



EMISSION REDUCTION IN FLEMISH AGRICULTURE: A FEASIBLE APPROACH ?

Workshop Madrid - 22/10/2014

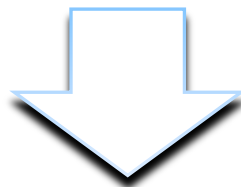
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- ❑ A few considerations ...
- ❑ Policy instruments
- ❑ Farm scale digestion ('pocket-digestion')
- ❑ Conclusions / challenges



Question workshop:

Which policies and measures should be prioritised in the agri- and horticultural sector?



*Consultations with
stakeholder*

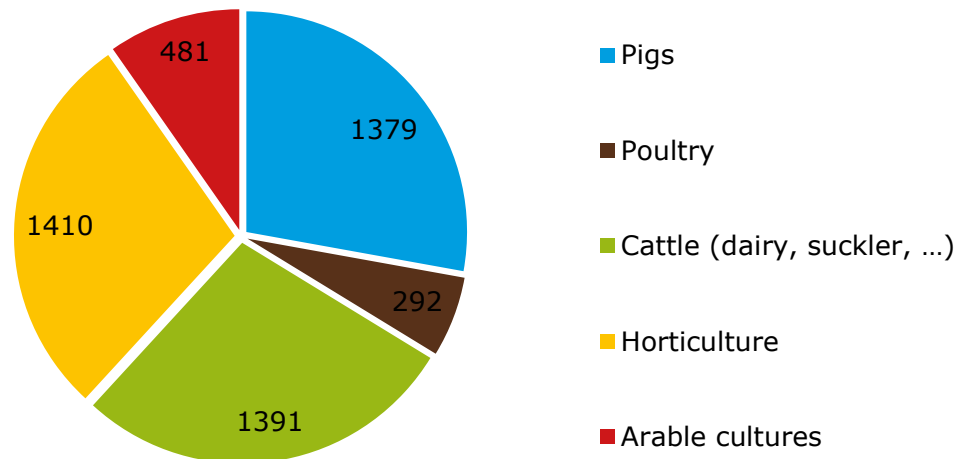
Which 'climate' measures are technically and economically feasible in the Flemish agri- and horticultural sector?

A few considerations ...

Source AMS

- Flemish agriculture sector is **very diversified**: cattle (dairy, beef), pig farming, poultry, crop production, greenhouses, ...

Turnover agriculture (+- 4,95 billion €)

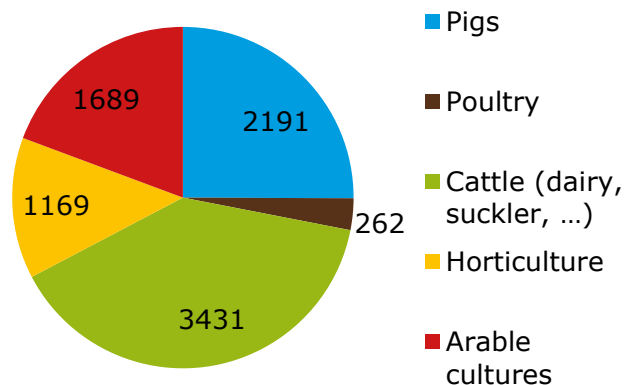


A few considerations ...

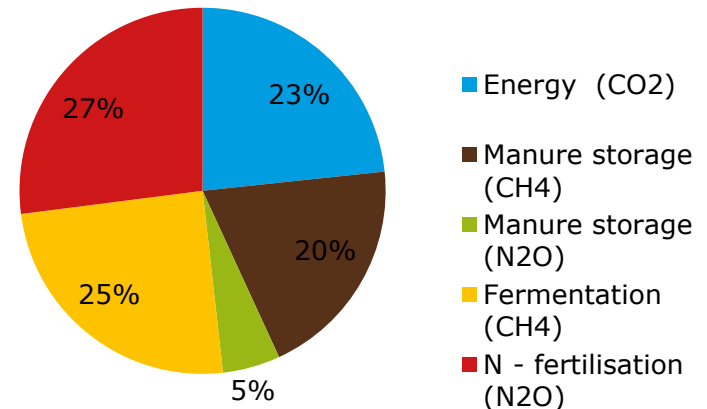
Source MIRA / VMM

- Flemish agriculture is responsible for 9 % of the total GHG - emissions (ETS + non-ETS) and **15 % of the non-ETS emissions** in Flanders

*GHG emissions (in CO₂-eq.)
in different sub-sectors*



*Distribution GHG emissions (in %) over
different agricultural practices*

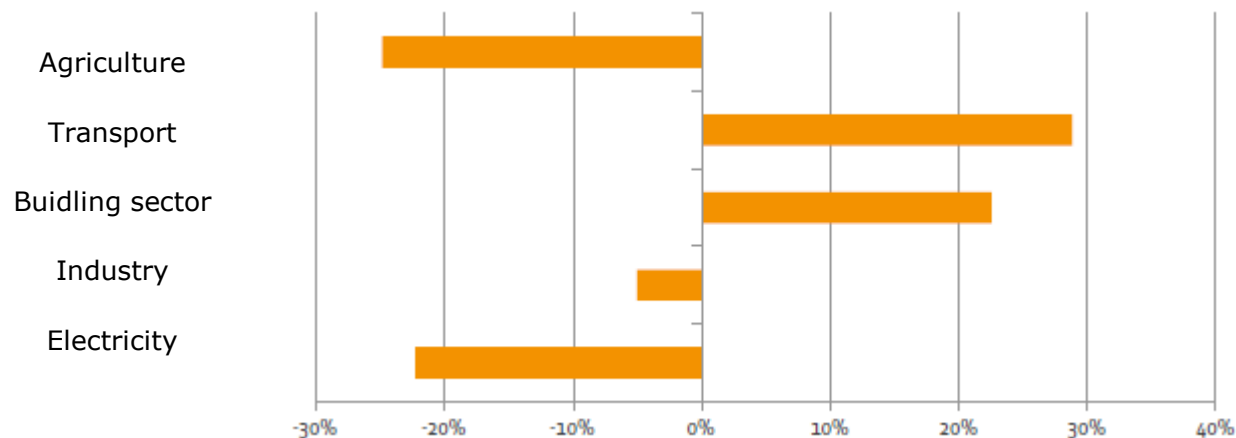


A few considerations ...

Source MIRA/VMM

- *historical advance* in GHG reductions (-23% <-> 1990) in comparison with other non-ETS sectors (transport, buildings, ...)

Evolution 1990 - 2010



A few considerations ...

□ *'trade offs' ...*

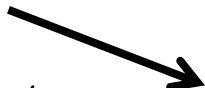
- *policies (nitrate - ammonia reduction program) -> What is the regional priority?*
- *measures ($\text{CO}_2 \leftrightarrow \text{CH}_4$; **N_2O** : $\text{NH}_4^+/\text{NH}_3 \leftrightarrow \text{NO}_3^- \leftrightarrow \text{N}_2$)*
 - *feeding strategy*
 - *optimise ratio grass (fresh, silage) / corn silage / concentrates*
 - *...*
 - *housing facilities*
 - *pasture / stable*
 - *...*
 - *fertiliser and manure management / policy*
 - *solid / liquid manure*
 - *...*

Policy instruments

□ promoting Good Agricultural Practices (GAP) by:

- consultation/information
- sensitization (*Enerpedia 2.0*)
- demonstration
- practical guides GAP

- Water
- Crop Protection
- Agriculture and Nature
- Fertigation



□ financial support for investments (*VLIF, VKF, ...*) on farm technologies !!!!!

□ ‘collateral profit ‘ from other policies:

- ✓ *Manure Action Program I to MAP V (Nitrates Directive)*
- ✓ *NH₃ - Reduction Program (NEC Directive)*
- ✓ *EPB = Energy Performance Buildings (Directive 31/2010/EC)*
- ✓ *CAP : Rural Development Program and Greening*
- ✓ ...

Support for investments on farm technology (VLIF, VKF)

Flemish Agricultural Investment Found (VLIF)

(new method in 2015!)

- ~~co-generation (greenhouses)~~
- insulation
- ~~photovoltaic~~
- wind (farm scale)
- heat pumps
- heat recovery
- digestion (farm scale) !
- AEA - stables
- fertigation (N)
- biomass
- ...

Flemish Climate Found (VKF)

- Farm scale digestion
- Enerpedia 2,0 (consultancy project)
- Pilot: heat distribution grid (low level heat) from a waste incinerator to a greenhouse complex (20 ha)

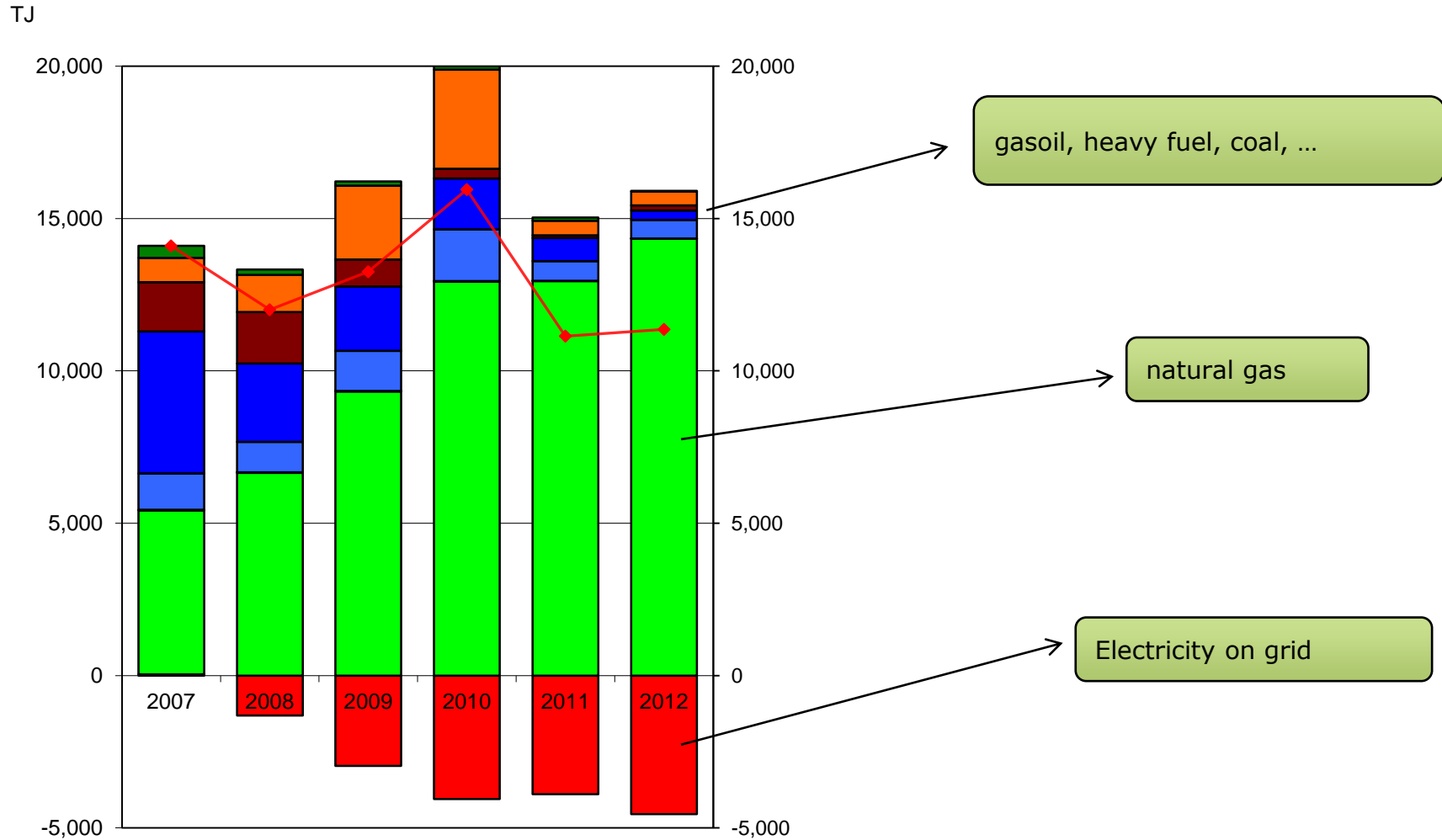


- 15,000 tons
eq. CO₂



Energy shift in agriculture (2007-2012)

Source: AMS



Manure digestion in Flanders

Source Biogas-E

- 2013: 580,000 ton manure digested (only 2,4%)
- +/- 30 'large' scale installations (+/- 300 kWe -> 1 MWe)
- 65 'farm scale' or 'pocket' installations on (dairy) farms (10 kWe, ...)
- 'theoretical' potential (5-10 m³ methane/ton manure) = ?

8,5 million tons
pig manure

16 million tons
cattle manure



'Farm scale' or 'pocket' digestion

Source Inagro, Bioelectric

- *co-generation (stirling motor):*
 - *10 kWe ... 30 kWe ... 100 kWe ...*
 - *$R_{elec} = 35\%$, $R_{heat} = 45 - 55\%$*
 - *$P_{elec} = +/- 70,000 \text{ kWh}$, $P_{heat} = +/- 105,000 \text{ kWh}$*
- *1 installation = 85 dairy cows = +/- 2,500 m³ manure*
- *+/- 100% (fresh) manure, limited amounts of biomass (f.e. organic waste)*
- *potential: 280.000 dairy cows => 8,4 million m³ manure => 3,500 installations (10 kWe) = 35 MWe and 45 - 55 MWh*
- *investment for (dairy) farms (+/- 100.000 - 150.000 €)*
- *corresponding investments in housing facilities (manure scraper, closed floor, silo for digested manure, ... to reduce more CH₄-emissions*

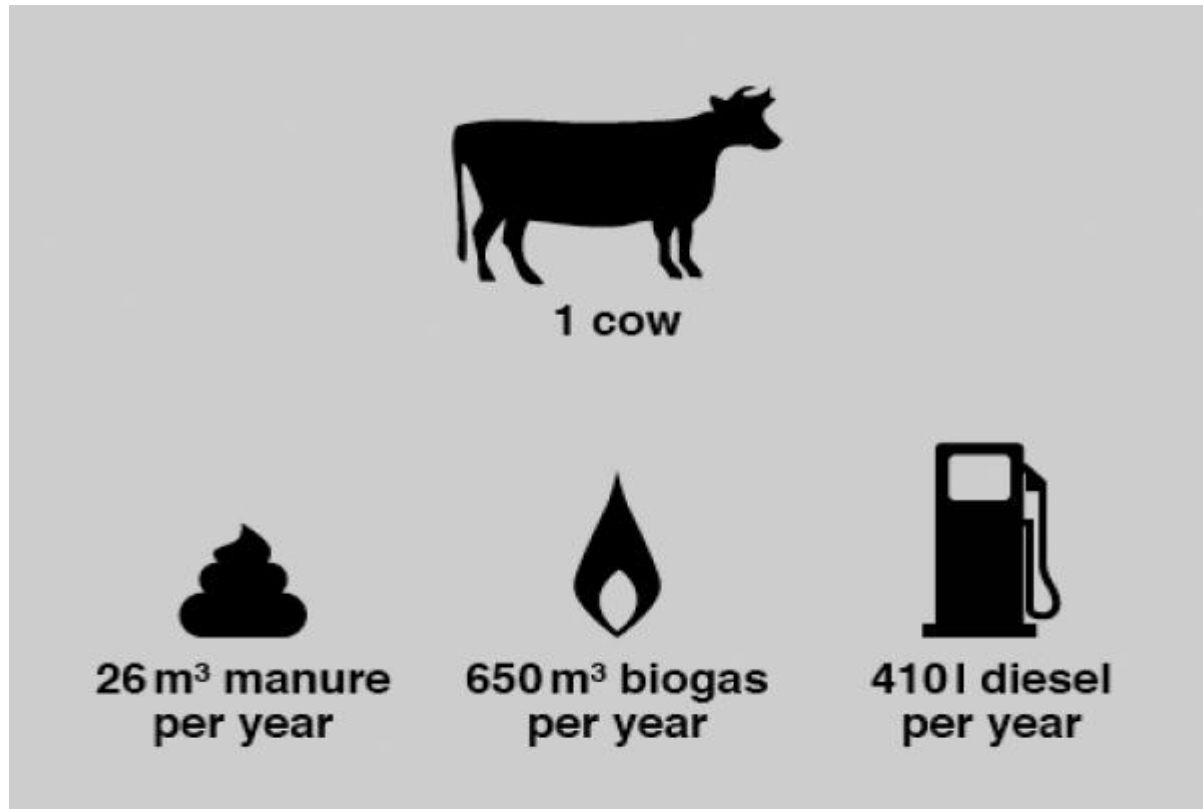
Farm scale digestion: a good climate measure?

Source Inagro, Biolectric



Farm scale digestion: a good climate measure?

Source Bioelectric



Not only renewable energy, but also less CH₄ - and N₂O-emissions !!!

Potential of GHG - reduction (digestion on dairy farms) in Flanders ?

- 280.000 dairy cows

Classic manure storage

- 50 kg CH_4 /cow and year (IPCC, Tier 2)
- 280.000 dairy cattle
- + 322,800 ton CO_2 -eq.



Farm scale digestion

- (1) 8,4 million m^3 manure
10 m^3 CH_4 / m^3 manure
+ 56,100 ton CO_2 -eq.
- (2) Renewable electricity ($E_{power} = 0,35$):
35 MWe ~ 245,000 MWh
- 122,500 ton CO_2 -eq.
- (3) Renewable heat ($E_{thermal} = 0,45$):
45 MWth ~ 315,000 MWh
- 63,000 ton CO_2 -eq.



Net result (ref. = natural gas):

- 452, 200 ton CO_2 -eq.
- 1,6 ton CO_2 -eq./ dairy cow

Strenghts and weaknesses

Strenghts

- 'farm scale' renewable heat- and electricity production
- acceptable payback time (12 -14 years)
 - ✓ organic matter manure (2 - 10%)
 - ✓ marketprices electricity and heat
 - ✓ $P_e = + - 50 \text{ €/MWh}$
 - ✓ $P_e = + - 140 \text{ €/MWh}$
 - ✓ $P_h = + - 75 \text{ €/MWh}$
 - ✓ financial support (certificates):
 - ✓ $GSC = 110 \text{ €/MWh}$
 - ✓ $WKC = 31 \text{ €/MWh}$
- reduction GHG = 1,4 - 3,5 ton CO_2 - eq. / cow (dairy)
- limit transportation of manure
- simple construction - limited building permission (NIMBY)
- no or limited use of 1^e generation biomass
- fertilser value of digested manure is better then 'fresh manure'

<10 kW



Weaknesses - challenges

- fresh manure -> extra investments in housing facilities, manure storage -> ...
- real GHG- reduction ?
- start-up problems ?
- housing of cattle:
 - ✓ open or closed?
 - ✓ manure treatment and storage?
 - ✓ effect on NH_3 , NO_3^- , ...?
- research is still required:
 - ✓ optimalsation fermentation -> pig farms?
 - ✓ heat use is not optimal
 - ✓ fertiliser value of digested manure
 - ✓ ...
- adaptation legislation:
 - ✓ 'solid' renewable energy policy
 - ✓ digested manure -> green fertiliser

Farm scale digestion: residual organic streams (endive racines)

Source INAGRO



Conclusions - challenges

- ❑ *Climate problem is difficult to understand for farmers !*
 - => measures *technically and economically feasible !* -> farm scale initiatives !
- ❑ *Important interaction (+ or -) with other policies*
 - => kwantification GHG - effect 'collateral profit' (more research)
- ❑ *Promoting Good Practical Measures (GAP) -> efficient use of materials (fertilisers, energy, ...)*
- ❑ *Financial support (technology) is important via:*
 - ❑ *Flemish Agricultural Investment Found (VLIF)*
 - ❑ *Flemish Climate Fund (VKF) ?*
 - ❑ *Renewable Energy Policy*
 - ❑ *...*
- ❑ *Research: feeding strategy livestock, ...*
- ❑ *Conditions for incorporation in the national inventory*
- ❑ *....*

Time for questions?



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