertiliser: mainly WFLDB - Energy: electricity (BE mix; ecoinvent), diesel combustion from EMEP/EEA.
Review and validation	Tool includes internal validations (all fields completed, are values within acceptable limits etc.). Data is completed or at least checked by a trained and accredited climate consultant and is validated in that sense. Farmers and consultants are asked to attach the data sources used to the consultation so that they could be verified (does not happen at present). However, linking to authentic data sources via DjustConnect ensures validation. Indicators ('key figures') are calculated and displayed along with the results for interpretation. Benchmark values also available for partial carbon footprints (per subsystem) for interpretation and verification.

Impact category Climate change

Direct N_2O emissions fert.	IPCC 2019 tier 1/2(Flanders=wet climate): 1,6% for all N applied by synthetic fertilisers (choice of fertilizers from EMEP category list)
indirect N_2O emissions fert.	IPCC 2019 tier 1/2(Flanders=wet climate): 1,4% of (NH3+NOx)-N and 1,1% of NO3-N (both independent of synth./org source)
NH_3 Volatilization (PPS - indirect N_2O emissions fert.)	EMEP tier2 (Flanders=temperate + pH normal): EF i.f.o. type of synthetic fertiliser
NO_x Leaching (PPS - indirect N_2O emissions fert.)	- NOx: EMEP (1.2% or 0.04 kgNO2/kgN (synth./org) - NO3 (aggregated over all inputs): N balance: N input (synth./org. fertilisers + crop residues) -N output (Ngas emissions & N uptake)= potential NO3-N
Direct N_2O emissions manure	IPCC 2019 tier 1/2(Flanders=wet climate): 0.6% for all N from org. inputs
Indirect N_2O emissions manure	IPCC 2019 tier 1/2 (Flanders=wet climate): 1.4% of (NH3+NOx)-N and 1.1% of NO3-N (independ. of synth./org source)
NH_3 Volatilization (PPS - indirect N_2O emissions manure)	Ammonia Emission Model Flanders (EMAV) developed by VMM; in terms of fertiliser type, application method, application or cropland or grassland
NO_x Leaching (PPS - indirect N_2O emissions manure)	- NOx: EMEP (1.2% or 0.04 kgNO2/kgN (synth./org) - NO3 (aggregated over all inputs): N balance: N input (synth/org fertilisers + crop residues) -N output (Ngas emissions & N uptake)= potential NO3-N
CH4 emissions crop residues	not considered
Direct N_2O emissions crop residues	IPCC 2019 tier 1/2(Flanders=wet climate): 0.6% for all N of organic inputs
indirect N_2O emissions crop residues	IPCC 2019 tier 1/2(Flanders=wet climate): 1.4% of (NH3+NOx)-N and 1.1% of NO3-N (un. From org/anorg. Source)
NH_3 Volatilization (PPS - indirect N_2O emissions crop residues)	excluded
NO_x Leaching (PPS - indirect N_2O emissions crop residues)	crop residues are included in the total N balance for NO3 leaching
CO_2 emissions from land use (e.g. peat oxidation)	not considered
N_2O emissions from land use (e.g. peat oxidation, tearing of grassland)	not considered
Crop protection	Production of plant protection products is not included due to the small contribution to climate impact.
(local) Land Use Change (LUC) emissions	not considered
Liming	75% limestone - 25% dolomite resp. 0.44 & 0.48kgCO2/kg lime
CO_2 emissions from carbon containing fertilizers (e.g. urea)	1.57 kgCO2/kgUrea-N
N excretion	Excretion numbers dependant on milk production per animal per year (VLM)
CH_4 enteric – mature cattle	IPCC 2019 Tier 2 Energy based. Key parameters: - % digestible energy - weight gain (set to 0 in IPCC, but corrected in Klimrek by ILVO estimations as a function of parity classes: 1st, 2nd or 3+ calving).
CH_4 enteric – young cattle	IPCC 2019 Tier 2 Energy based.
CH_4 manure management	IPCC 2019 Tier 2: - VS calculated from digestible energy coefficient of the ration - MCF for slurry calculated from temperature per month in Flanders and storage duration. - MCF for solid manure dependant on storage duration from IPCC table. Successive storage systems are taken into account in the MCF calculation for slurry and for solid manure weighted by storage duration.
Direct N_2O manure management	IPCC 2019 Tier 2 default EF table
indirect N_2O manure management	IPCC 2019 Tier 1/2 (Flemish excretion rates) EFs (~fertiliser application) - NH3: EMAV for barn emissions and EMAV for external storage where available (if not available, IPCC is used) - Assumption NOxN=N2ON (WFLDB and others) - NO3: IPCC (corrected for capped storage)
CH4 from grazing	IPCC 2019 B0 and MCF dependant grazing regime
Direct (& indirect) N_2O from grazing	- N2O: IPCC 2019 - NH3: EMAV 8% Nexcretion on pasture - NOx= 0.08kgNOxN/kgTAN*0.6kgTAN/kgNex - NO3 (part of total N balance)
CH_4 manure treatment	Not included due to lack of EFs
Combustion of fuels	Direct use of inputs on the farm is included. Diesel consumption in contract work calculated based on default consumption (OFFREM) and requested work runs. Emission factors: EMEP/EEA.