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Special

# Cows and pigs for sale!?

## Assessing the side-effects of low carbon transition pathways in livestock farming in the Netherlands

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### TRANSrisk project

The objective of TRANSrisk (www.transrisk-project.eu) is to explore low emission transition pathways and analyse the possible associated risks. A key feature of TRANSrisk is that it brings together quantitative techniques (such as models) and qualitative approaches (such as participatory consultations with stakeholders). This combined approach enables identification of possible low emission transition pathways which are technically and economically feasible, and acceptable from a social and environmental viewpoint.

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

Are you a stakeholder involved in agriculture, livestock, manure management or bioenergy? Feel free to join the discussion and share your thoughts and insights with the TRANSrisk project. For more information, please contact Eise Spijker of JIN Climate and Sustainability (eise@jin.ngo).

## Livestock transition pathways

Within the TRANSrisk project one of the Dutch case studies focuses on low-carbon transitions in the livestock sector. The first transition pathway considers Integrated Manure Management (IMM). IMM combines a set of technologies including stable and floor systems, manure handling-storage systems, anaerobic digesters as well as manure/digestate treatment (possible configuration shown in Figure 1).

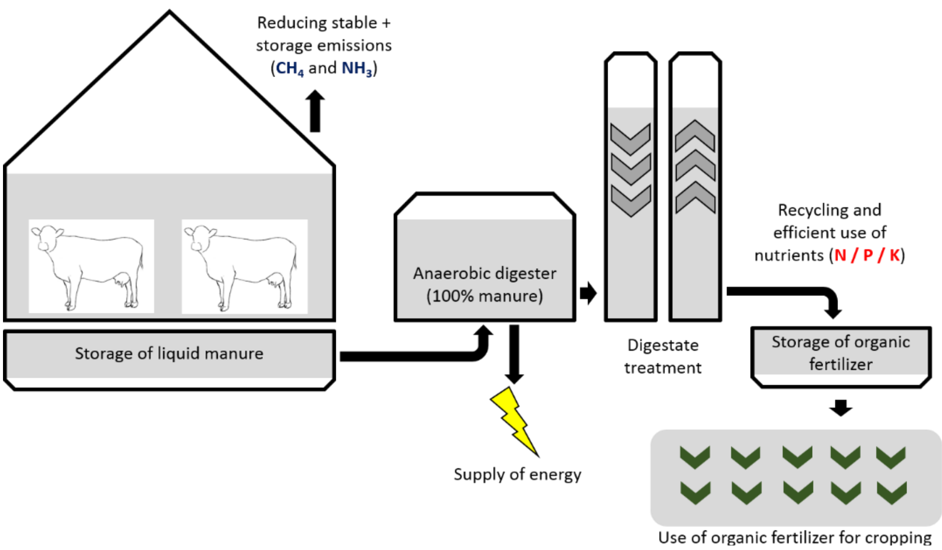


*Figure 1. IMM as a low-carbon transition pathway in the livestock sector*

IMM results in the production of biogas and organic fertilisers, while reducing emissions of methane ($CH_4$) and ammonia ($NH_3$). An alternative to IMM is a reduction of animal numbers in the sector. This second transition pathway could achieve a similar (not identical) environmental performance as with IMM.

While deliberately decreasing or limiting the size of the important livestock sector in the Netherlands (≈3% of GDP) may seem odd, there are clear signals that a decline of livestock farming is upcoming.[1,2] In recent years, societal concerns and environmental impacts have increased in parallel with the growth and industrialisation of the sector. This occurred in an extremely livestock-dense region (Figure 2). Limiting further growth of the sector to mitigate the existing health, safety and/or environmental risks, hardly seems sufficient knowing that a substantial reduction of various impacts is needed. In this case

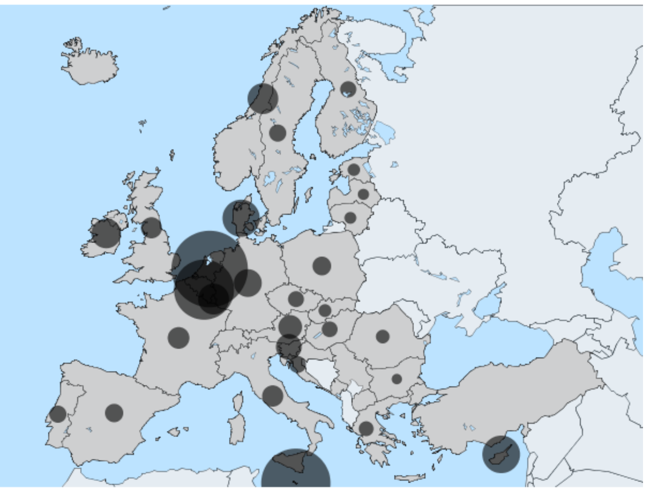

*Figure 2. Livestock density in the EU-28 in 2013 in livestock units per ha. Source: Eurostat (2015).*

study a reduction of livestock (RL) is considered to be a realistic alternative low carbon transition pathway.[3,4]

## Environmental targets

Table 1 shows key environmental targets relevant for the livestock sector. It also shows the current status of achievement for the 2020-30 targets. As agriculture is the sector with the highest emissions of $CH_4$ and $NH_3$ (resp. 67% and 87% of national total) it is to be expected that a significant share of the required mitigation burden will fall on its subsector - livestock. With regards to phosphate excretion, the Dutch livestock sector is producing considerably more manure (i.e. nutrients) than is allowed to be spread on agricultural soils under the EU Nitrates Directive. On the short term (2020), meeting the $NH_3$ emissions and phosphate excretion targets appear to be most problematic. In the run up to 2030, it is also likely that reducing $CH_4$ emissions from livestock will become more urgent. On the positive side, manure digestion can significantly contribute to the production of renewable energy.

## Scoring of pathways

Both low-carbon transition pathways (IMM and RL) can be 'scored' in terms of their contribution to meeting these environmental targets. The IMM pathway positively contributes to reducing $CH_4$, $CO_2$ and $NH_3$ emissions, and increases the production of renewable energy, while it has a neutral effect on the excretion of nutrients. The RL pathway results in reduced emissions of $CH_4$, $NH_3$, as well as reduced excretion of phosphates and nitrogen. On top of these environmental effects both pathways also have a number of other socio-economic and environmental side-effects (Table 2). The RL pathway would result in a direct loss of GDP as meat and dairy output decreases substantially, while the IMM pathway could be considered more suitable for animal health as the in-stable climate improves due to shorter manure storage times. The RL pathway could also lead to a lower level of international cost-competitiveness of the Dutch agricultural sector (i.e. cropping), as at some point a shortage of cheap soil nutrients might arise. This could result in higher use of fossil fertilisers and cover crops. Also in terms of domestic employment both pathways have a different impact.

## Next steps

The next step within the TRANSrisk project is to quantify these (and other) effects in Table 2with the help (macro-)economic models and to further explore the relative importance of these side-effects when it comes to implementing a certain low-carbon transition pathway. With a better understanding of the key side-effects of alternative pathways it will be easier to develop a more robust and integrated policy framework to foster a low-carbon transitions in the livestock sector.

*Table 1. An overview of key national/sectoral environmental targets relevant for the agricultural sector in the Netherlands*

| Target | Current (year) | 2020 | 2030 | Unit | Policy framework |
|---|---|---|---|---|---|
| Renewable energy | 5,80% (2015) | 14% | 27%* | Gross final energy | EU Climate & Energy Framework |
| Non-ETS | 98,1 (2014) | 111,6 | -40%# | Mt $CO_2$-eq. | Effort Sharing Decision |
| Non $CO_2$-in agriculture | 19 (2014) | 16 | - | Mt $CO_2$-eq. | Agro Covenant |
| Air – ammonia (national) | 134 (2014) | 128 | 120 | Kt | Clean Air Policy Package |
| Phosphates (national) | 176,3 (2015) | 172,9 | - | Mln. kg | Nitrates Directive |
| Phosphates (dairy sector) | 86,1 (2014) | 84,9 | - | Mln. kg | Dairy sector Covenant |

**At the EU level. National targets are not foreseen.*

*# EU level target for GHG is -40%, but an effort sharing decision with national targets for the Non-ETS sectors at the member state level is foreseen.*

Sources: www.emissieregistratie.nl and CBS for current energy and environment data & EU Directives and sector covenants for quantitative targets 2020/2030

*Table 2. Overview of (side-)effects of transition pathways*

| Contribution to target | IMM | RL | Remark |
|---|---|---|---|
| **Renewable energy** | | | |
| PJ | + | 0 | **IMM** - Manure digestion = biogas |
| **GHG emission reduction** | | | |
| $CH_4$ – enteric fermentation | 0 | +* | **IMM** - Does not reduce enteric fermentation |
| $CH_4$ – manure management | + | +* | **IMM** – Reduces $CH_4$ emissions from manure storage<br>**RL** - Less livestock = lower manure excretion = less manure stored |
| $CO_2$ – avoidance of fossil fuel | + | 0 | **IMM** - Due to biogas production<br>**RL** – Smaller sector might result in lower use of fossil energy |
| **Ammonia emissions** | | | |
| Stables & storage | + | + | **IMM** - Improves in-stable air quality (shorter manure storage times) |
| Application to soil | 0 | + | **IMM** – Use of organic fertiliser/digestate does not seem to significantly change $NH_3$ emissions on land relative to RL where untreated manure is used<br>**RL** – national $NH_3$ emissions on land reduce due to lower manure use |
| **Nutrient excretion** | | | |
| N | 0 | + | **IMM** - only changes manner in which N and P become available |
| P | 0 | + | **RL** - will immediately result in lower excretion of N and P |
| **Possible side-effects[5]** | **IMM** | **RL** | **Remark** |
| Domestic availability of 'cheap' soil nutrients | - | - | **IMM** – does not change absolute production levels of soil nutrients, but is likely to increase costs for fertilisation relative to use of untreated animal manure<br>**RL** – When scarcity on manure market arises alternative, more expensive means of fertilisation needed (e.g. increase fossil fertilisers and more intermediate/cover crops for organic matter)<br>In both cases, this might could affect competitiveness of NL agricultural sector |
| Animal health – air quality | + | 0 | **IMM** - stimulates short manure storage times (increases biogas yield), which helps to improve in-stable climate |
| Animal health – use of antibiotics | + | +* | **IMM** - Quality standards for using organic fertilisers likely to include max. pharmaceuticals concentrations<br>**RL** – in absolute terms use of antibiotics in NL would reduce |
| Animal welfare – grazing time (cattle only) | 0 / - | + / - | **IMM** - is likely to increase cost of production, hence, when a farmer has committed to IMM there is an incentive to capture most manure to be fed into the process (could reduce grazing time to legal minimum)<br>**RL** – Implies more hectares grazing land per animal, and could increase grazing time per animal. However, it has to remain economic to retain same amount land for grazing/roughage production |
| Animal welfare – stable space | + | 0 | **IMM** – Requires investments in innovative stable systems, which is mostly done in relation to mayor refurbishments that are likely to ensure more spacious stables<br>**RL** – Implies consolidation/reduction of livestock sector investments, hence is less likely to foster investments in more innovative stable systems |
| Human health | + | +* | **RL** - Does not guarantee that human health effects are properly tackled (it does reduce intensity and probably reduce significance of overall risk)<br>**IMM** - controlled IMM processes provide an ideal background for better sanitisation and overall hygiene |
| International competitiveness livestock sector | - | - | **IMM** – cost of production likely to increase, which might be offset by sustainability price premium on products (or a government subsidy), but this premium is not certain in international competitive markets (and with state aid regulations) |
| Impact on GDP | + / - | - | **IMM** – has potential to increase domestic investments in IMM activities, could result in lower imports of food products and (renewable) energy, and export of organic fertilisers, but could be mitigated by loss of market share in export markets for animal protein<br>**RL** – smaller sector results in less feed imports, but also could reduce size of animal feed industry and reduces exports of food products and increases imports of food products, can have negative effect on NL food processing industry. |
| Employment | + | - | **IMM** – employment levels likely to remain stable (or slightly increase) due to operation and management needs of IMM facilities, only when (inter)national demand pays a good price for more sustainable animal proteins<br>**RL** – employment levels likely to decrease in, directly in livestock farming, but also in associated (sub-)sectors such as food processing |

Symbols indicate (+) positive, (-) negative, (+/-) uncertain/unknown or (0) neutral/insignificant effect of the low carbon transition scenario.
*Provided that this does not lead to replacement of same livestock practices to other regions in the world (i.e. 'leakage').

Source: TRANSrisk project / JIN Climate and Sustainability, 2016

### *Notes*

[1] In a letter (7 July 2016) publishing a report regarding the human health risks related to livestock farms the Dutch Cabinet announces to submit the legislative proposal 'animal numbers and public health' (*Wetsvoorstel dieraantallen en volksgezondheid*) to the 2nd Chamber. This legislative proposal – which already dates back from 2014 - would enable the Dutch provinces to assign areas where the total animal numbers can be maximised/limited.

[2] In the run up to the implementation of the (new) quota system for so-called phosphate production rights already in 2017, during the first half of 2016, already 63.000 more (mainly dairy) cows have been brought to slaughterhouses in the first half of 2016 relative to the same period in 2015.

[3] Preliminary (own) calculations suggest that swine and dairy cattle stocks might need to be reduced by a maximum of 40% in order to meet the national 2030 target for $NH_3$ emissions and that might lead to about 1% decrease in Dutch GDP that is equal to the current economic growth in Netherlands.

[4] Other low carbon transition pathways are also possible. In this case study only the IMM and RL pathways are considered.

[5] List of side-effects is non-exhaustive. Other side-effects to consider are 1) $N_2O$ emissions, 2) rural development, 3) technological innovation, etc.