

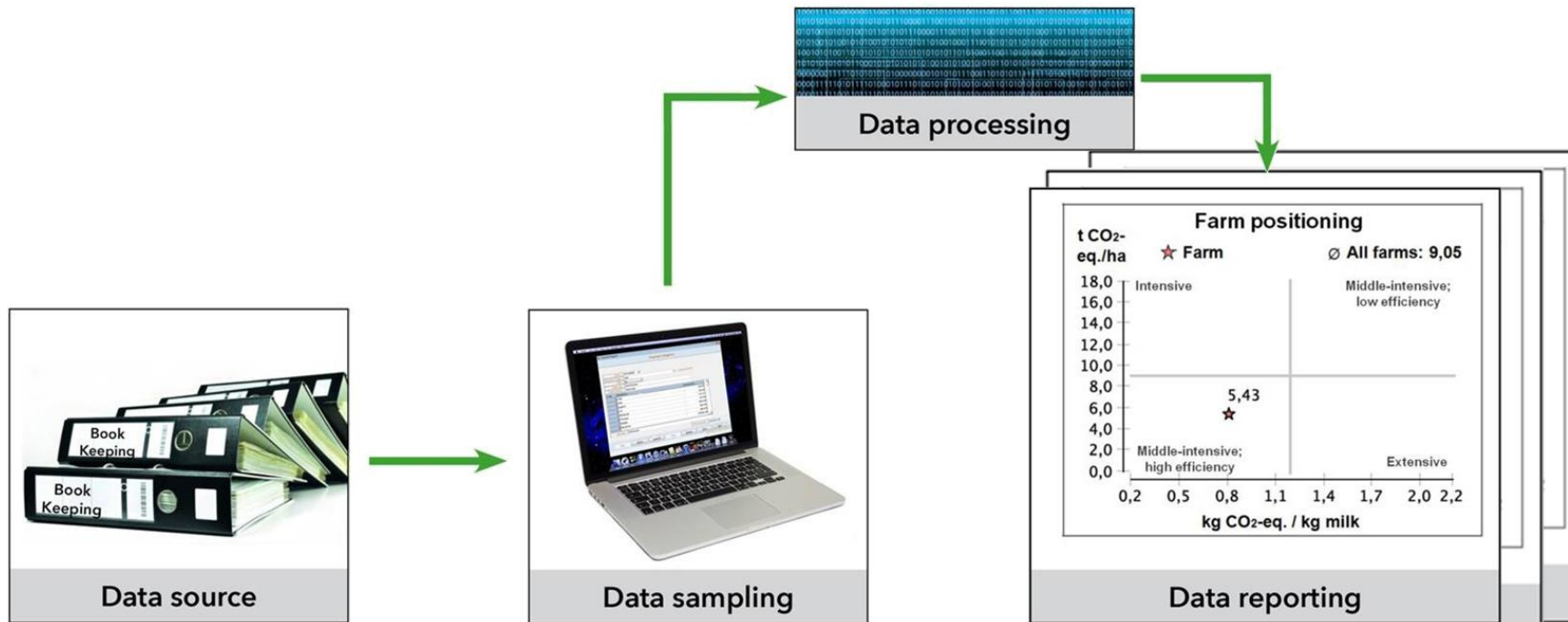
Assessment of greenhouse gas emissions and carbon credits of livestock farms in Luxembourg



presented by M.Sc. Rocco Lioy

The CONVIS sustainability monitoring
<https://www.youtube.com/watch?v=HcolpJDRIgw>

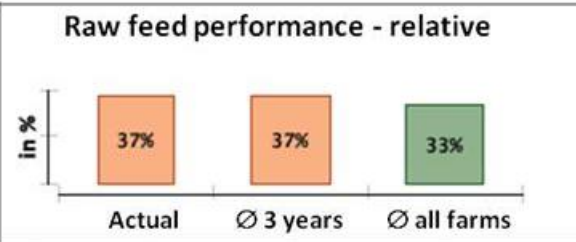
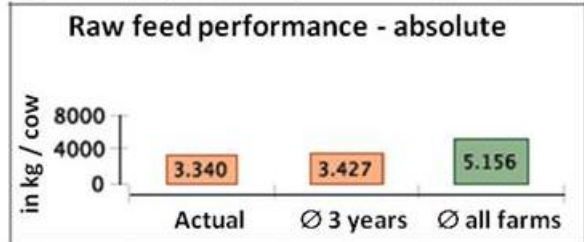
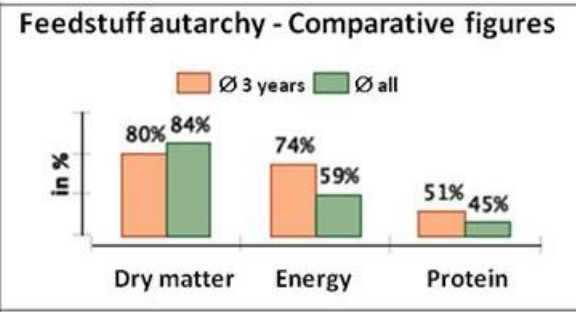
The CONVIS sustainability monitoring: In 1,5 hours from raw data to farm evaluation



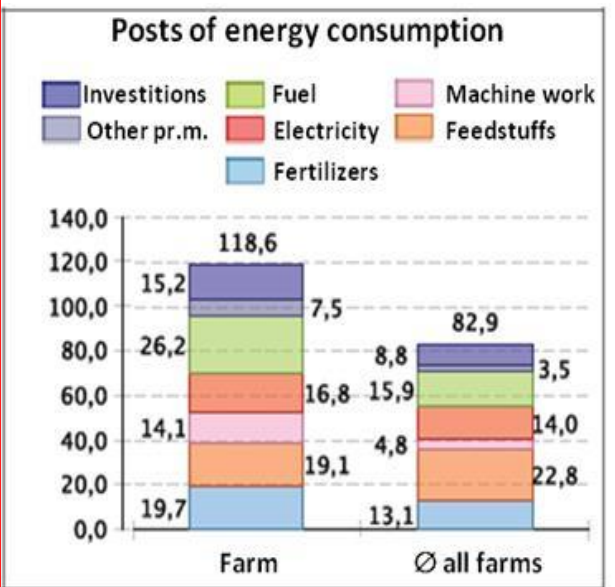
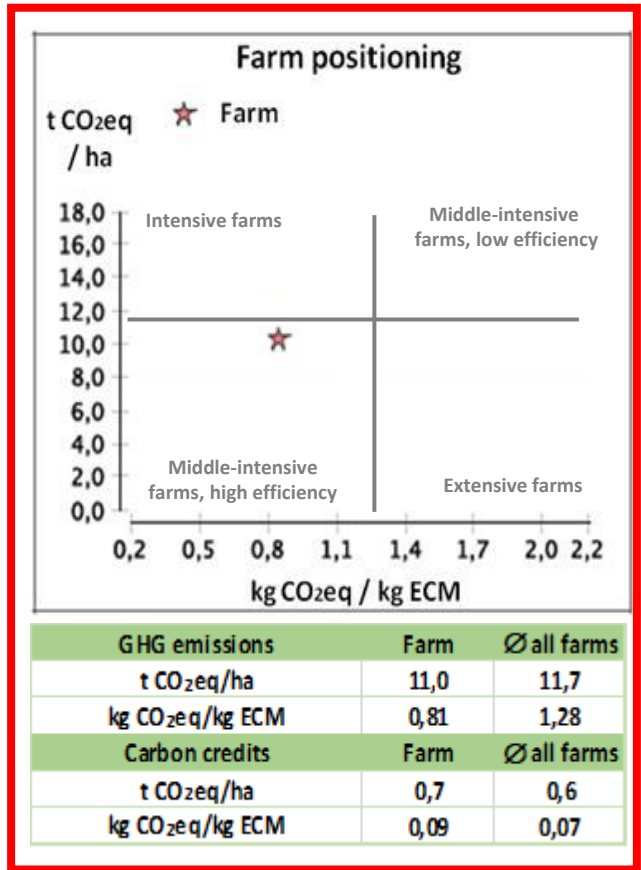
Dairy farming and dairy production

Figures	Farm	Ø all farms
Size (ha)	65,4	75,7
Cereals (ha)	4,0	8,7
Mays silage (ha)	10,2	15,7
Other crops (ha)	0,0	3,4
Grassland (ha)	51,2	53,7
Dairy cows (n)	43,0	65,4
Young animals (n)	62,7	77,1
Animal density (LAU/ha)	1,3	1,5
kg milk per farm	386.723	549.443
kg milk per cow	8.994	7.406
kg milk per ha (intensity)	5.918	7.289
kg live weight per ha	178	201

Feedstuff autarchy of dairy herd			
	Dry matter	Energy	Protein
Actual	80%	74%	51%



Consumption per 100 kg milk	Concentrate dt	Energy conc. dt	Protein conc. dt	Electricity kWh	Medicaments €	Water m ²	Fuel l
Farm	0,31	0,26	0,05	7,74	1,72	0,29	2,97
Ø all farms	0,23	0,17	0,05	6,25	0,79	0,30	1,83



Energy demand	Farm	Ø all farms
l Fioul-eq/ha	1263	914
l Fioul-eq/t ECM	120,5	99,1

*The Carbon footprint calculation tool
of CONVIS ist now SGS-certified*

**Greenhouse Gas Verification Statement Number
5249226**

Verification Statement Date: 16.06.2021

This Statement is not valid without the full verification scope, objectives, criteria and findings available on pages 2 to 3 of this Statement.

The Product Carbon Footprint Calculation Tool of
CONVIS s.c.

4 zone artisanale et commerciale
L-9085 ETTTELBRUCK
LUXEMBURG

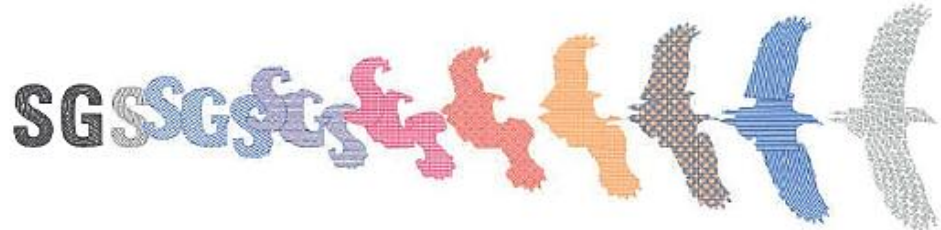


ppa Dr. Christian Temme
Director
Industries & Environment
Environment, Health and Safety



Authorised by:

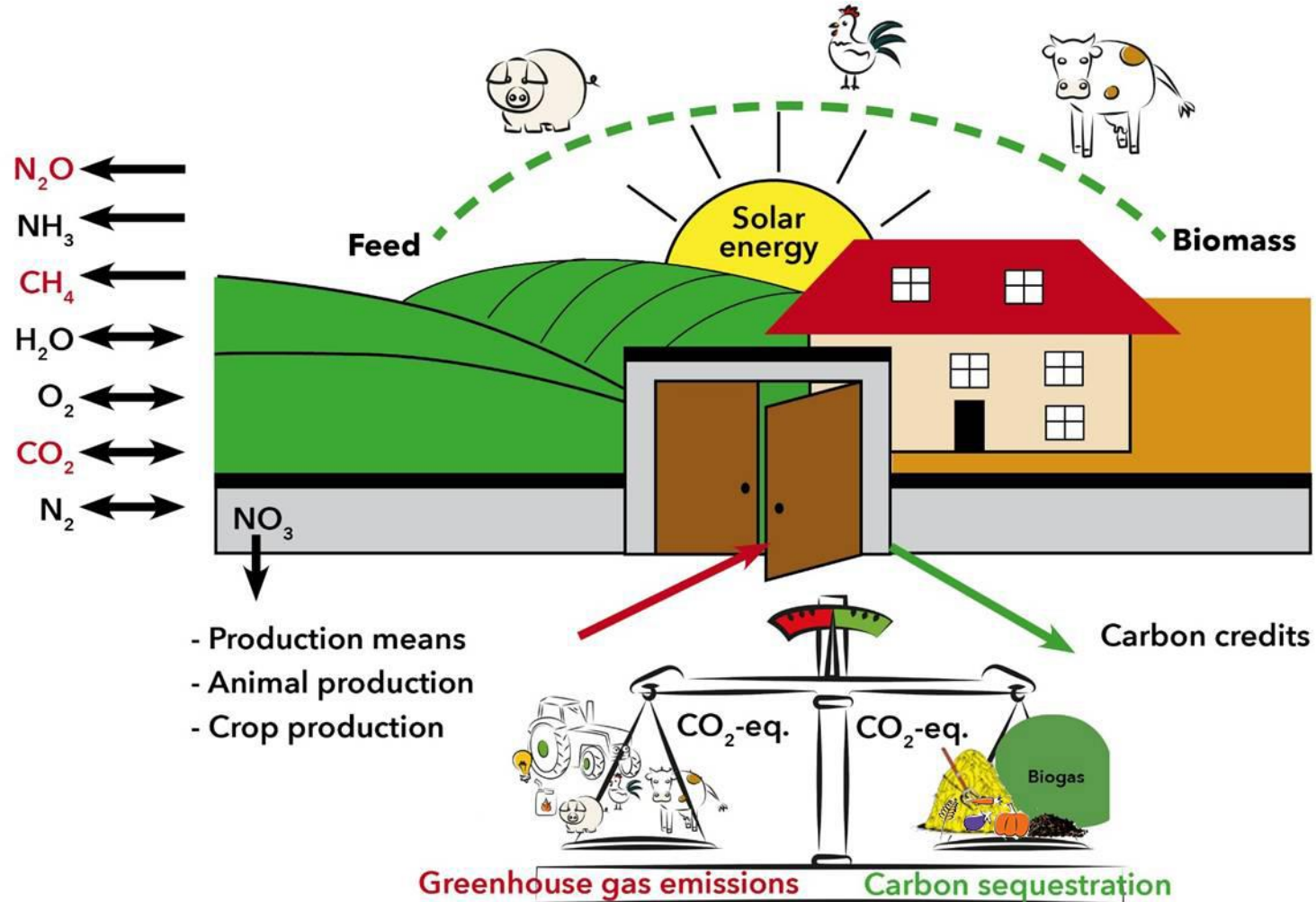
i.A. Dina Bauer
Lead Auditor
Industries & Environment
Environment, Health and Safety
SGS Institut Fresenius GmbH
Goerzallee 305a
D - 14187 Berlin



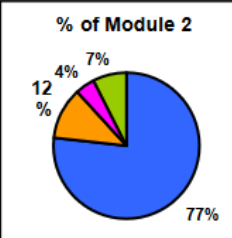
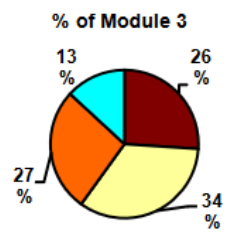
Main applications of the CONVIS-Tools (references)

- **Interreg project IV A** Great Region „**OPTENERGES**“ with animal husbandry farms from Luxembourg, France and Belgium (2009-2012)
- **Life-Project „DAIRYCLIM**“, mit Dairy farms from Luxembourg, Belgium und Danmark (2016-2019)
- **SUSTAINABILITY MONITORING** of Luxembourgish cattle and pig farms (2012-2020), corresponding of about **22%** of the whole **agricultural area in Luxembourg**
- **STUDY** to mitigate the climate impact of Luxembourgish agriculture, carried out on behalf of the **Luxembourgish Environmental Ministry** (2018)
- **Interreg project V A** Great Region „**AUTOPROT**“, with dairy farms from Luxembourg, Germany, France und Belgium (2018-2022)
- **Interreg-Project** Region Upper Rhine „**KLIMAKO**“ with animal husbandry farms from Germany, France and Switzerland (2021-2023)

Greenhouse gas emissions and carbon credits by CONVIS



Greenhouse gas inventory

Emission sources	kg CO ₂ /ha	kg CH ₄ /ha	kg N ₂ O/ha	t CO ₂ -eq/ha	% of total emissions	GWP = 25*CH ₄ ; 298*N ₂ O
Fertilizers	304,5	0,1	1,1	0,63	7,3	
Feedstuffs	511,0	4,6	0,7	0,83	9,6	
Electricity, fuel, machine work	714,3	0,5	0,0	0,74	8,6	
Other prod. means, investments	409,1	7,3	0,6	0,78	9,0	
Module 1 : production means (total)	1.938,9	12,4	2,4	2,98	34,5	
Enteric fermentation, stable emissions	-	122,6	-	3,06	35,5	% of Module 2 
Storage of slurry and farm yard manure	-	12,2	0,5	0,46	5,3	
Spreading organic manure	-	0,1	0,6	0,17	2,0	
Grazing	-	0,1	1,0	0,30	3,4	
Module 2 : animal husbandry (total)	-	134,9	2,1	3,99	46,2	
Soil emissions	-	-	1,5	0,43	5,0	% of Module 3 
Mineral N-fertilization, urea, liming	62,6	-	1,7	0,57	6,6	
Fuel combustion	443,3	0,0	0,0	0,45	5,2	
Crop residues, humus depletion	190,5	-	0,1	0,22	2,5	
Module 3 : crop production (total)	696,4	0,0	3,3	1,67	19,3	
Total GHG emissions	2.635,3	147,4	7,8	8,64	100	

Carbon credits

Carbon credits	t CO ₂ /ha
Biofuel (rape)	0,028
Biogas-Electricity	0,236
Biogas-Heat	0,023
Conversion of arable land into grasland	0,067
Positive humic balance (arable land)	0,293
Photovoltaic-Electricity	0,042
Total Carbon credits	0,689

1. Methane: Enteric fermentation *[Kirchgessner et al. 1991]*

➤ Dairy cows

kg CH₄/cow and year: $15 + 0,548 * \text{kg Live weight}^{0,75} + 0,0048 * \text{Milk performance (kg Milk per cow and year)}$

➤ Other cattle

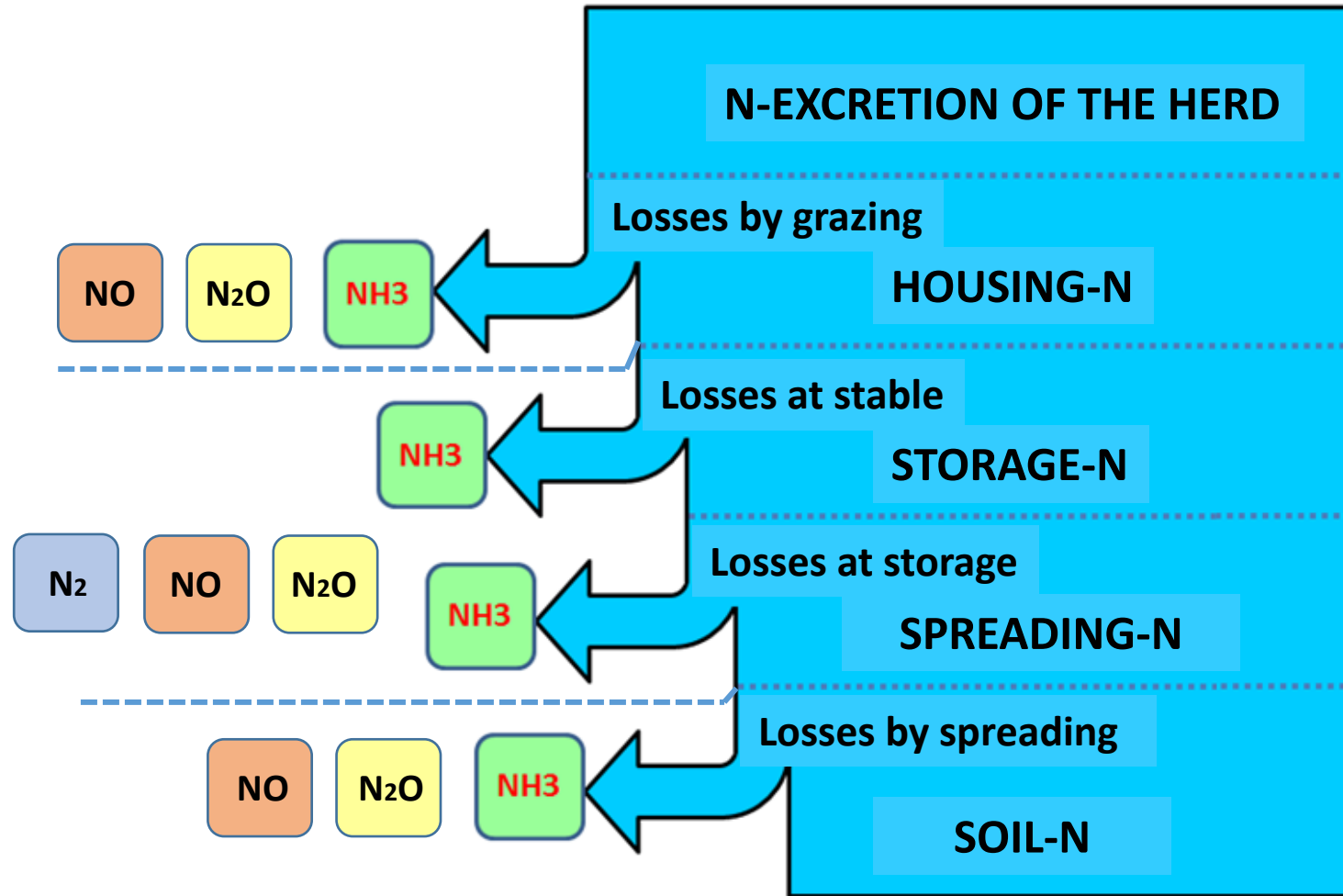
g CH₄ / animal / d = $55 + 1,2 * \text{kg Live weight}^{0,75}$

2. Methane: Manure management *[IPCC 2006]*

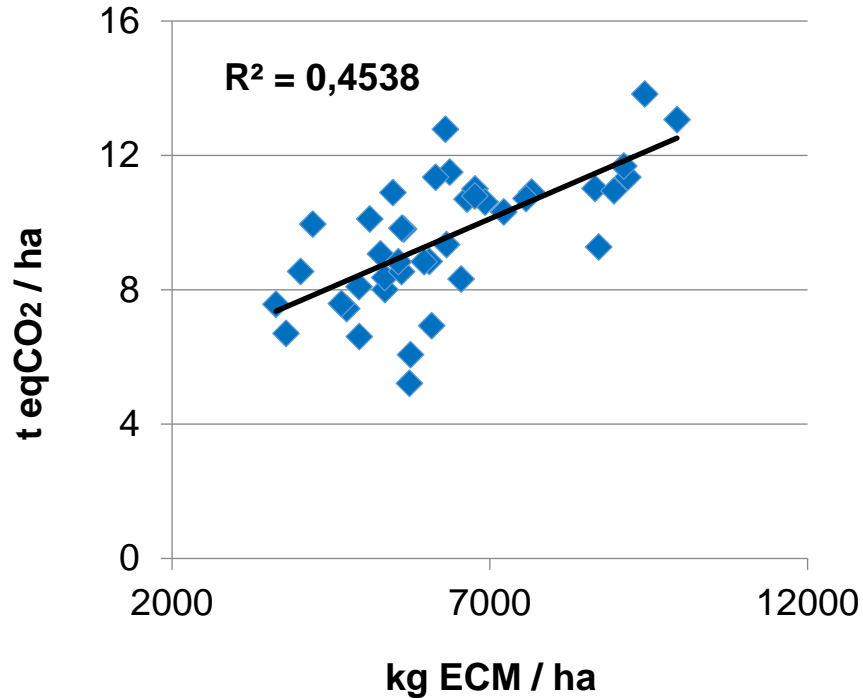
CH₄ (storage) in kg/d = $VS_s * B_0 * MCF * \rho_{CH_4}$

Module animal husbandry: key methodological notes

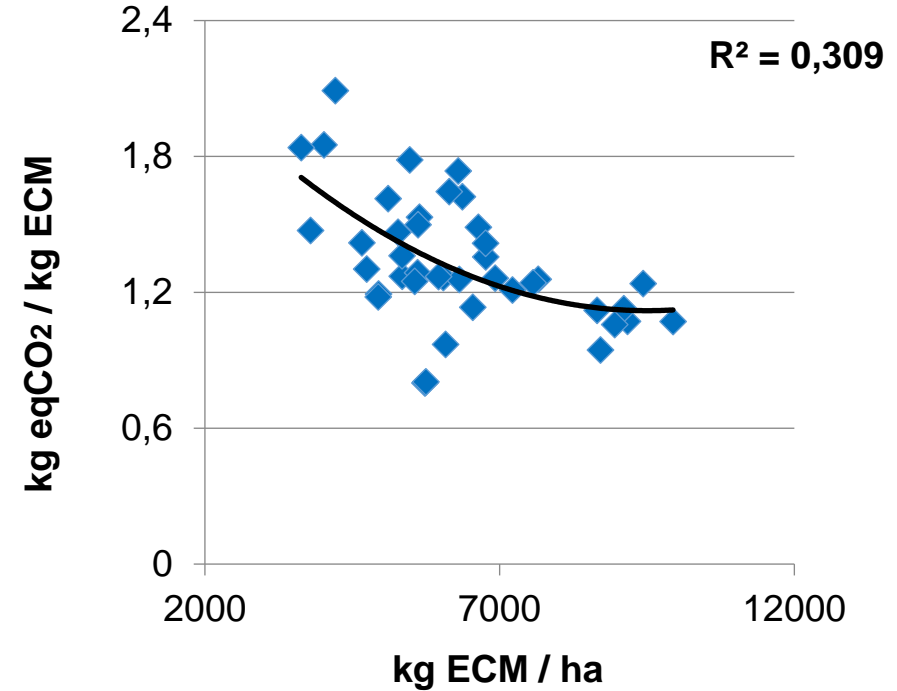
3. N₂O-emissions [IPCC 2006]: A mass-flow concept



Behaviour of GHG emissions related to production surface and produced milk in function of production intensity



t eqCO₂ / ha = pressure indicator

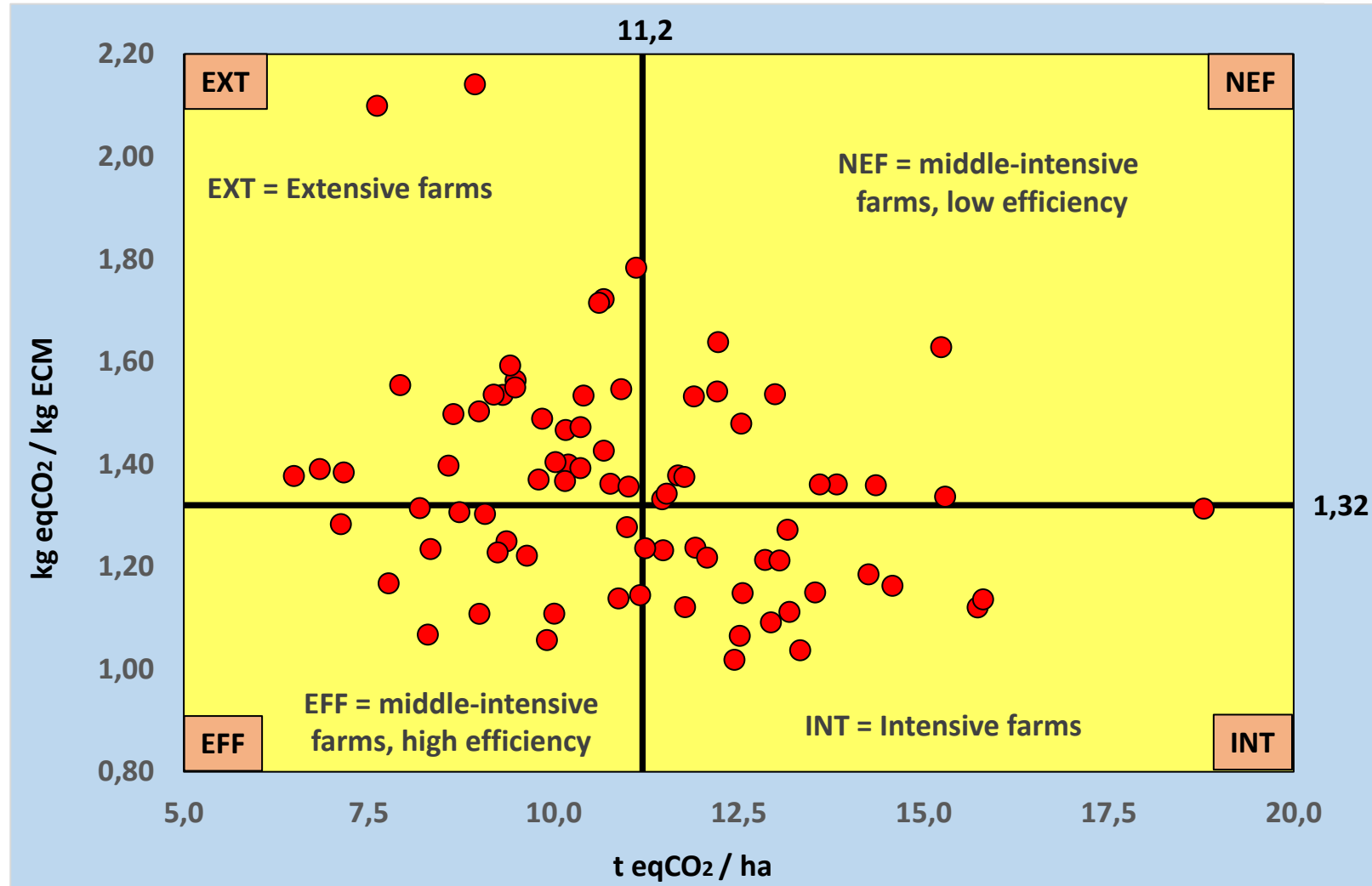


kg eqCO₂ / kg ECM = efficiency indicator

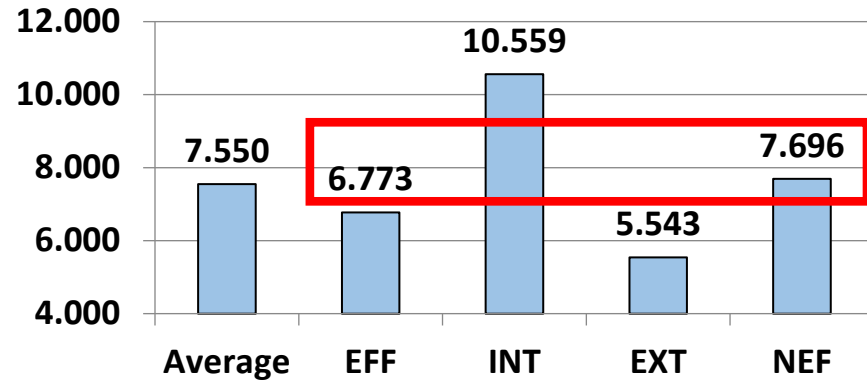
**First example of results from CONVIS-farms*
in the frame of the Interreg-project „AUTOPROT“**

***80 dairy farms - average 2014, 2015, 2016**

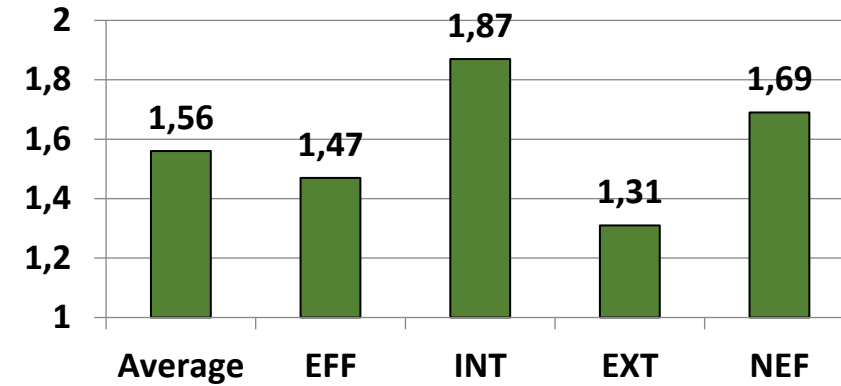
Principle of farm segregation



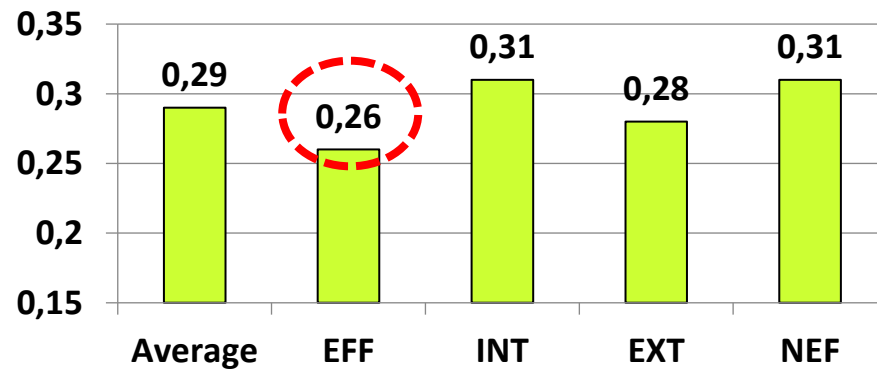
Production intensity (kg ECM/ha)



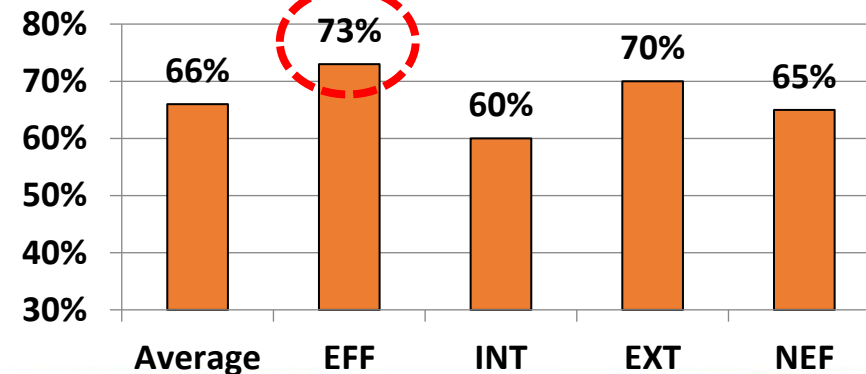
Animal density (LAU/ha)



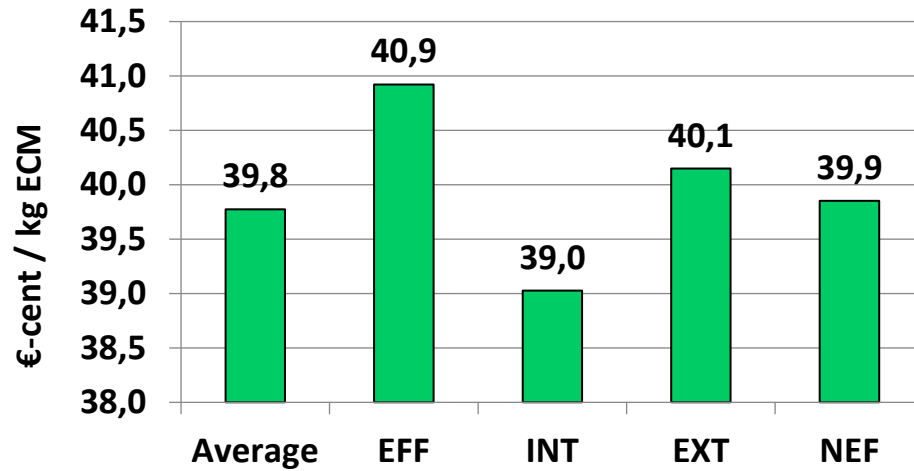
Concentrate efficiency (kg/kg ECM)



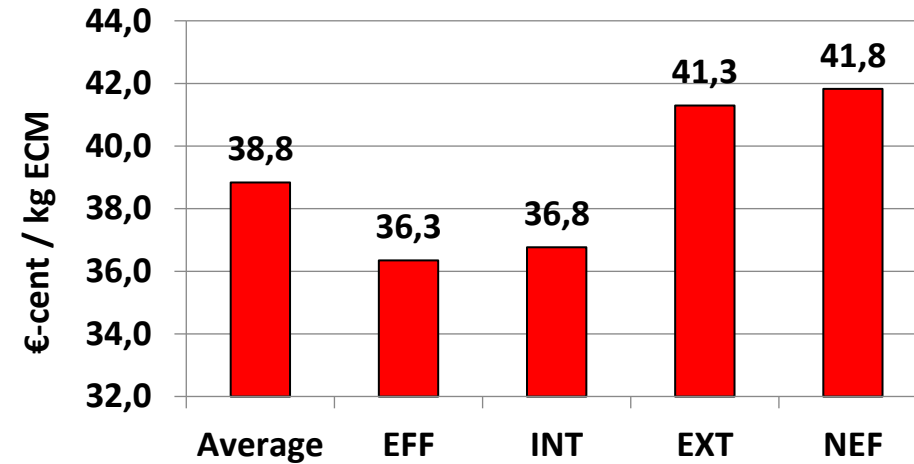
XP-Autarky of crop production (%)



Incomes*

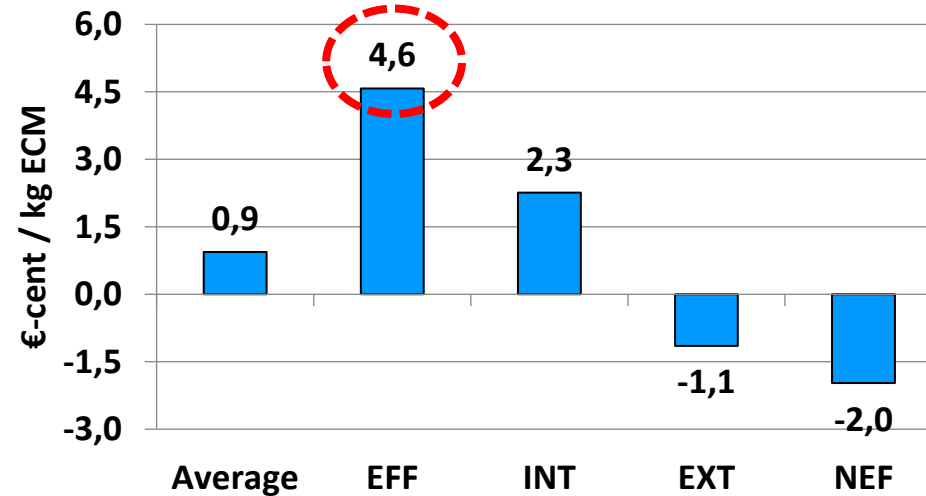


Costs



***Without subventions**

Profit (incomes* - costs)



KEY CONCLUSION



Many thanks !