

# Livestock farming and GHG emissions reductions in Ireland



**Trevor Donnellan**

Economist

Teagasc

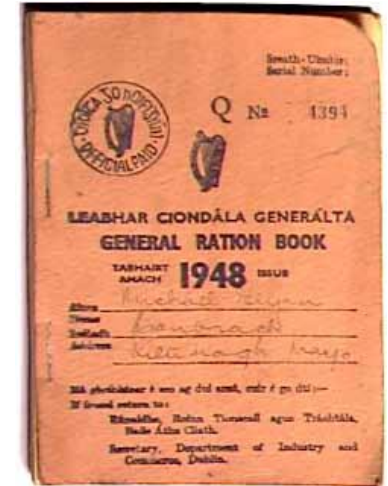
[trevor.donnellan@teagasc.ie](mailto:trevor.donnellan@teagasc.ie)

# Content

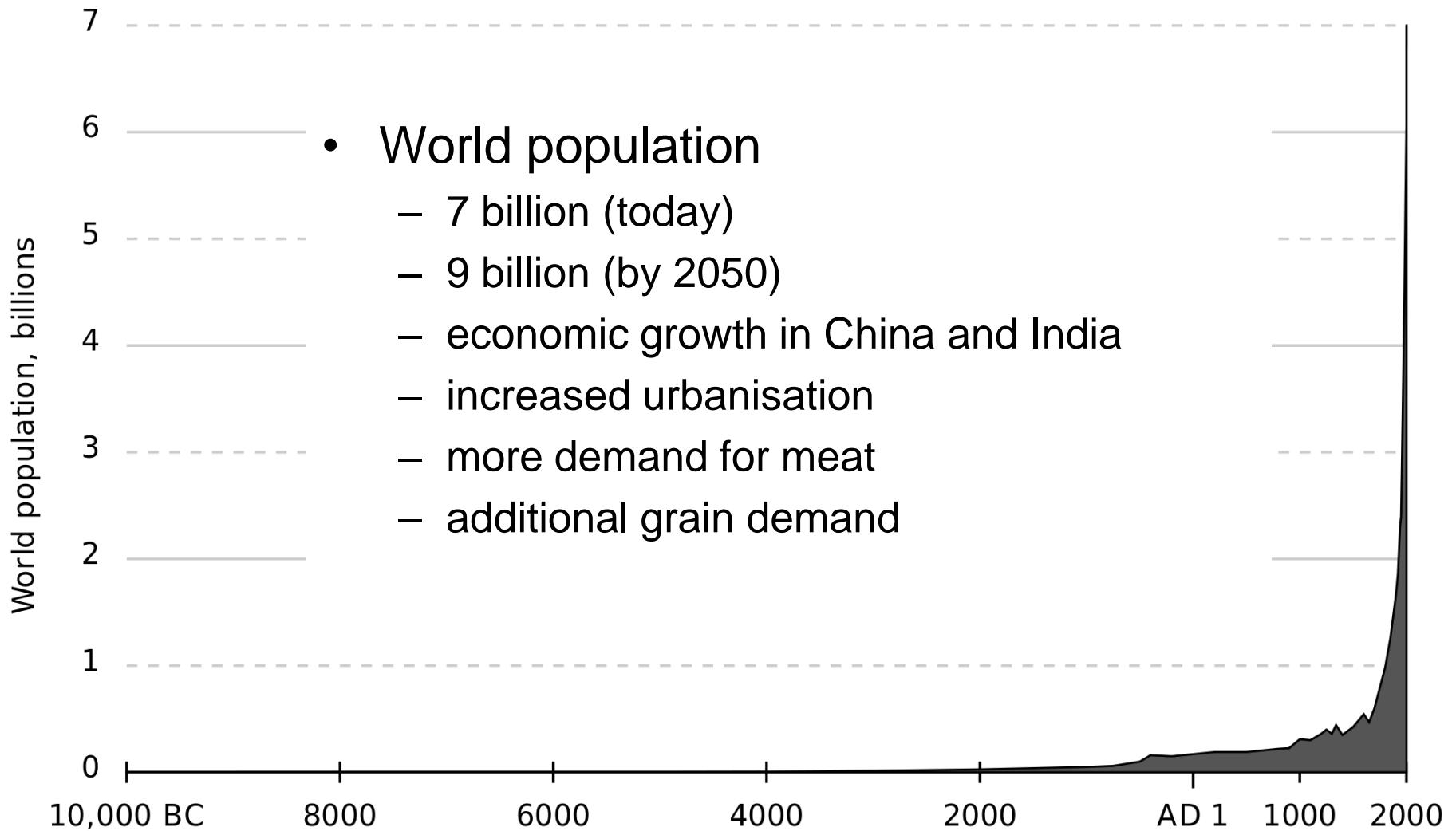
- **GHG emissions from Agriculture in EU**
  - With focus on Ireland
- **Mitigation Strategies**
- **Mitigation Measurement**
  - Developing MAC Curves for agricultural GHG abatement
  - IPCC vs LCA
- **Lessons for incentivisation of abatement in agriculture**
- **Complementary Strategies**
  - Addressing Food waste
- **Conclusion**

# 50 Years of Food Production

- **Post World War II**
  - Food rationed - farmers urged to produce more
  - Investment in agricultural research
  - Strong government support for agriculture
- **By 1980s**
  - Dramatic progress in food production
  - Milk lakes and grain mountains in EU
  - Caps on production in some sectors
- **1990s**
  - Disengagement from agriculture (sunset industry label)
- **Today**
  - Demographic pressures, competition from biofuels, environmental constraints, climate shocks, low stock levels, price volatility

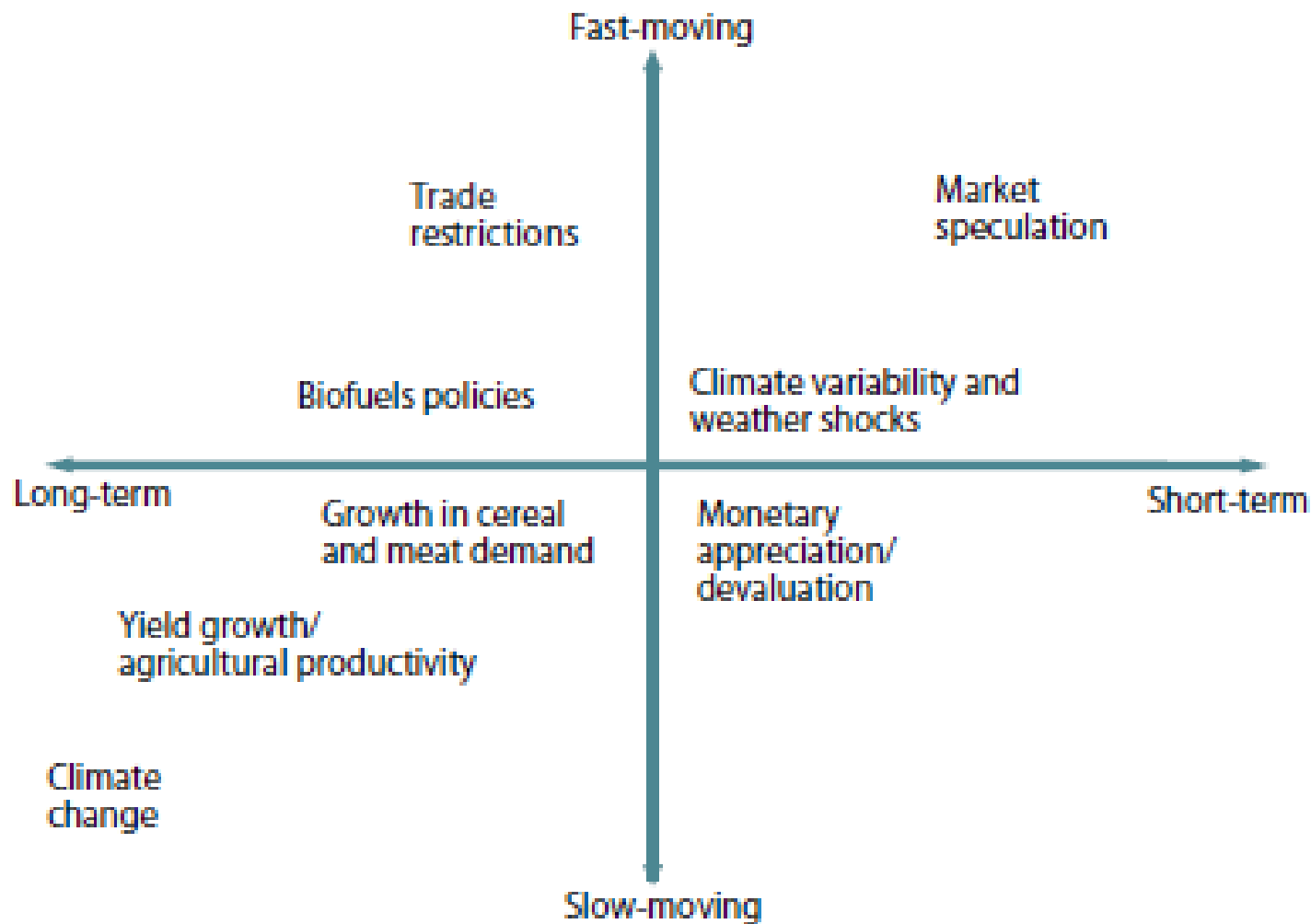


# The Demographic Challenge



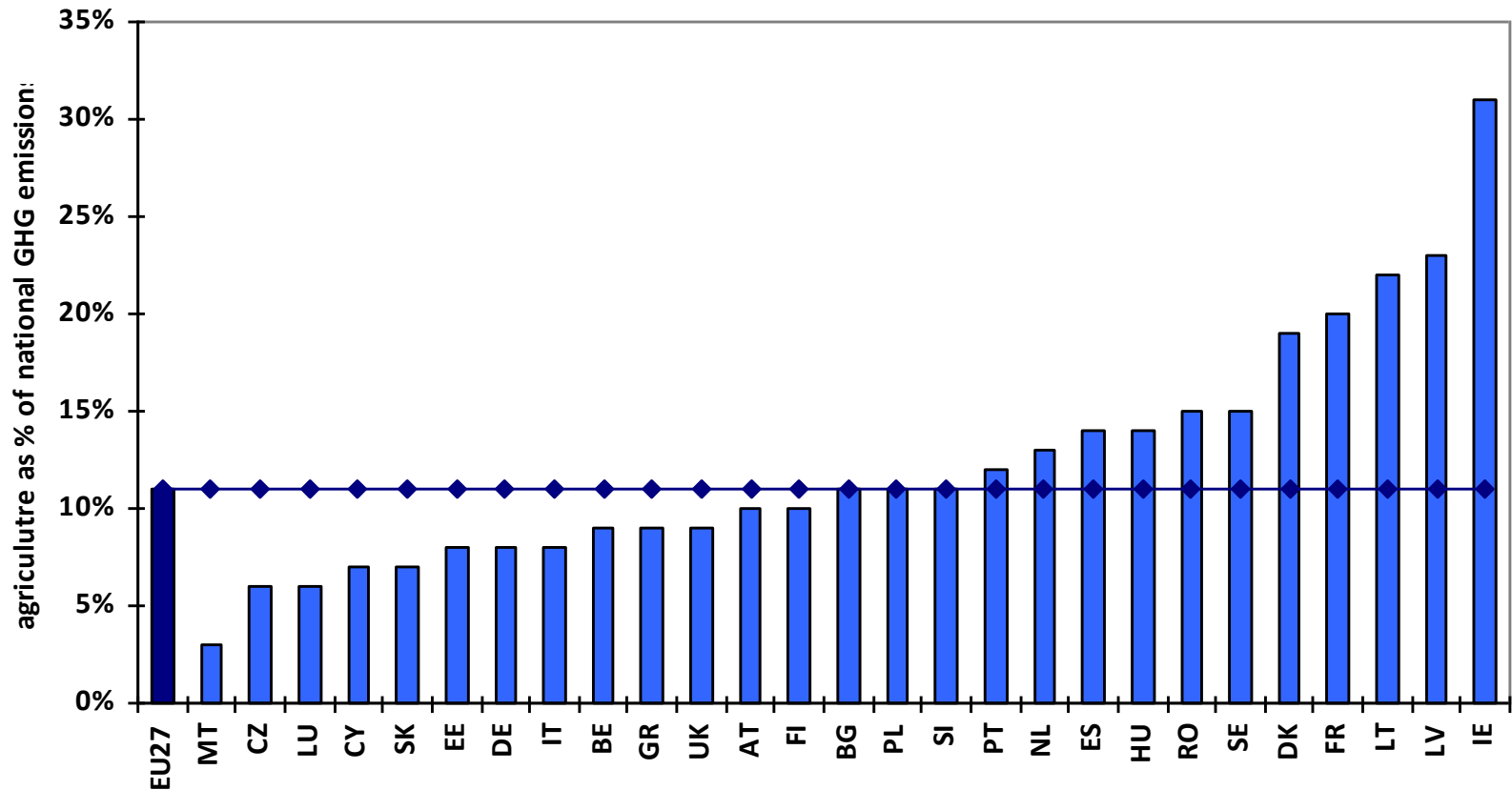
- World population
  - 7 billion (today)
  - 9 billion (by 2050)
  - economic growth in China and India
  - increased urbanisation
  - more demand for meat
  - additional grain demand

# Wider Challenges for Agriculture



Source: Looking ahead at World Food and Agriculture Perspectives to 2050

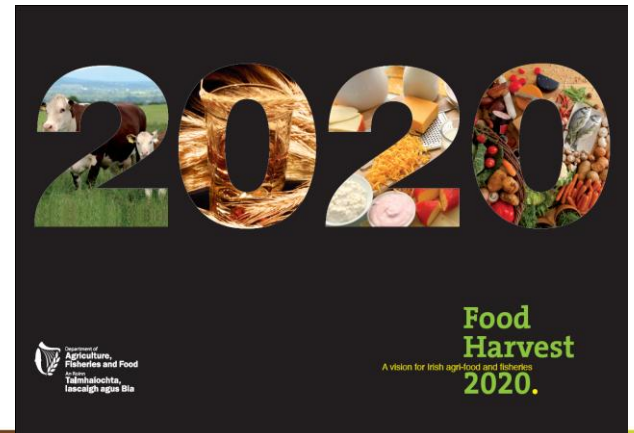
# Proportion of GHG emissions from agriculture in EU Member States in 2010



Source: European Environment Agency, Greenhouse Gas Data Viewer

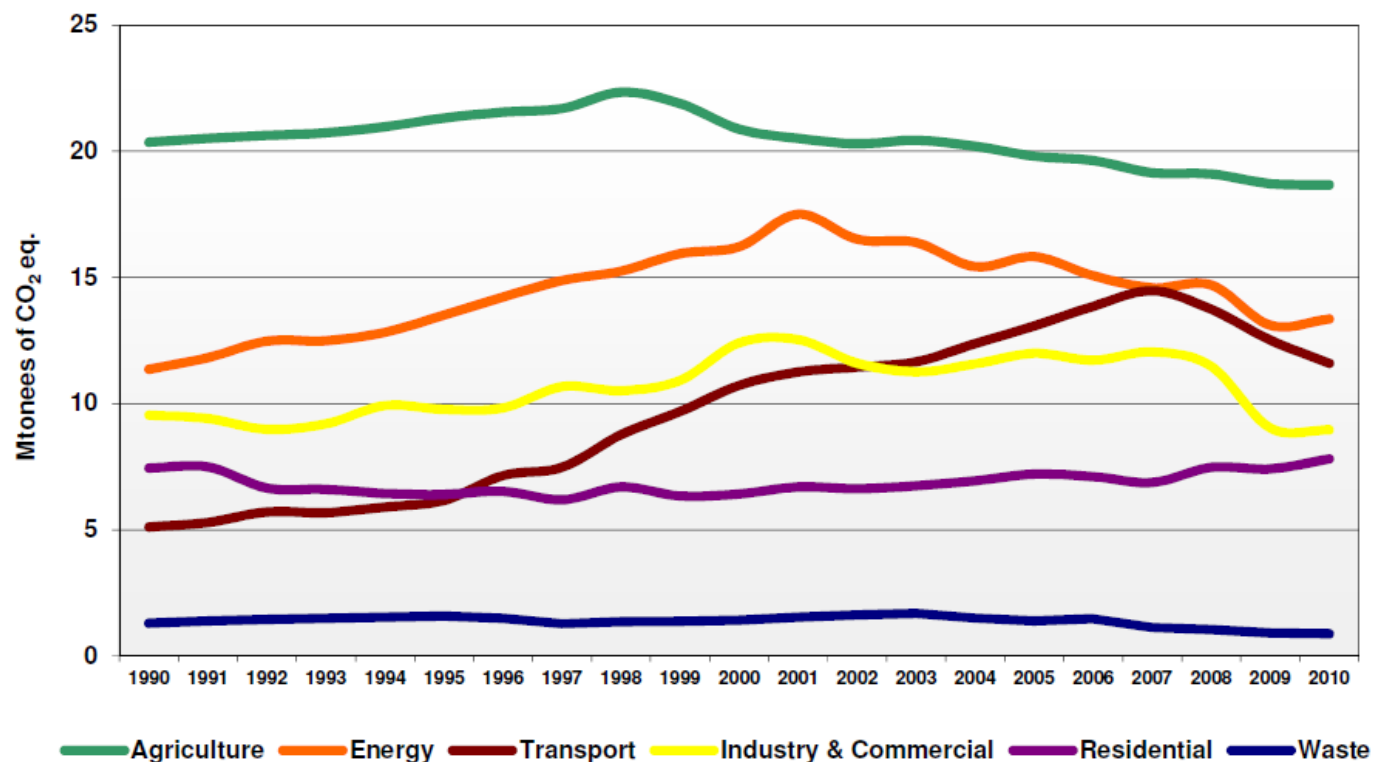
# EU Emission Reduction Commitments

- **EU has committed itself to GHG reductions to be achieved by 2020**
  - Individual emissions targets for each EU Member State
- **Irish GHG reduction target of 20%**
  - Agriculture 43% of non-ETS emissions in Ireland
  - Desire to increase agricultural production in Ireland
  - Exploit removal of EU milk quota
  - Ireland 90% grassland
  - Ruminant agriculture dominates



# Trends in Irish GHG Emissions by IPCC Sector

## Trends over time



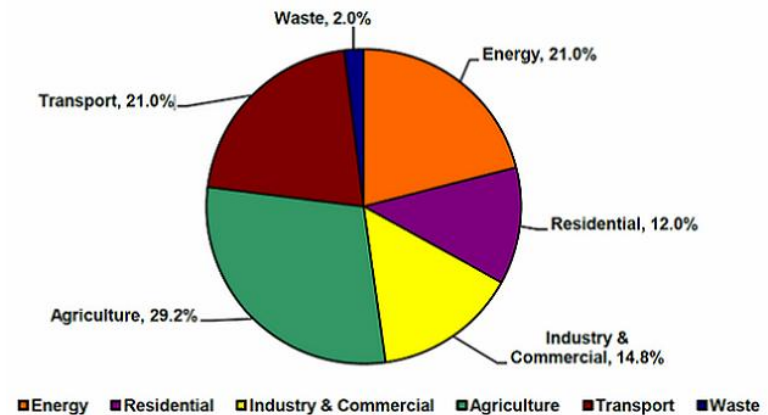
Source: EPA, 2012

[www.epa.ie/downloads/pubs/air/airemissions/GHG\\_1990-2010\\_Provisional\\_2012.pdf](http://www.epa.ie/downloads/pubs/air/airemissions/GHG_1990-2010_Provisional_2012.pdf)



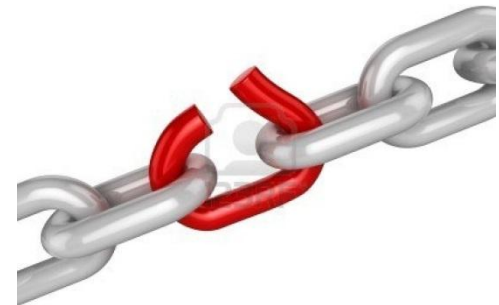
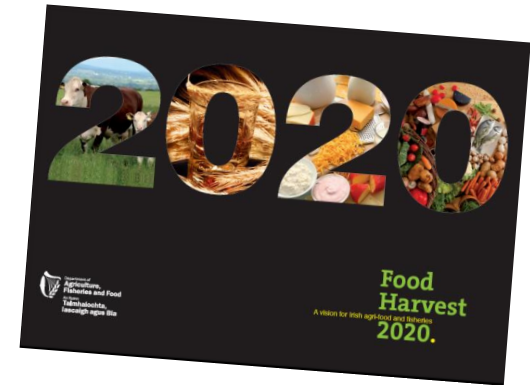
# Irish Agriculture and GHG Emissions

- **Highly export focused**
  - making contribution to food security
- **Largely based on bovine livestock**
  - milk and beef exports dominate
- **But sector at farm level generates:**
  - 30% of Ireland's GHG emissions
- **National GHG emissions**
  - must be cut by 20% by 2020 (relative to 2005)



# Future GHG Emissions and Irish Agriculture

- **Ambitious growth targets to 2020**
  - Food Harvest 2020
  - milk, beef, sheep & pig meat production
- **More production will imply more emissions**
  - Unless emissions can be decoupled from production
  - This means reducing substantially the emissions per unit of product produced



# Adoption of mitigation strategies is constrained by several factors

- **Biophysical environment (technical potential)**
  - Manure cannot be applied to all soils at the start of the growing season
- **Cost (economic justification)**
  - Measures which cost too much make no sense
- **A Marginal Abatement Cost (MAC) curve can be developed to reflect these constraints**
  - Measures the cost and abatement potential associated with each measure
  - Based on national research on mitigation measures

# Different Metrics

- **GHG emissions measured in multiple ways**
- **IPCC approach**
  - sectoral basis (farm level only)
  - measured in aggregate
  - confined to territorial boundary
  - narrow definition
- **LCA approach**
  - multi sectoral basis (from farm to fork)
  - measured per unit of output
  - no territorial boundary
  - wide definition
- **Different approaches creates different incentives to address emissions**

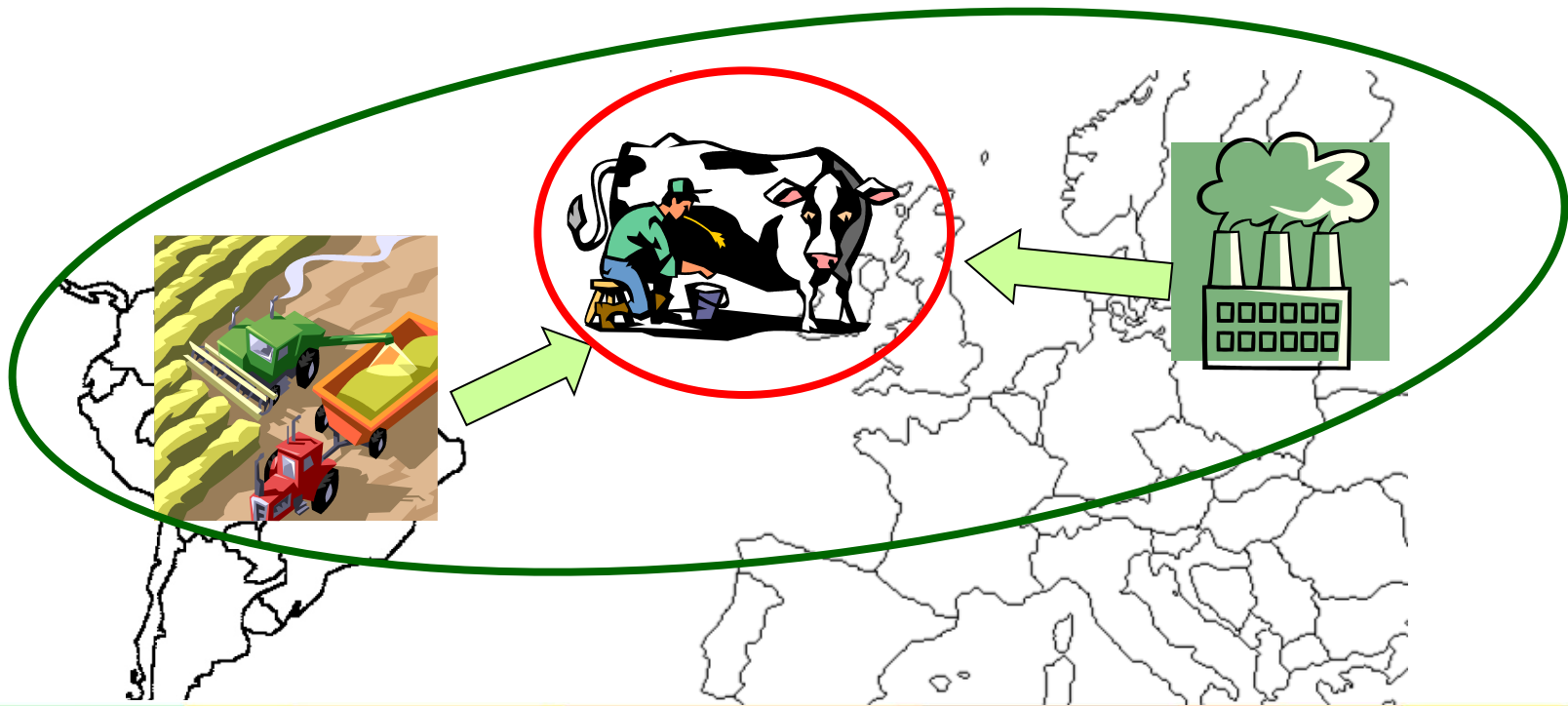


**Intergovernmental Panel on Climate Change (IPCC)**



# IPCC vs LCA Approach

- **Life Cycle Assessment (LCA):** “real abatement potential”
- **Inventory methodology (IPCC):** “accountable potential”



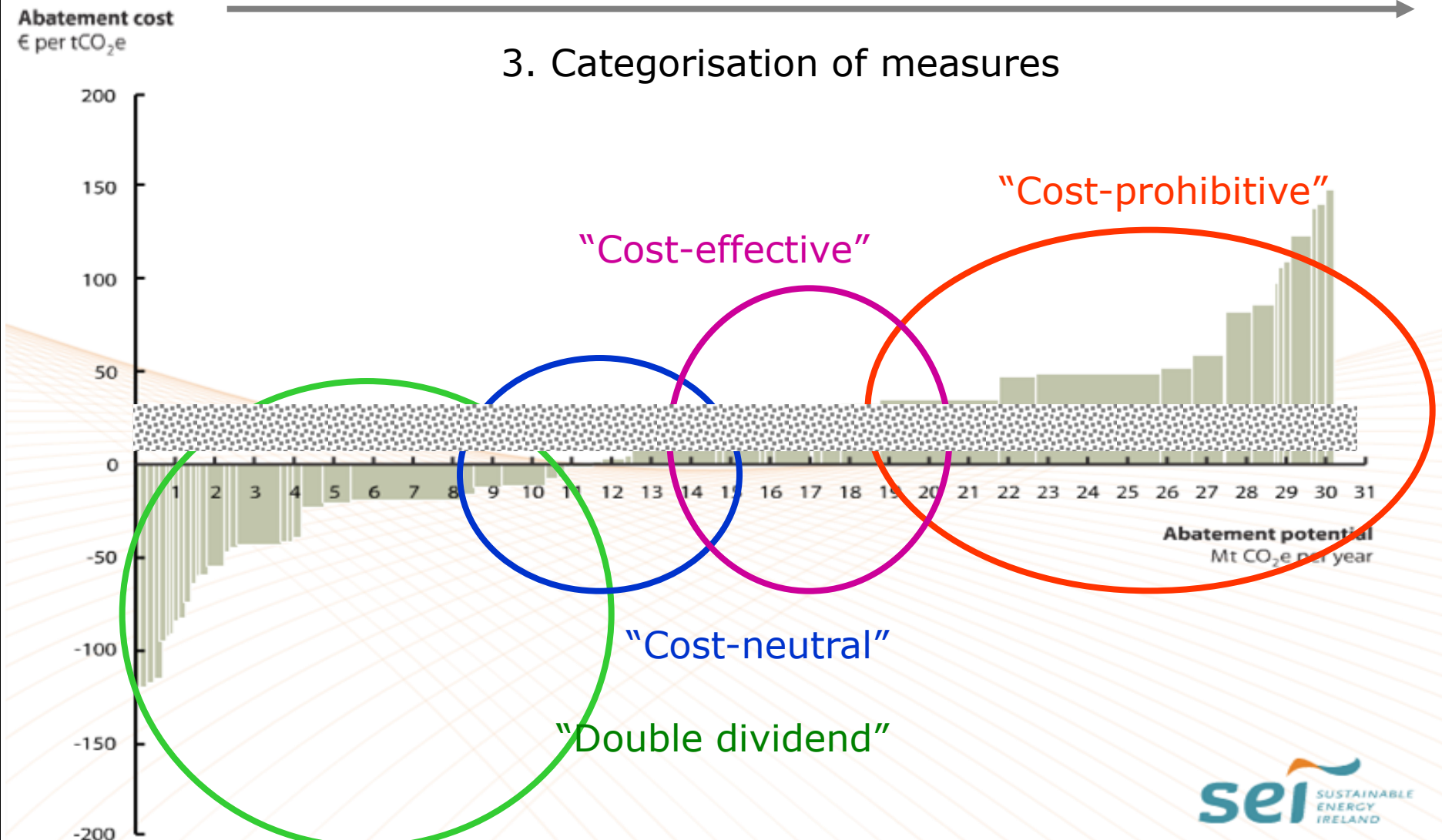
1. Order of magnitude



2. Ranking of measures



3. Categorisation of measures



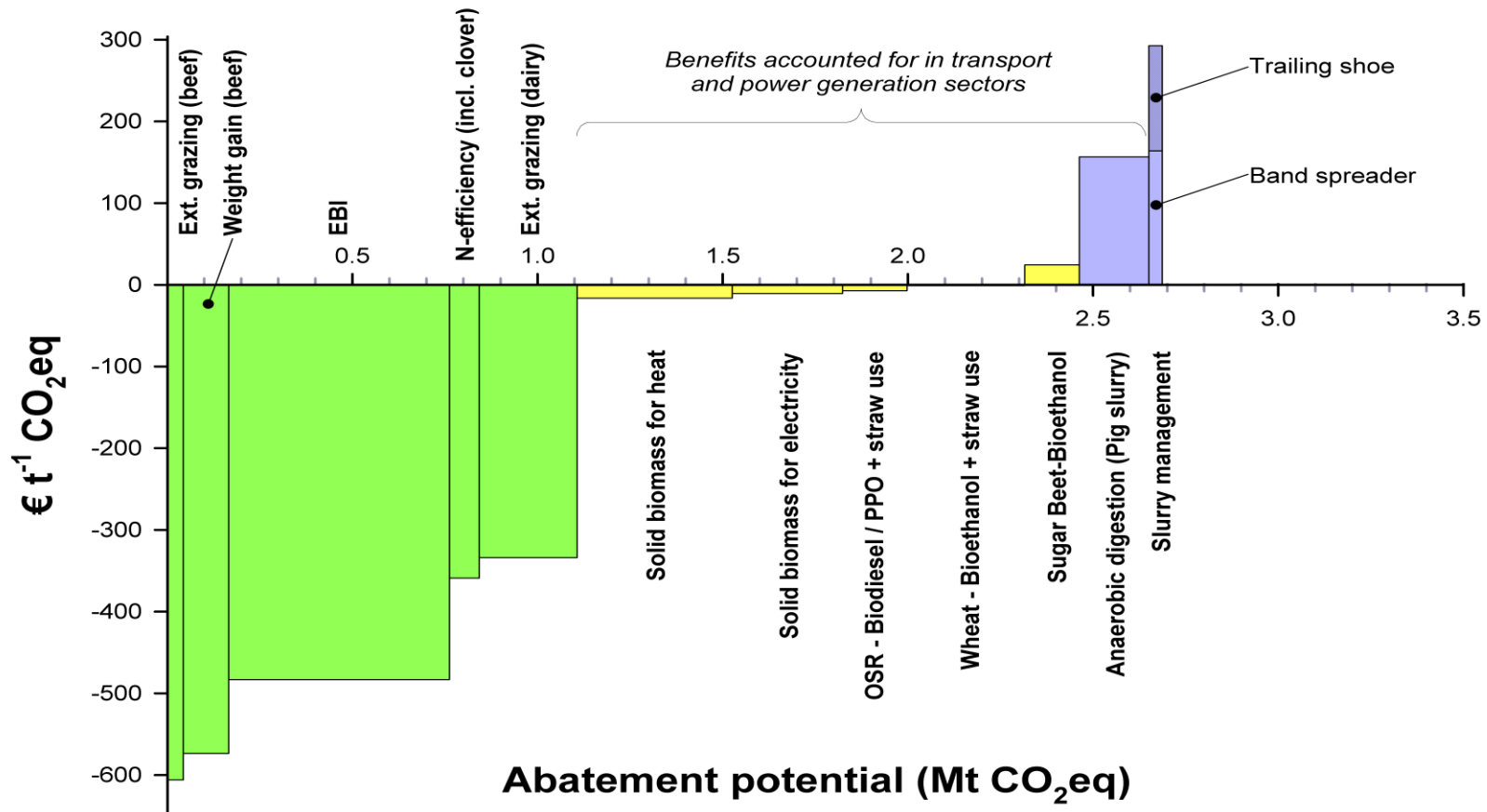
Source: Motherway & Walker, 2009  
[www.seai.ie/Publications/Low\\_Carbon\\_Opportunity\\_Study](http://www.seai.ie/Publications/Low_Carbon_Opportunity_Study)



# Results IPCC

## Approach for Irish Agriculture

### Marginal Abatement Cost Curve (IPCC)



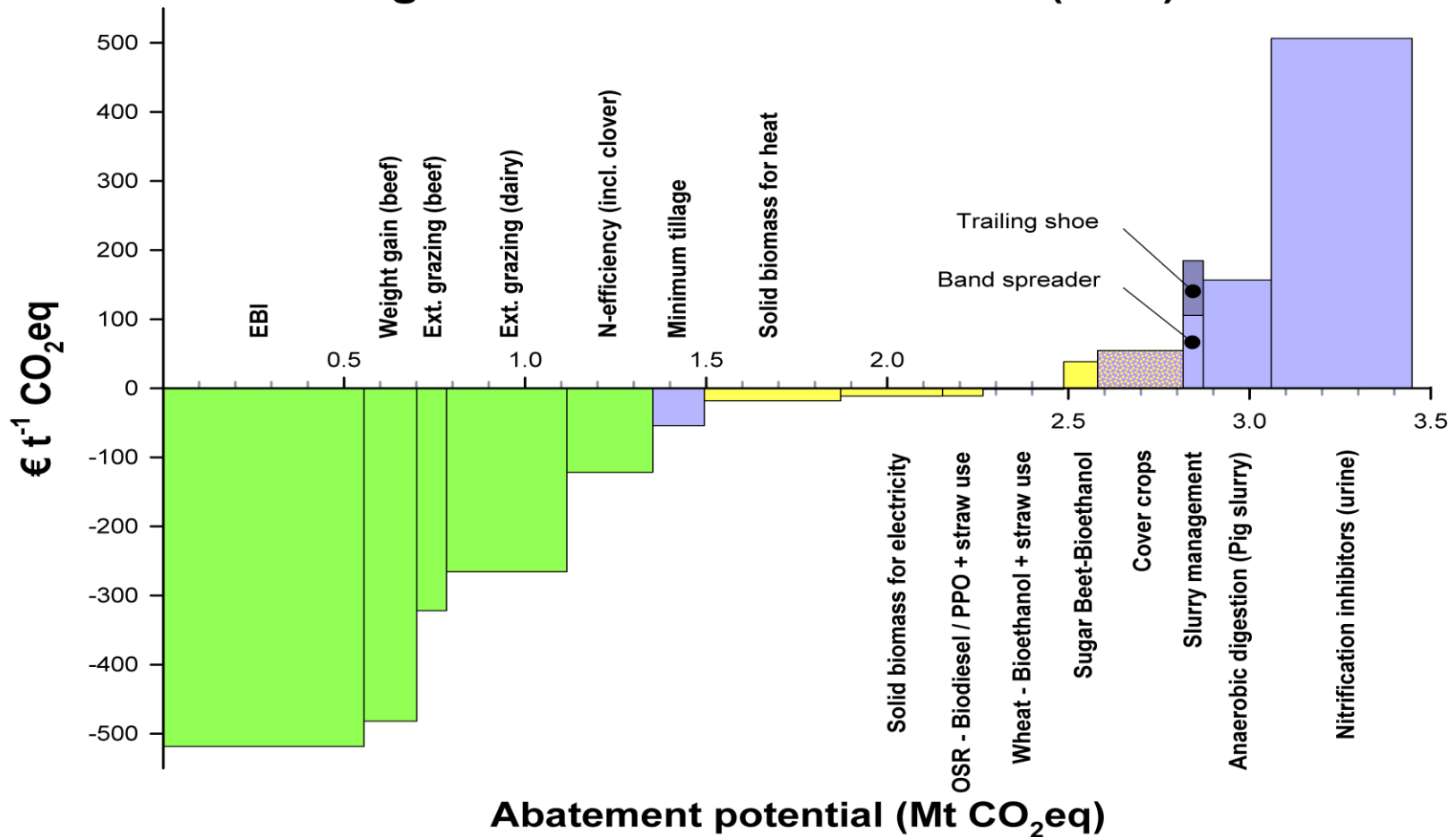
# IPCC MACC for Irish Agriculture

- **Technically reduce emissions by 2.7Mt CO<sub>2</sub>eq**
- **Most with zero or negative cost measures**
  - 2.3Mt CO<sub>2</sub>eq of abatement under the IPCC method would be achieved at zero or negative cost
- **Cost Negative Measures**
  - Greatest potential in mitigation measures that increase productivity, (increasing genetic merit for dairy and beef cattle)
- **Cost Neutral Measures**
  - Land use change measures - such as bioenergy crops
- **Cost Prohibitive Measures**
  - Technology measures
- **Problem:** abatement due to land use change measures such as oilseed rape are not attributed to agriculture



# Results LCA Approach for Irish Agriculture

## Marginal Abatement Cost Curve (LCA)



# LCA MACC for Irish Agriculture

- **Technically reduce emissions by 3.4Mt CO<sub>2</sub>eq**
- **LCA technical abatement potential 28% greater than that identified under the IPCC approach**
  - Approx 2.5 Mt CO<sub>2</sub> Eq of abatement under the LCA method would be achieved at zero or negative cost
- **Cost Negative Measures**
  - associated with approaches which increase farm efficiency
- **Cost Neutral Measures**
  - Land use change measures
- **Cost Prohibitive Measures**
  - New technologies in general (apart from minimum till)

# IPCC MACC for Irish Agriculture

## MACC curve

- Total realistic abatement potential by 2020: c. 2.5 Mt CO<sub>2</sub>eq
- But volume accounted for in inventories is just 1.1 Mt CO<sub>2</sub>eq
- Cost rankings of strategies:
  - *efficiency < land use change < technology*
- Requires intensive knowledge transfer programme

## Further reductions would require:

- Change in accountancy arrangements (forestry, biofuels)
- Future measures, subject to ongoing research

# The need to monitor incentivisation

- **IPCC method underestimates abatement potential for agriculture by 50% relative to LCA method**
  - IPCC approach attributes emissions reductions to other sectors or to other countries (Agri sector is not credited for its efforts)
- **IPCC accounting reduces incentive for farmers to adopt particular abatement measures**
  - especially in case of bioenergy (credit goes to the energy user)
- **Further reductions from agriculture may require improved farm incentivisation**
  - change in the way emissions reductions are credited to particular economic sectors
  - via domestic offsetting or consumption based GHG accounting

# Other Approaches: Can We Reduce Food Losses and Food Waste?

- **A reduction in food losses**
  - food which spoils before it reaches the consumer, which is an issue predominantly for the developing world
- **A reduction in food waste**
  - food which consumers in the developed world buy and subsequently throw away, will need to be reduced
- **Reducing food losses**
  - requires investment in education, technology and infrastructure in the developing world
- **Change in consumers' attitudes**
  - Reducing the amount of food wasted by consumers in the developed world
- **Food is relatively cheap**
  - For many in the developed world, so at present there is little economic incentive for many consumers to address their food waste

# Long Term Solutions

- **Reprioritise Agri-food research**
  - Boost yields, increase tolerance to stress, animal vaccines
  - Enhance food shelf life and educate consumers to reduce waste
- **Enhance Educational Programme for Farmers**
  - Need to maximise take up of viable food production technologies
  - Long time lag in taking technology from lab to farm
- **Technologies such as GMOs?**
  - Hostile public opinion in EU
  - Can we afford to ignore this technology any longer?
  - Will Europe be left behind by Rest of World?
  - Or is staying GMO free a viable point of difference for EU food
- **Examine balance between environment and food production**
  - Do we already have the right balance? That's a political question

# Thank You

# Emission reduction is not an insurmountable challenge

- **Look at how food is produced in the Developed World**
  - use technology (GM?) to make agriculture resilient to climate change
  - manage water resources, use precision technologies for irrigation, farming practices which save water and drought tolerant crop varieties
- **Look at how food is produced in the Developing World**
  - existing technologies for greater food production not fully utilised
  - infrastructural, logistical and marketing challenges to be overcome
  - tailor global knowledge of agricultural science to farming in local regions
- **Ensure production is used by final consumer**
- **Challenge for science & society in 21<sup>st</sup> century is twofold**
  - More food must be produced
  - but in a way that limits the impact on the environment
- **In Short - We need a Green Revolution of a different kind**



# Measures to Reduce Emissions

## Measures included in analysis:

- Accelerated gains in the genetic merit of cows (as measured by the Economic Breeding Index)
- Higher daily weight gain in beef cattle
- Extended grazing season
- Manure management
- Other gains in nitrogen efficiency (incl. use of clover)
- Use of nitrification inhibitors
- Minimum tillage techniques
- Use of cover crops
- Bio-fuel/bioenergy crops
- Anaerobic digestion of pig slurry