EU Impact analysis on GHG-emission proposal: Focus on agriculture

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Outline

- Motivation & background work at the JRC
- EU agricultural emissions in perspective
- Methodology: CAPRI Model
- Scenario assumptions
- Main results
- Limitations
- Conclusions

Motivation (I)

- Provide an overview of the evolution of agricultural GHG emissions in Europe
- Understand how model-calculated GHG emissions would evolve (i.e. projections to 2030)
- Identify which technological mitigation options could be applied and at which costs by EU Member States (i.e. mix of policy options regarding emission reduction targets and mitigation options)
- Assess whether the existing CAP budget and existing policy instruments would be adequate to guarantee net emission reduction in EU agriculture over the medium term (i.e. subsidies for adoption)

Motivation (II)

Contribution to the Impact Assessment of the LULUCF legislative proposal

(see presentation by Peter Wehrheim)

EUROPEAN COMMISSION

Brussels, 20.7.2016
COM(2016) 479 final

2016/0230 (COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change

(Text with EEA relevance)

{SWD(2016) 246 final}
{SWD(2016) 249 final}

EN EN

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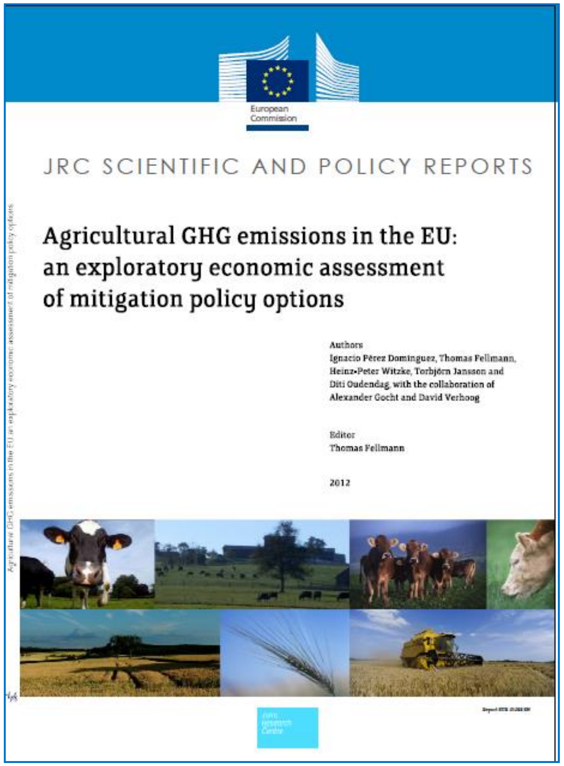
Background studies



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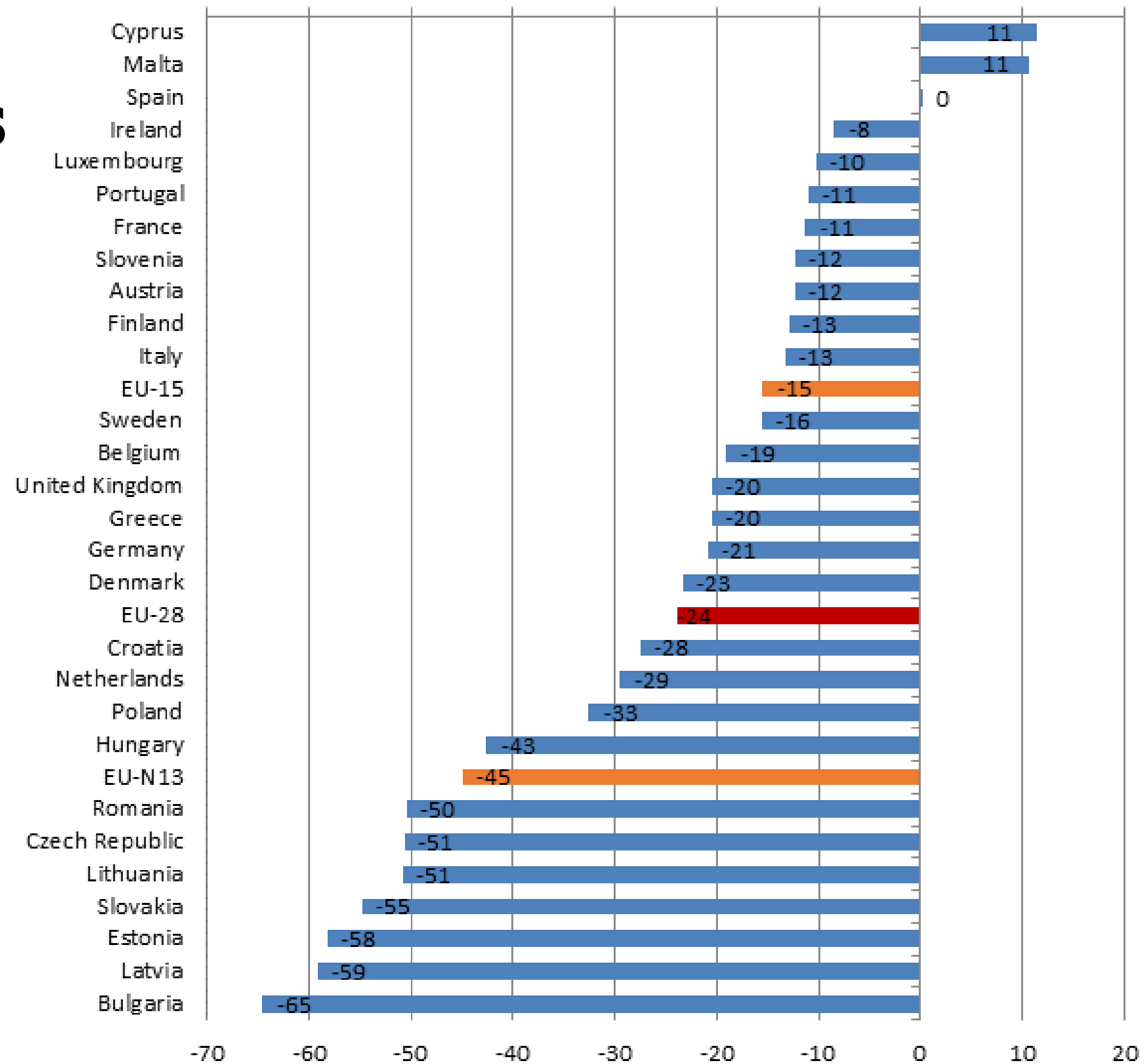
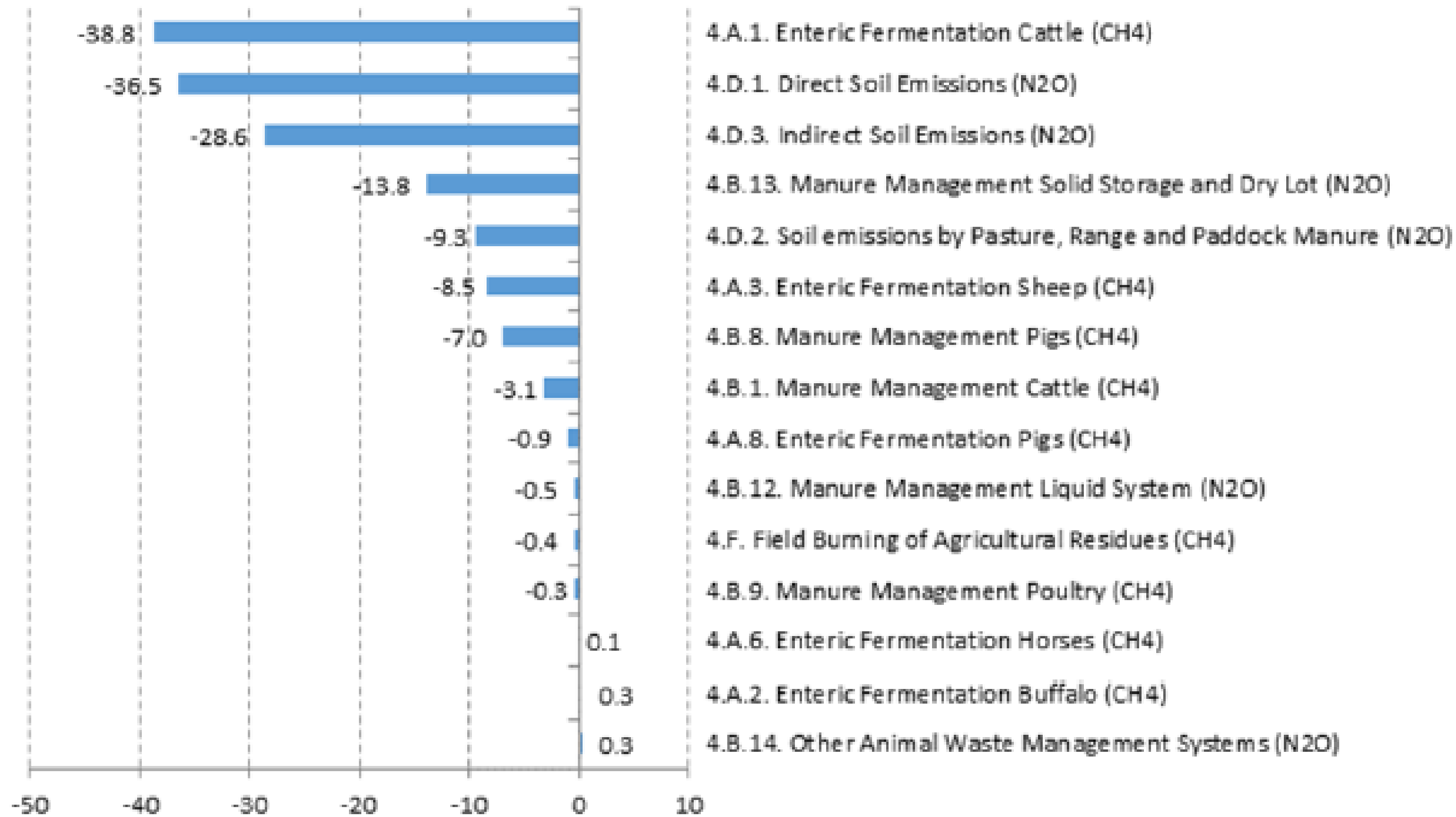
Changes in GHG emissions per MS in % (1990-2012)

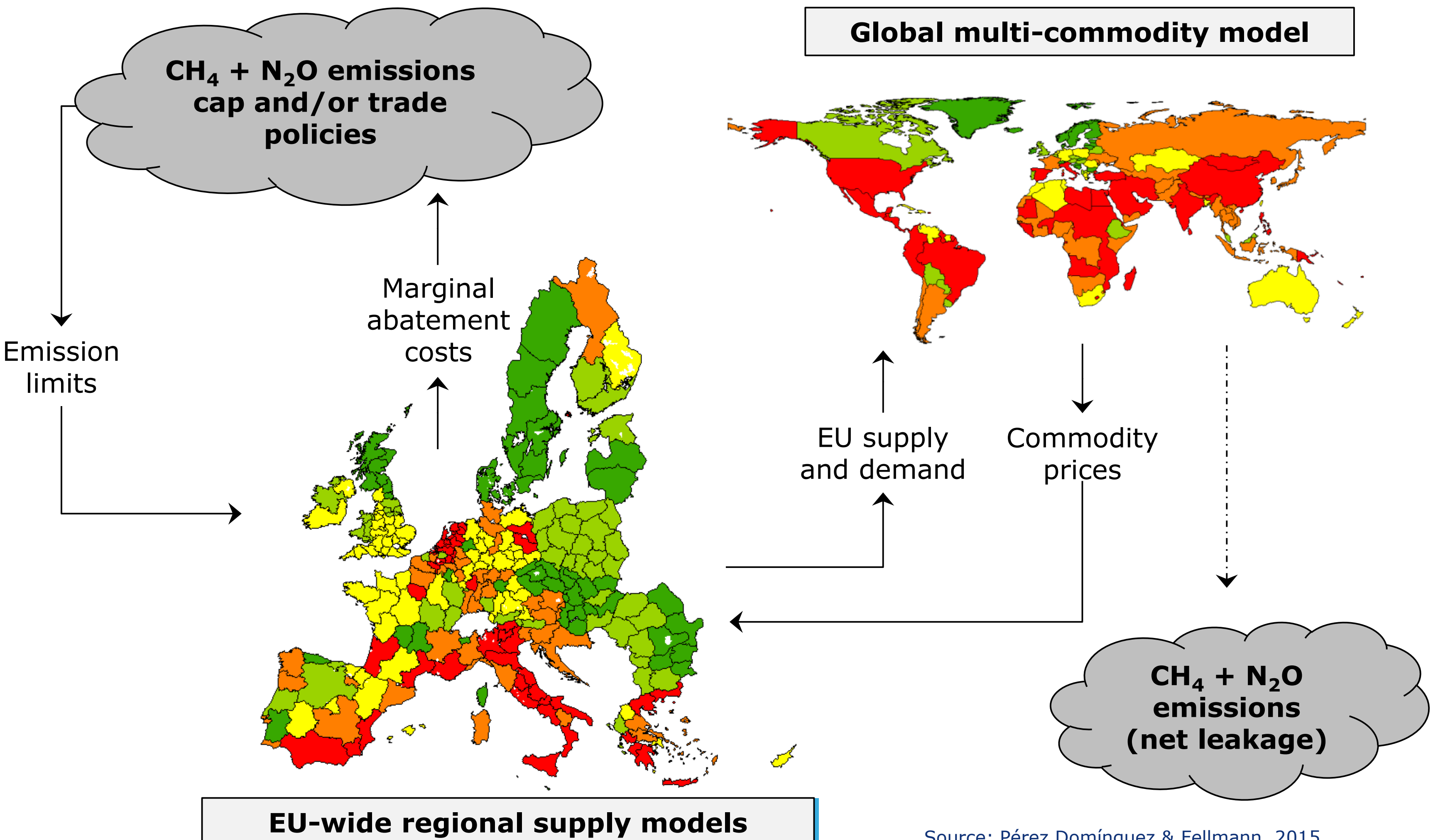


Source: EEA (2015)

Changes in GHG emissions by source in million tonnes CO2eq (1990 – 2012)



Methodology: CAPRI Model structure



Source: Pérez Domínguez & Fellmann, 2015

Methodology: GHG emission module

- **Main approach**: endogenous calculation of non-CO2 emissions (methane and nitrous oxide), mainly following IPCC 2006 Tier 2 Guidelines
- **Coverage of emission inventories**: almost full, but only non-CO2 emissions reported under 'agriculture', CO2 module under construction
- **Data sources for mitigation technologies:** GAINS, KTBL, EU-funded projects (e.g. AnimalChange, GGELS), expert information from ad-hoc workshops

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Scenarios & main drivers in EcAMPA2

	Emission reduction target	Voluntary Subsidies for adoption	Mandatory implementation of technologies (additional)	Tech. progress
HET15	15%			
HET20	20%			
HET25	25%			
SUBV80	20%	80%		
SUBO80	20%	80%	Yes *	
SUBV80-noT		80%		
SUBV80-TD	20%	80% **		Rapid

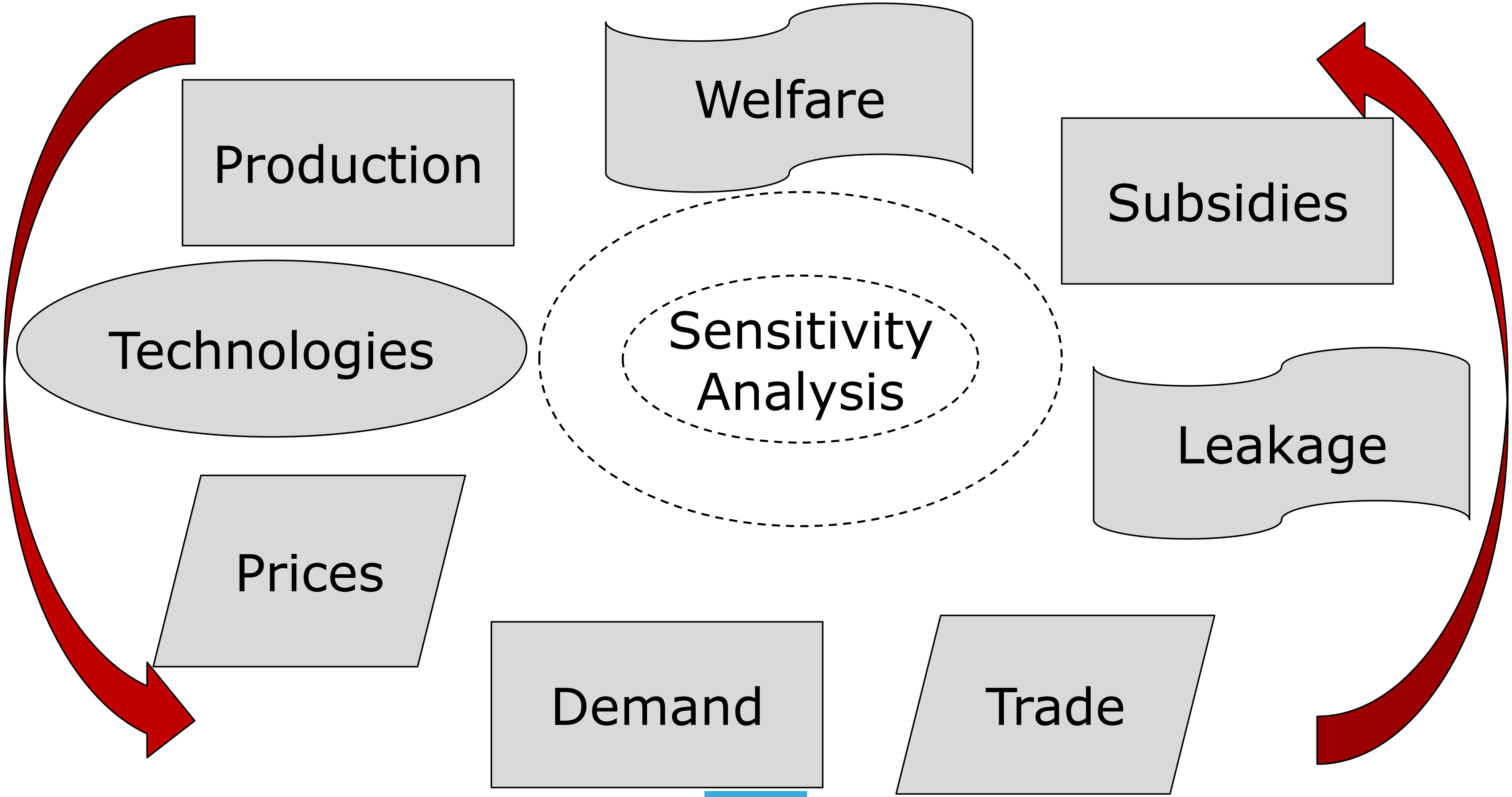
* For Anaerobic digestion, Variable Rate Technology and increased share of legumes on temporary grasslands
** Including Nitrate ad feed additive and vaccination against methanogenic bacteria in rumen

Mitigation technologies considered

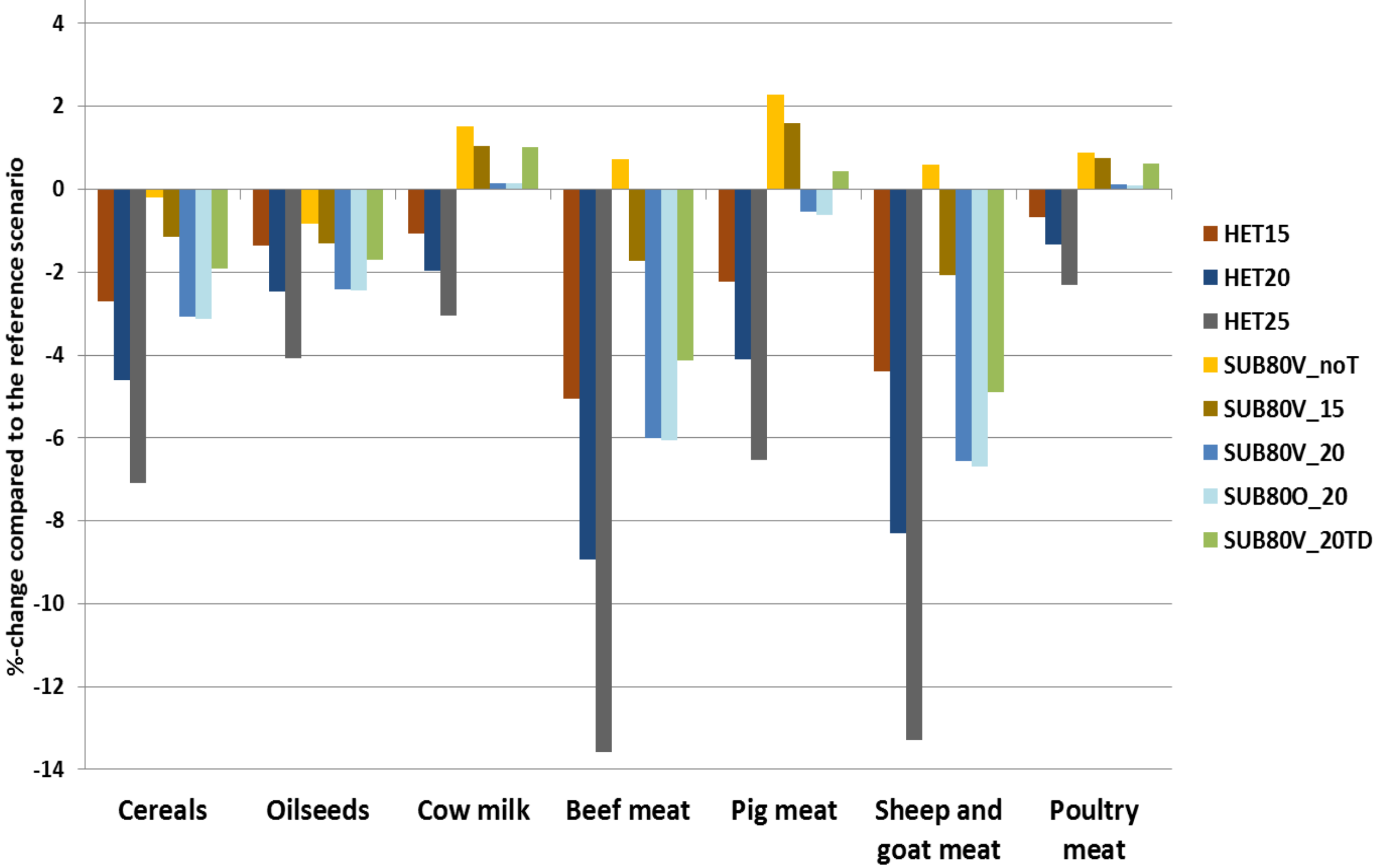
Anaerobic digestion: farm scale[1]	Better timing of fertilization[2]	Nitrification inhibitors[2]
Precision farming[2]	Variable Rate Technology[1,2]	Rice measures
Fallowing histosols	Low nitrogen feed	Feed additives: linseed
Increasing legume share on temporary grassland[1]	Genetic improvements: increasing milk yields of dairy cows[2]	Genetic improvements: increasing ruminant feed efficiency
Feed additives: nitrate[3]	Vaccination against methanogenic bacteria in the rumen[3]	

[1] Mandatory to adopt in the scenario SUB80O_20 (but only for farmers fulfilling certain size criteria)
[2] Considered to have a higher potential in the scenario SUB80V_20TD (more rapid technological development)
[3] Only considered in scenario SUB80V_20TD (more rapid technological development)

Main results: outline

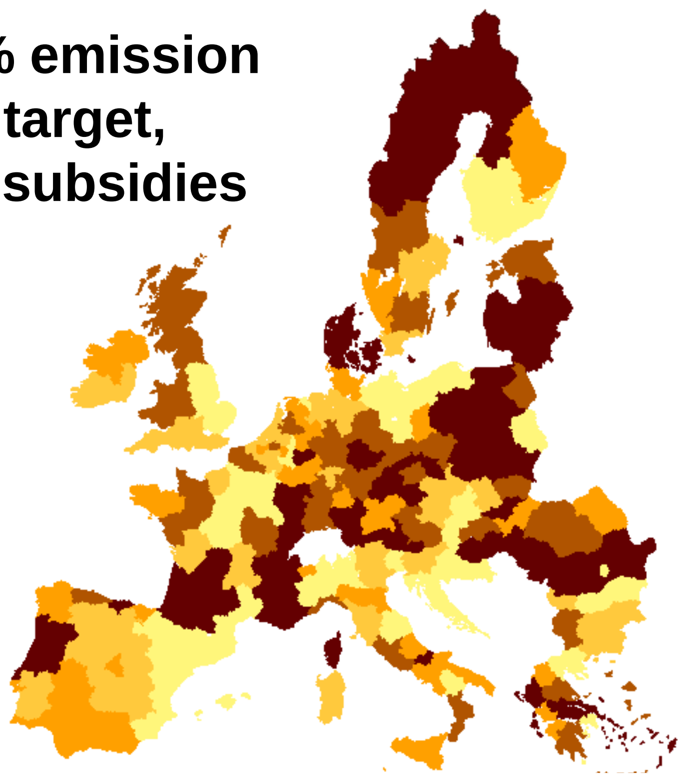


EU production effects
(% change vs. the baseline)

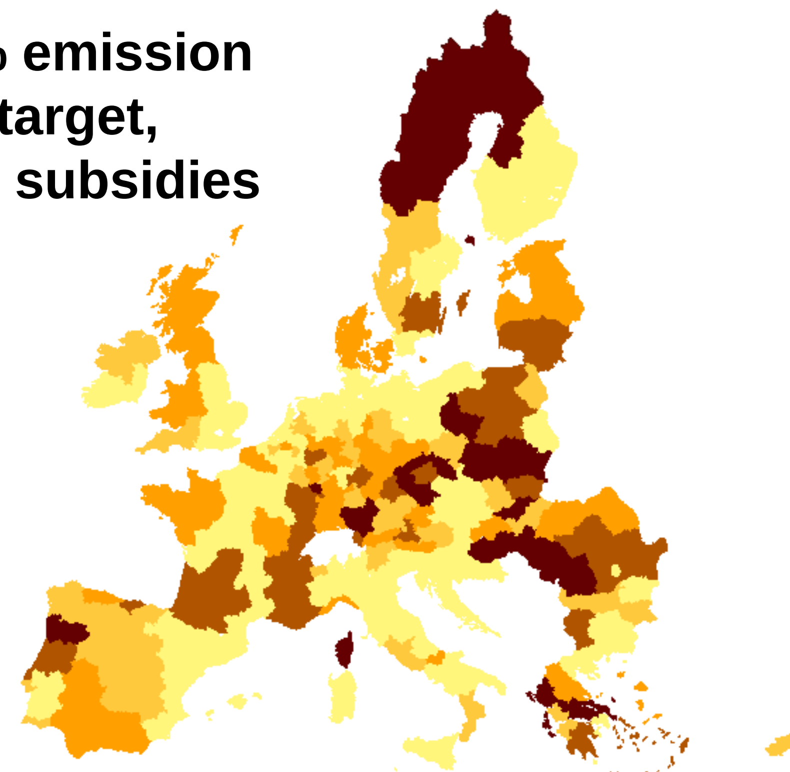


Regional production effects: beef supply
(% change vs. the baseline)

20% emission target, no subsidies



20% emission target, 80% subsidies



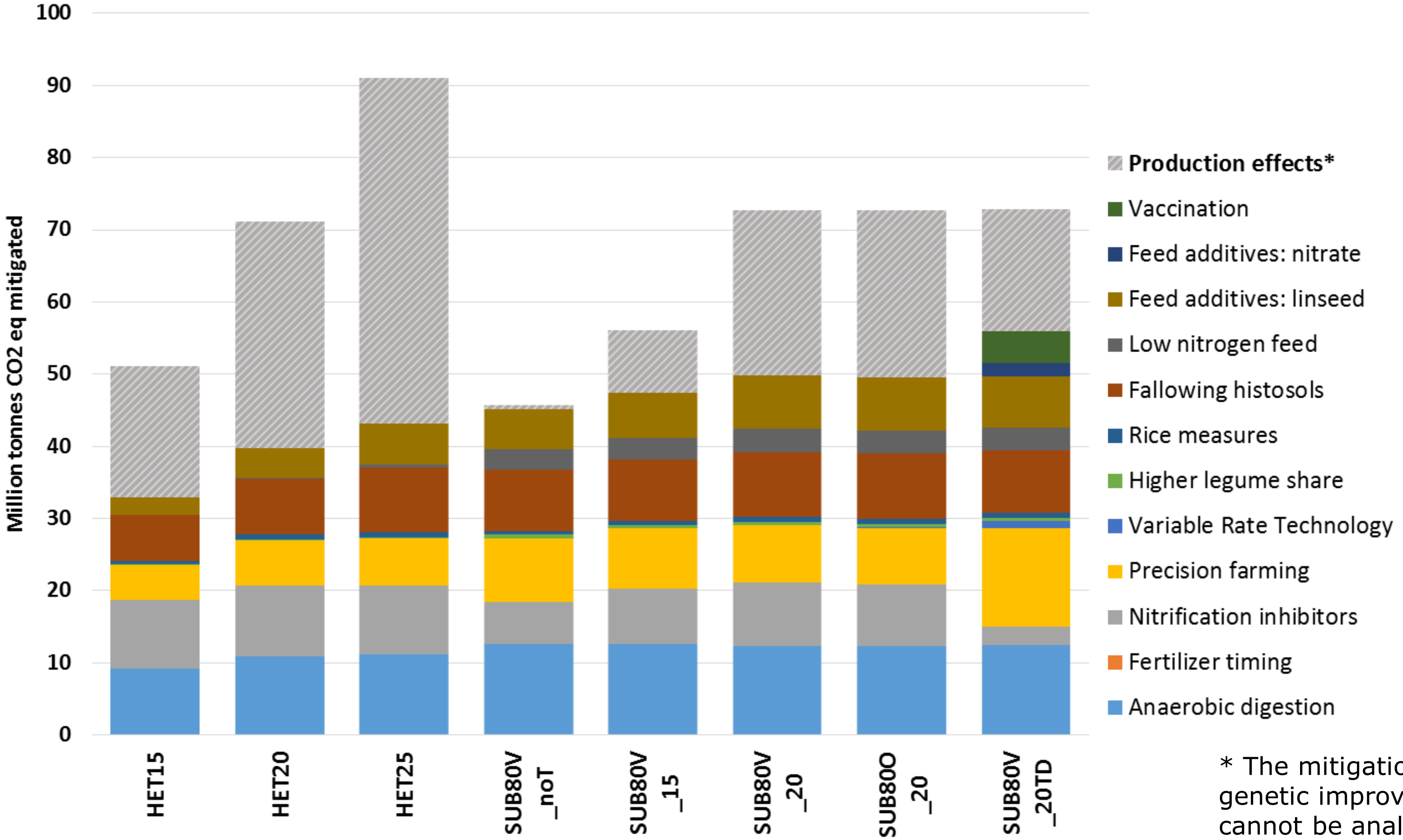
-27% < -13 | < -10% | < -8% | < -5% | < -2%

Mitigation technology adoption
(% of total mitigation)

	HET15	HET20	HET25	SUB80V _noT	SUB80V _15	SUB80V	SUB80O	SUB80V _TD
	Share in total GHG emission reduction							
Mitigation technologies*	64%	56%	47%	99%	85%	68%	68%	77%
Production changes	36%	44%	53%	1%	15%	32%	32%	23%

* Does not include the mitigation effects from the measures related to genetic improvements as it is not possible to disentangle the effects of the breeding programmes on total agricultural emissions from their related production effects.

Contribution of each technology to total mitigation



* The mitigation effects linked to genetic improvement measures cannot be analysed in isolation and are added to mitigation achieved by changes in production.

EU net trade

	REF	HET15	HET20	HET25	SUB80V _noT	SUB80V _15	SUB80V _20	SUB80O _20	SUB80V _20TD
	EU net trade in 1000 t								
Cereals	47,491	46,328	45,145	42,203	46,252	46,101	44,764	44,734	45,921
Oilseeds	-12,528	-12,714	-12,852	-13,124	-12,240	-12,283	-12,419	-12,420	-12,141
Other arable field crops	1,390	1,386	1,396	1,384	1,428	1,460	1,494	1,494	1,556
Vegetables and Permanent crops	-18,969	-19,170	-19,356	-19,644	-19,135	-19,203	-19,390	-19,393	-19,331
Oils	-10,530	-10,517	-10,506	-10,509	-10,363	-10,359	-10,357	-10,357	-10,305
Oil cakes	-18,757	-16,937	-15,240	-13,168	-13,866	-13,073	-11,320	-11,287	-10,598
Beef	157	-27	-134	-247	183	85	-55	-57	-4
Pork meat	1,855	1,321	883	340	2,220	2,034	1,516	1,503	1,730
Sheep and goat meat	-321	-368	-413	-484	-319	-345	-393	-394	-375
Poultry meat	1,340	1,136	943	675	1,404	1,335	1,146	1,143	1,239
Dairy products	3,694	3,508	3,352	3,155	3,880	3,802	3,636	3,635	3,785

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Agricultural producer prices

	HET15	HET20	HET25	SUB80V _noT	SUB80V _15	SUB80V _20	SUB80O _20	SUB80V _20TD
	%-difference to REF							
Cereals	1.0	1.8	3.8	0.6	0.8	1.7	1.7	0.9
Oilseeds	1.3	2.2	4.0	-1.0	-0.6	0.5	0.5	-1.0
Other arable field crops	1.7	3.0	5.4	0.7	1.0	2.2	2.3	1.4
Vegetables and Permanent crops	0.5	1.0	1.7	0.5	0.6	1.1	1.1	1.0
Beef	13.4	25.9	43.8	-1.6	4.0	16.4	16.6	10.7
Pork meat	4.4	8.8	15.5	-2.7	-1.3	2.8	2.9	0.9
Sheep and goat meat	5.8	11.4	17.5	-0.6	2.4	8.5	8.6	6.0
Poultry meat	2.1	4.0	6.8	-1.0	-0.2	1.6	1.7	0.7
Cow and buffalo milk	6.6	12.3	19.7	-6.6	-3.9	1.8	1.9	-3.1
Sheep and goat milk	4.5	9.0	15.0	-4.1	-1.7	3.4	3.4	0.0
Eggs	2.1	4.0	6.7	0.0	0.7	2.5	2.6	1.5

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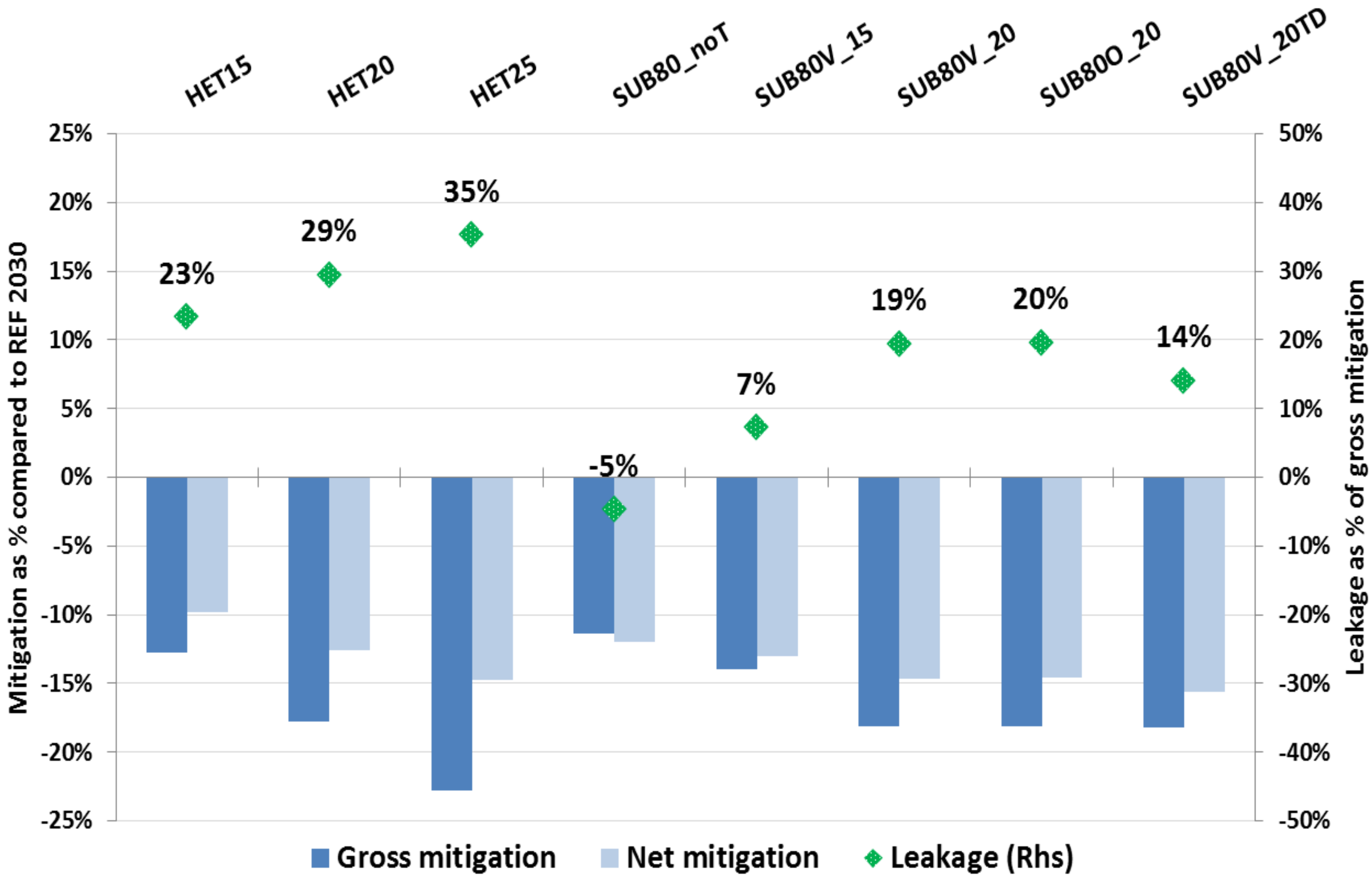
GHG emissions and leakage



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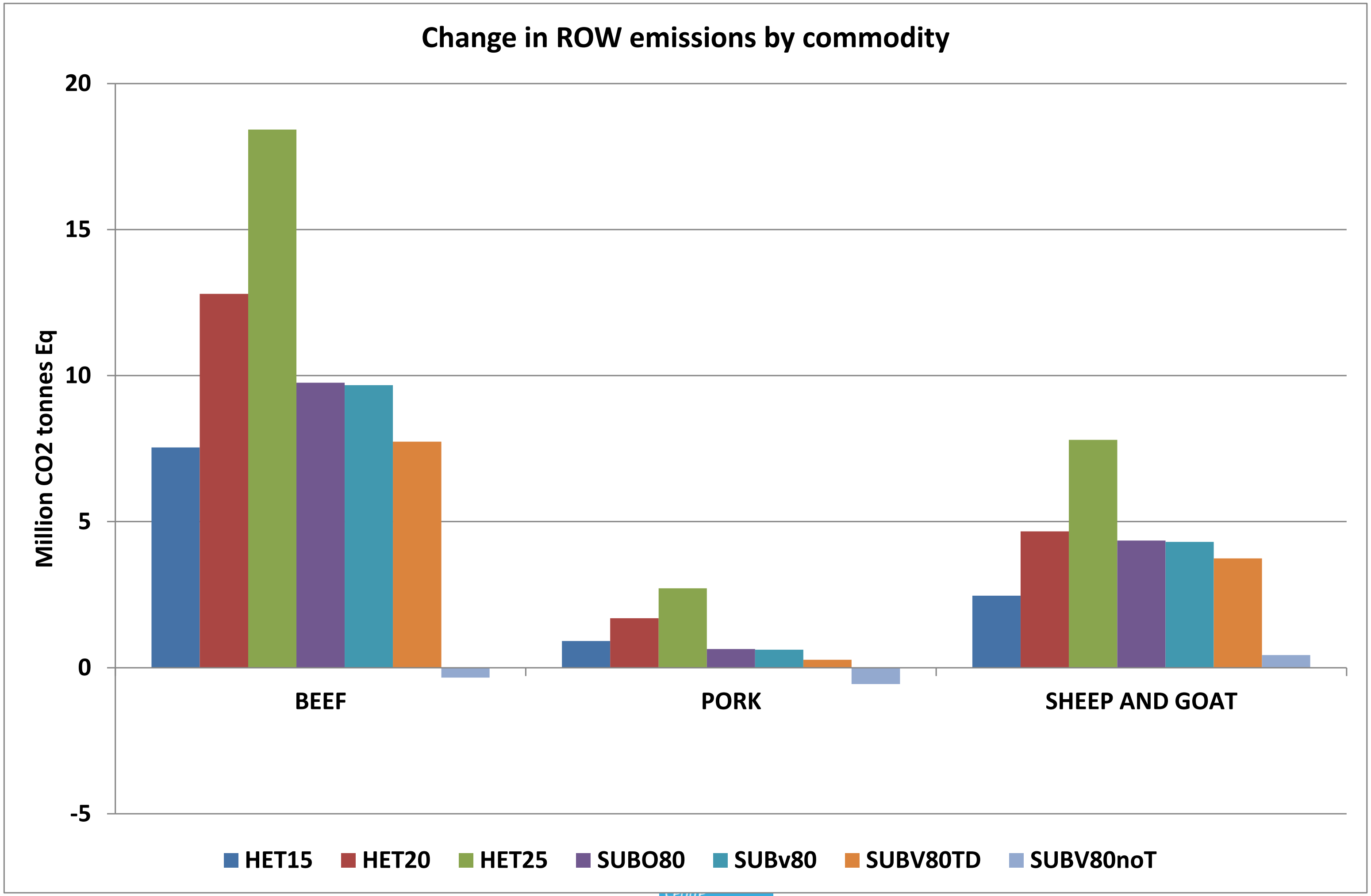
Emission leakage in beef markets



EU GHG mitigation subsidies

Scenario		Total subsidies to mitigation technologies (bio. Euro)	Subsidy per tonne total CO_2 mitigated (Euro/t)
Non-subsidised Voluntary Adoption of Technologies	HET15/HET20/HET25	NA	NA
Subsidised Voluntary Adoption of Technologies, No Mitigation Target	SUB80V_noT	12.7	278
Subsidised Voluntary Adoption of Technologies	SUB80V_15	13.0	233
	SUB80V_20	13.6	188
Subsidised Mandatory/Voluntary Adoption of Technologies	SUB80O_20	13.7	188
Subsidised Voluntary Adoption of Technologies (with more rapid technological development)	SUB80V_20TD	15.6	215

Note: The subsidies presented in the table are for the projection year 2030, they are relative to the REF scenarios, and they are in prices of 2030.

Limitations

- Comparative static analysis (e.g. no capital investment flows, no market disruptions, normal weather conditions)
- Cost-effectiveness of agriculture in isolation (e.g. no multiplier effects from other non-ETS sectors)
- Limited set of technologies and still not thoroughly tested in isolation, very limited knowledge about adoption
- Baseline: limited information (EU Outlook only to 2025), not always a perfect fit, no explicit climate payments… but good coverage of pillar 1 and 2 payments
- Technology transfer for leakage calculations only based on historical trends

Conclusions

- Without further action, agricultural GHG emissions in the EU-28 are projected to decrease by 2.3% by 2030 compared to 2005.
- The setting of GHG emission reduction obligations for the EU agriculture sector without financial support shows important production effects, especially in the EU livestock sector
- The decreases in domestic production are partially offset by production increases in other parts of the world (leakage)
- Adverse effects on EU agricultural production and emission leakage are significantly reduced if subsidies are paid for the application of technological emission mitigation options… however, with considerable budgetary costs to trigger adoption

Thank you for your attention

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Scenario assumptions: baseline (I)

PILLAR I		
Instrument	Base year 2008	Baseline 2030
Direct payments	As defined in 2003 reform and 2008 Health Check (HC); covering SFP or (SAPS)	2013 reform (partially) implemented
Decoupling	Historical/Regional/Hybrid schemes	Basic Payment Scheme
Coupled direct payment options	As defined in 2003 reform (including Article 68/69 and CNDP)	VCS according to the options notified by MS up to 01/08/2014*
Redistributive payment	NA	Not implemented
Young Farmer Scheme	Not implemented	Not implemented
Green Payment	NA	Green Payment component granted without restriction (only limitation: no conversion of permanent grassland)*
Capping	Modulation implemented	Implemented according to 2013 reform. Capped budget redistributed over RD measures
Convergence	NA	included

Scenario assumptions: baseline (II)

PILLAR II		
Instrument	**Base year 2008**	**Baseline**
Agri-environmental schemes	Less Favoured Areas (LFA) and Natura 2000 payments	Areas with Natural Constraints (ANC) and Natura 2000
Business Development Grants / investment aid	Not considered	Not considered
Common Market Organization		
Instrument	**Base year 2008**	**Baseline**
Sugar quotas	Yes	Abolition of the quota system in 2017
Dairy quotas	Yes	Quota system expires in 2015
Tariffs, Tariff Rate Quotas	Yes	Maintained at current level
Export Subsidies	Yes	Not applied in 2030

Scenario assumptions: technologies

<table>
<tr><th>Mitigation Technology</th><th>HET20</th><th>SUB80V</th><th>SUB80O</th><th>SUB80V_TD</th></tr>
<tr><td>1. Anaerobic digestion: farm scale</td><td>A+noS</td><td>A+SV</td><td>A+SM</td><td>A+SV</td></tr>
<tr><td>2. Better timing of fertilization</td><td>A+noS</td><td colspan="2">A+SV</td><td>A+SV
(unrestricted)</td></tr>
<tr><td>3. Nitrification inhibitors</td><td>A+noS</td><td colspan="2">A+SV</td><td>A+SV
(unrestricted)</td></tr>
<tr><td>4. Precision farming</td><td>A+noS</td><td colspan="2">A+SV</td><td>A+SV
(unrestricted)</td></tr>
<tr><td>5. Variable Rate Technology (VRT)</td><td>A+noS</td><td>A+SV</td><td>A+SM</td><td>A+SV
(unrestricted)</td></tr>
<tr><td>6. Increasing legume share on temporary grassland</td><td>A+noS</td><td>A+SV</td><td>A+SM</td><td>A+SV</td></tr>
<tr><td>7. Rice measures</td><td>A+noS</td><td colspan="3">A+SV</td></tr>
<tr><td>8. Fallowing histosols</td><td>A+noS</td><td colspan="3">A+SV</td></tr>
<tr><td>9. Low nitrogen feed</td><td>A+noS</td><td colspan="3">A+SV</td></tr>
<tr><td>10. Feed additives to reduce methane emissions from enteric fermentation: linseed</td><td>A+noS</td><td colspan="3">A+SV</td></tr>
<tr><td>11. Genetic improvements: increasing milk yields of dairy cows</td><td>A+noS</td><td colspan="2">A+SV</td><td>A+SV
(full potential)</td></tr>
<tr><td>12. Genetic improvements: increasing ruminant feed efficiency</td><td>A+noS</td><td colspan="3">A+SV</td></tr>
<tr><td>13. Feed additives to reduce methane emissions from enteric fermentation: nitrate</td><td colspan="3">Not available</td><td>A+SV</td></tr>
<tr><td>14. Vaccination against methanogenic bacteria in the rumen</td><td colspan="3">Not available</td><td>A+SV</td></tr>
</table>

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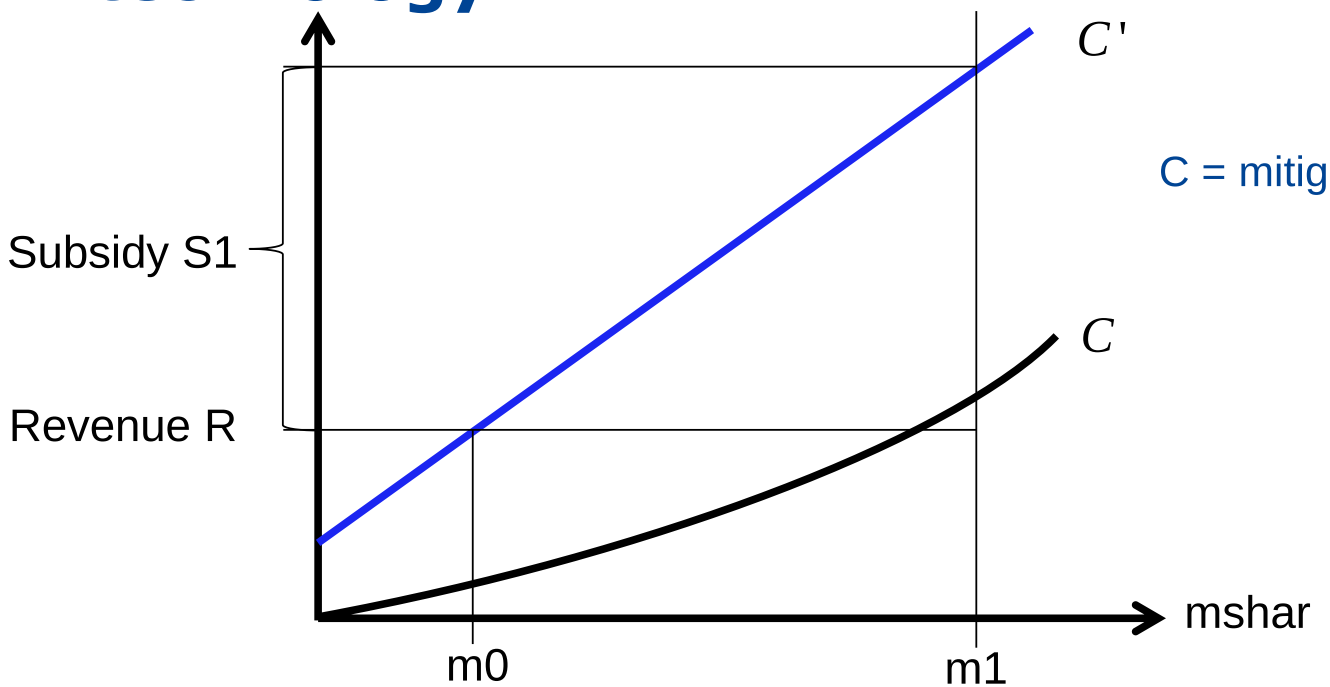
Technological GHG mitigation options considered

1. Anaerobic digestion: farm scale
2. Better timing of fertilization
3. Nitrification inhibitors
4. Precision farming
5. Variable Rate Technology
6. Increasing legume share on temporary grassland
7. Rice measures
8. Fallowing histosols
9. Low nitrogen feed
10. Feed additives: linseed
11. Genetic improvements: increasing milk yields of dairy cows
12. Genetic improvements: increasing ruminant feed efficiency
13. Feed additives: nitrate
14. Vaccination against methanogenic bacteria in the rumen

Modelling costs and uptake of mitigation technologies

- Production and cost functions in CAPRI are *non-linear*,
  - i.e., CAPRI considers that additional costs (may) exist that are not included in the pure accounting cost statistics (and these costs increase more than proportionally when production/uptake of technologies expands).
  - Costs provided in databases are usually based on average values for the entire farm sector, not considering farm/farmers specifics.
- Application of mitigation technologies depends on incentives
  - For commodity production, 'responsiveness' to economic and political incentives is expressed in terms of (price–supply) elasticities.
  - For mitigation technologies, 'responsiveness' is expressed in terms of an increase in uptake of a mitigation technology if a certain subsidy is granted for mitigation.

Representation of mitigation cost curves in CAPRI with positive initial implementation of a technology

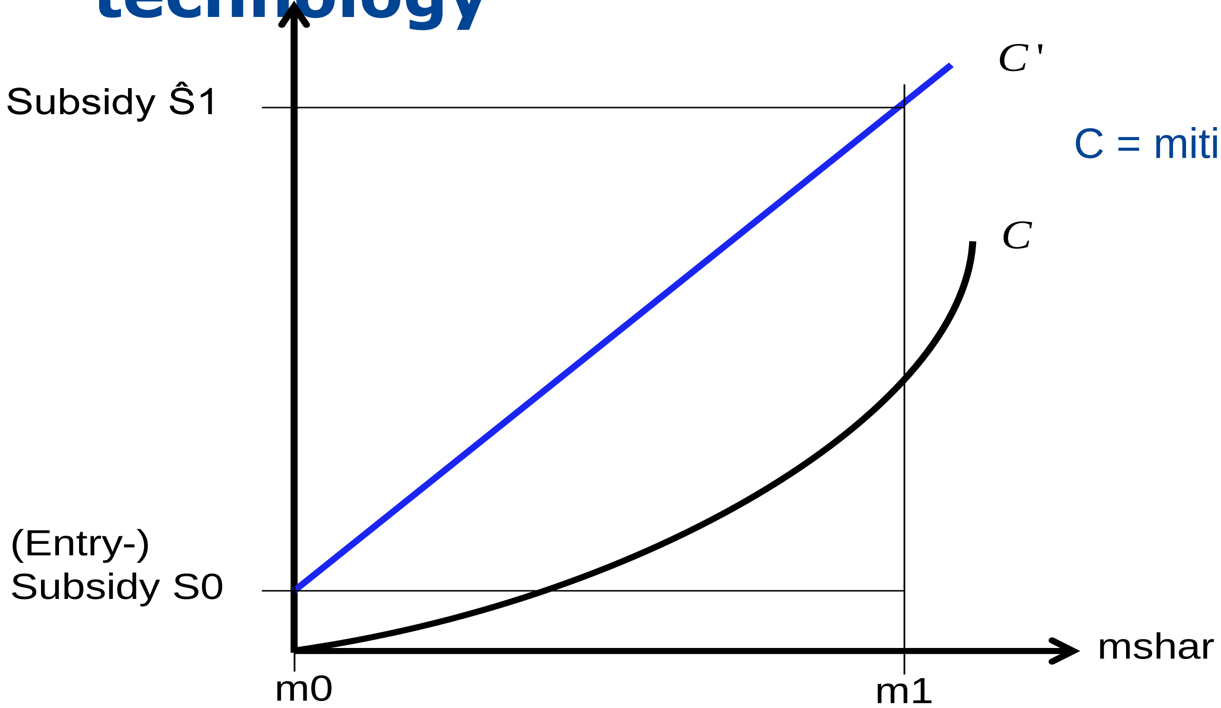


C = mitigation cost per activity

mshar = vector of the level of implementation
m0 = current level of implementation
m1 = maximal possible implementation level

Assumption: m1 achieved with a relative subsidy of 80% of the accounting costs

Representation of mitigation cost curves in CAPRI with zero initial implementation of a technology



C = mitigation cost per activity

mshar = vector of the level of implementation
m0 = current level of implementation
m1 = maximal possible implementation level

Assumption: m1 achieved with a relative subsidy of 120% of the accounting costs