Reduced discharge - towards full recovery of nutrient and energy from animal manure:

Efforts in Dairy Sector

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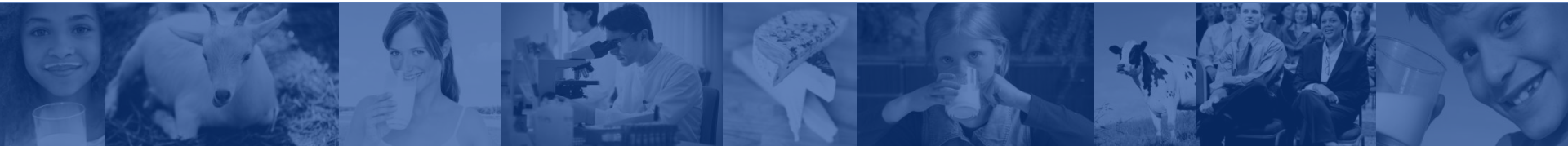


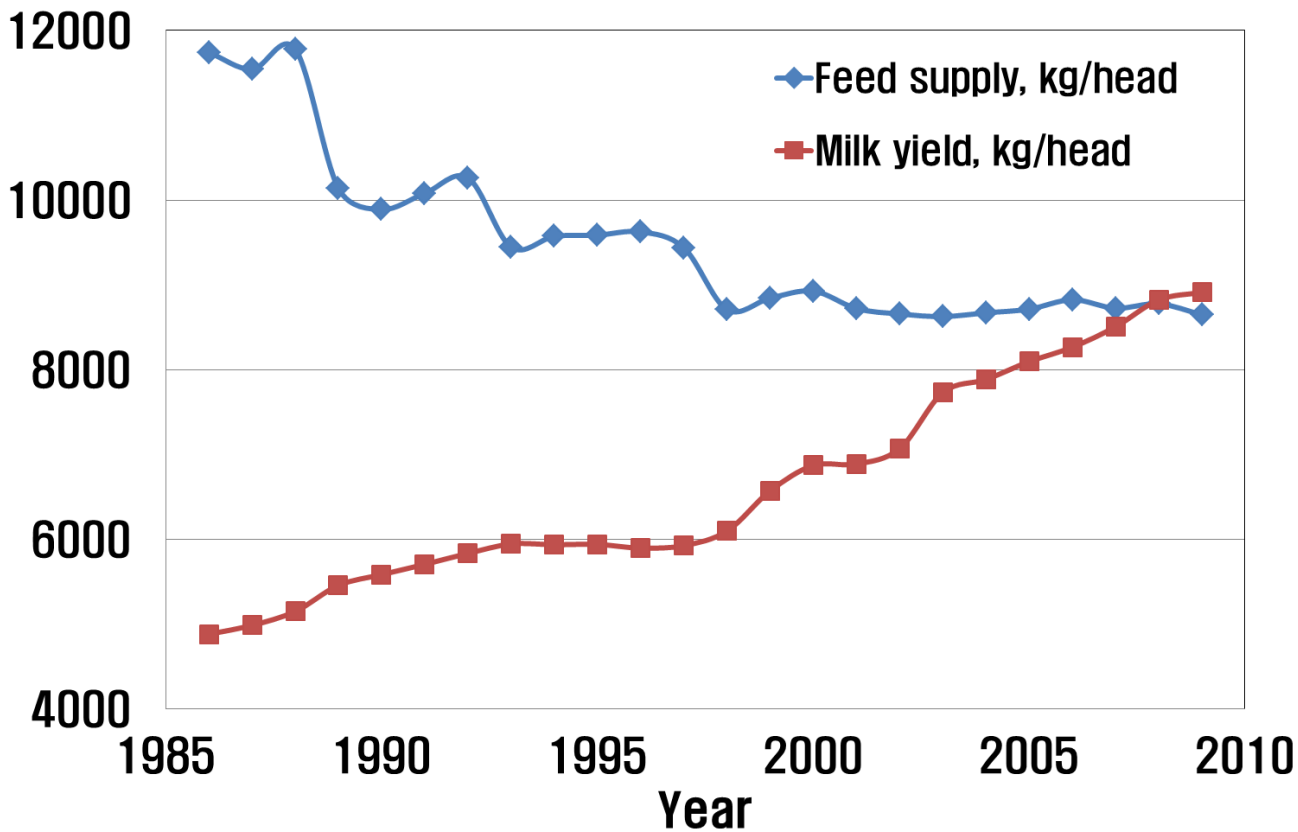
Challenges in Dairy Production

- Need to increase environmental and economical sustainability
  - Need to reduce GHG emissions and nutrients in manure to reduce impact on water and air quality
  - Need to implement a better manure management

- The very first step is to reduce nutrients in diets while maintaining or improving animal performance
  - Improve feed efficiency
  - Need to improve accuracy of predicting nutrient requirements of animals in various physiological stages and nutrients available to meet requirements in specific production situations

Improvement of Feed Efficiency

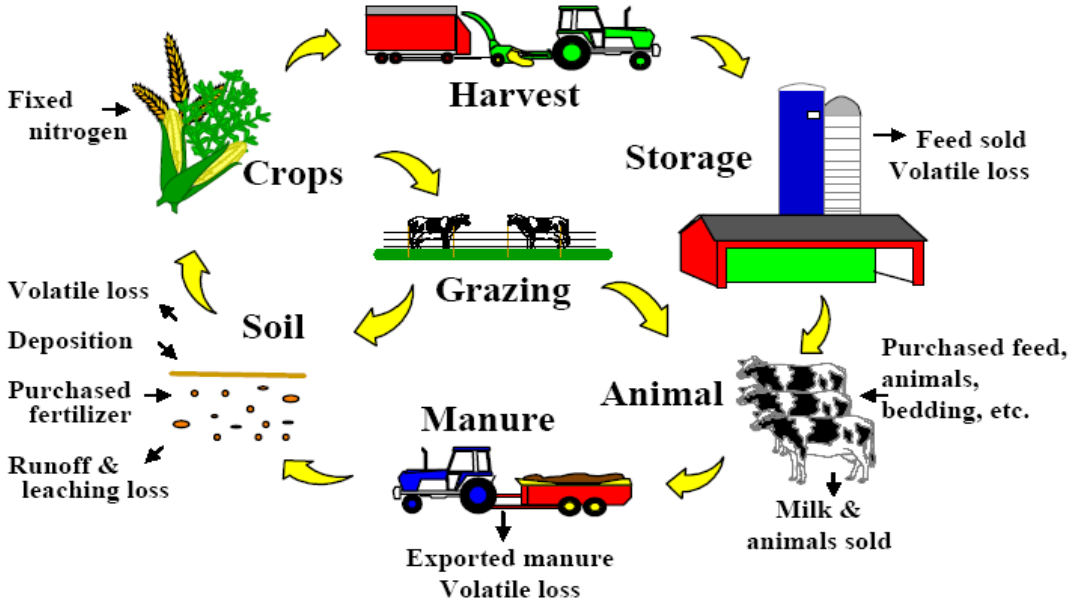
- There has been a continuous increase in feed efficiency due to improvement in genetics and nutritional management → less resource use



2010 Dairy Statistics Yearbook, Korea Dairy Commitee

Development and application of whole farm nutrient management (WFNM)

- Whole farm nutrient management (WFNM) includes the consideration of import of nutrients to the farm, movement and transformation (including losses) of nutrients within the farm operation, and export of milk, crops, or manure
  - Example: USA - Cornell University Nutrient management Planning System (cuNMPS)



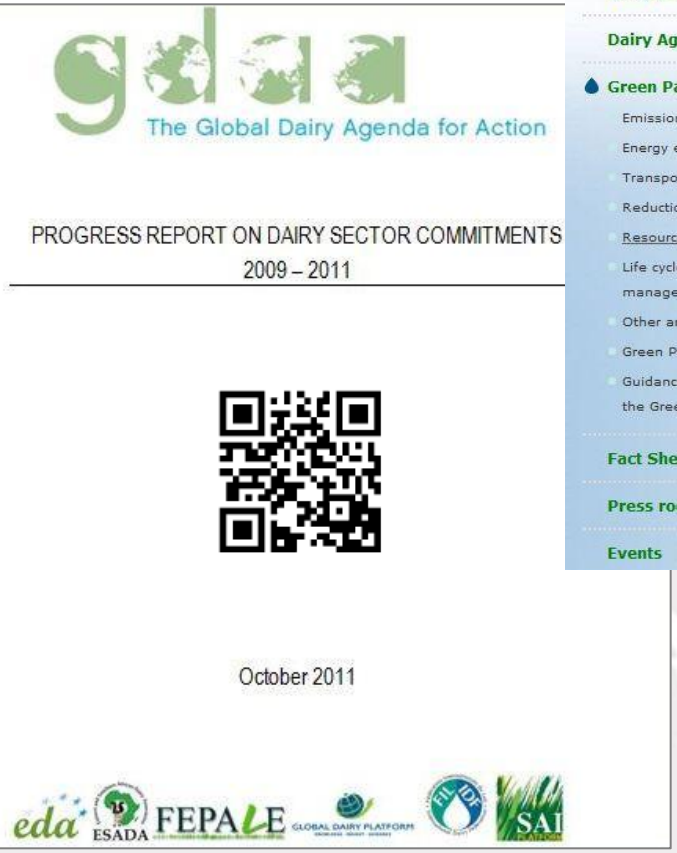
Practical application of whole farm nutrient management

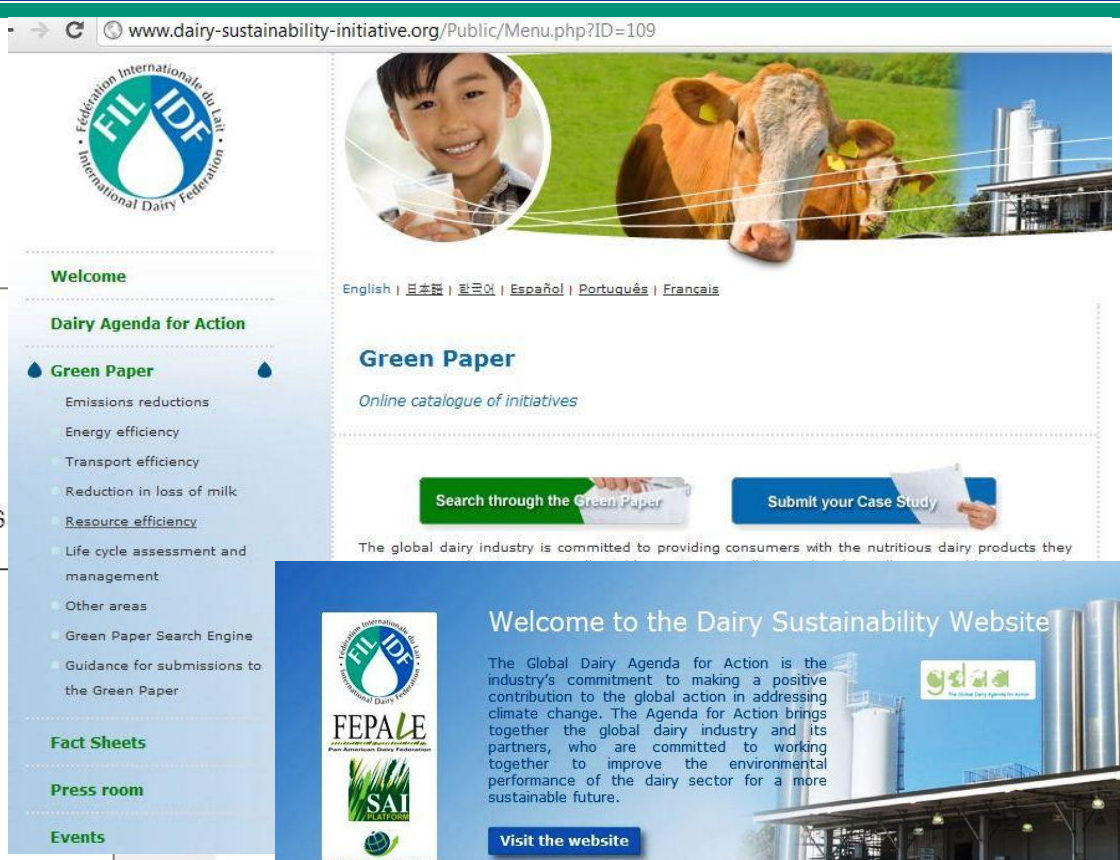
- Results from a 5 year field application of cuNMPS on a dairy farm in NY, USA (Tylutki et al., 2004)
- Shows possibility of an increase in both environmental and economical sustainability of a dairy farm

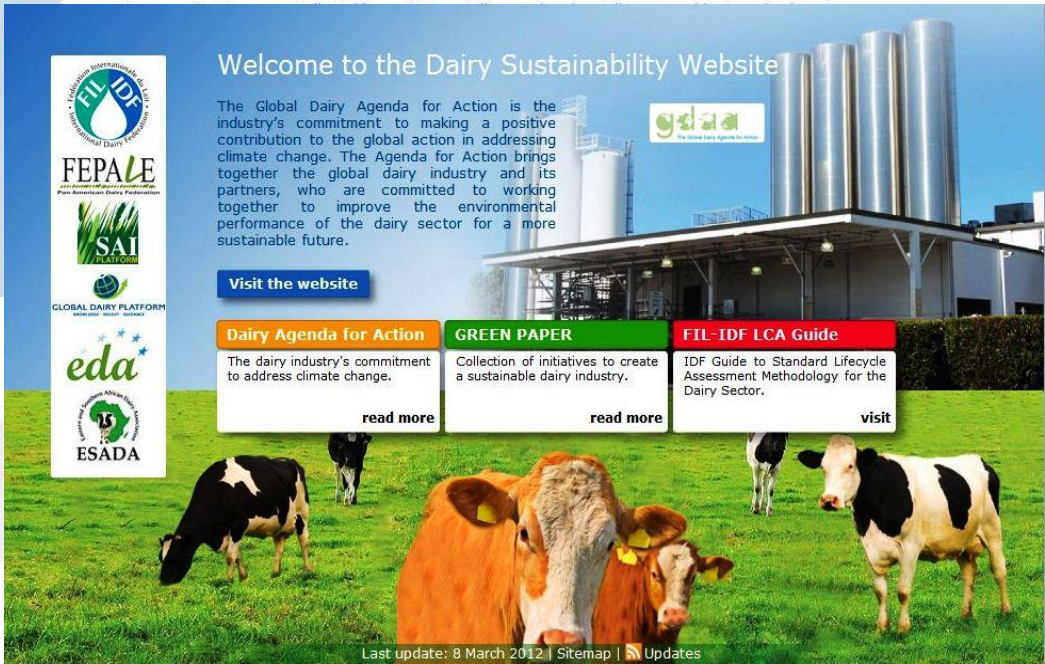
	Purchased feed, $/day	Milk, lb/day	N, lb/year	P, lb/year
Before	1813	27,622	309,043	43,435
After	1375	40,167	256,349	31,192
% change	-34.2	45	-17.1	-28.2

Progress in Dairy Industry

www.dairy-sustainability-initiative.org

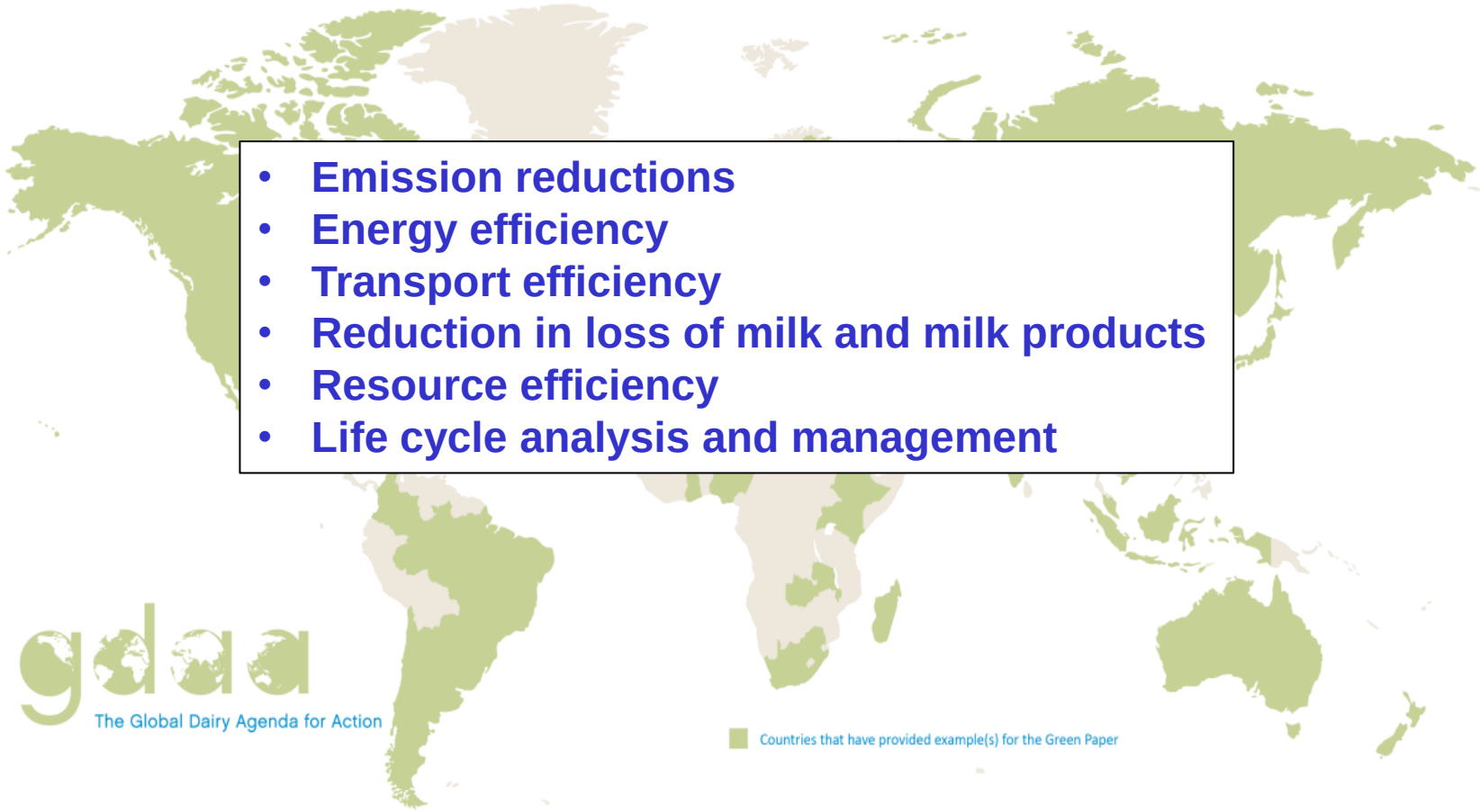






Sharing Best Practice globally

Geographical participation in the Green paper



- **Emission reductions**
- **Energy efficiency**
- **Transport efficiency**
- **Reduction in loss of milk and milk products**
- **Resource efficiency**
- **Life cycle analysis and management**

405 case studies from 51 countries on the Green Paper

Examples of actions addressing better manure management on the Green Paper

- **Technological solutions:** on-farm separation of liquid and solid fractions and complete recycling into re-usable elements such as bedding, NPK fertilizer without runoff/leakage into freshwater sources (ex. Russia, USA - nutrient management system NuWay™, Argentina – INTA effluent treatment system; DeLaval systems)
- UK on-farm initiatives:
  - DairyCo reviewed all available research information and developed clear **guidance on the management of slurry and farm yard manures on pastures** containing optimal levels of clover.
  - Development of a **near infrared spectroscopy (NIRS) test** for the analysis and characterisation of farm manures and other organic materials (joint Industry and Government collaboration).
  - On-farm **manure management plans.**
- **Dairy effluent manuals** (Chile, Australia)

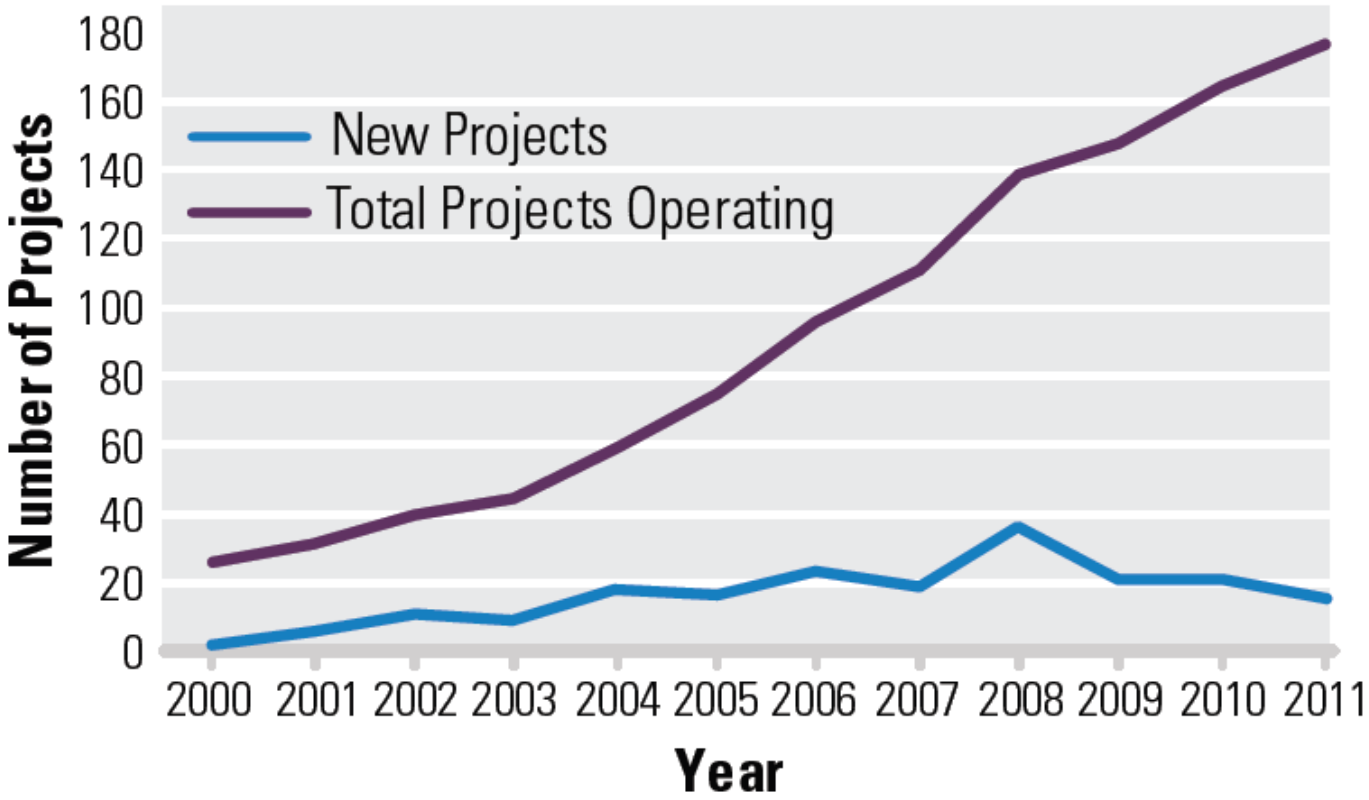
Examples of actions addressing better manure management on the Green Paper

- Legislative reforms (e.g. Israel; Europe – limits on stocking rates, ban on application on land & minimum storage requirements over winter)
- Biogas generation from manure through anaerobic digestion – all over the world but often requires community projects to be economic
- Relatively simple and affordable manure storage and composting in soil pits on small holder farms (India – NADEP technology)

The Global Dairy Agenda for Action

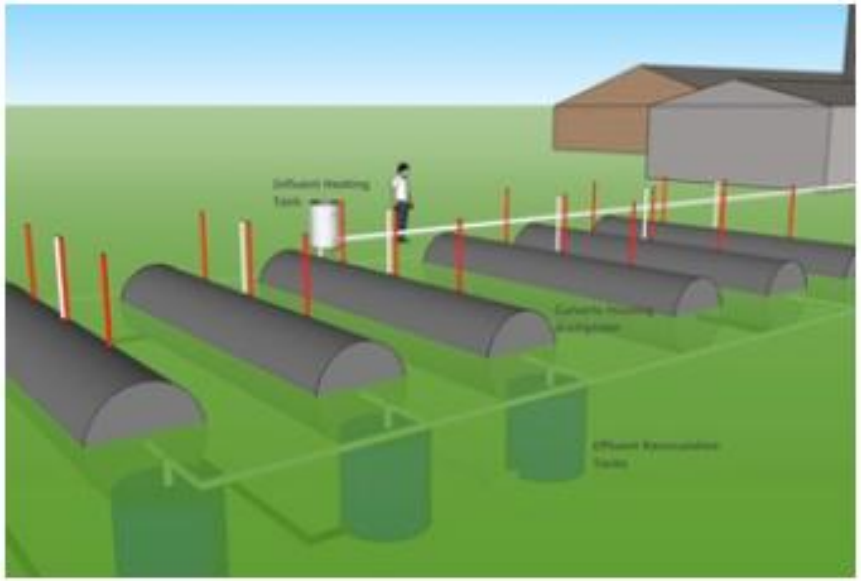
Dairy manure application without treatment & Diary manure composting (USA)

About 80% of operating digesters in the US is located at dairy farms

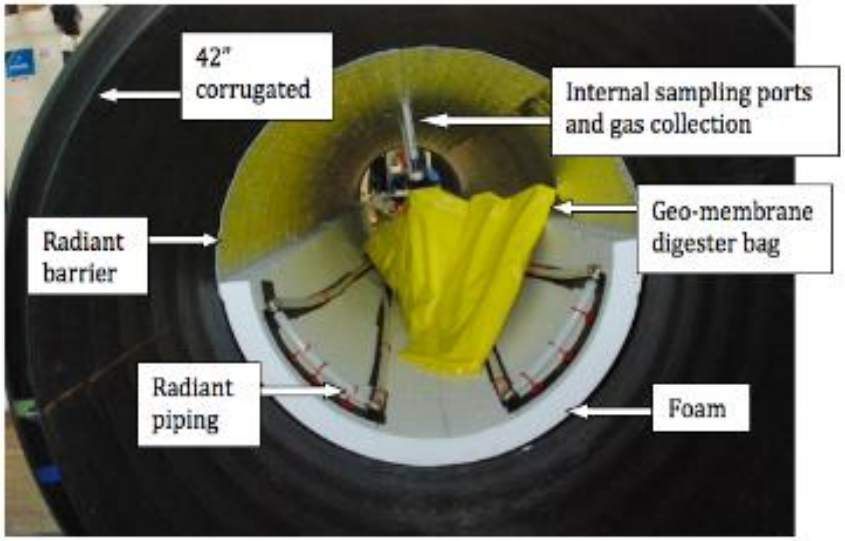


Source : US EPA AgSTAR, 2011. U.S. Farm anaerobic digestion systems : A 2011 Snapshot

Low-cost Anaerobic digesters for dairy manure (UMD)



Pictured are six of the nine 20" long digesters. Each digester holds 750 gallons of wastewater and has a 25 day retntion time, resulting in a total 6750 gallons of manure being treated by the system. Six digesters receive un-separated manure and three digesters receive separated manure.



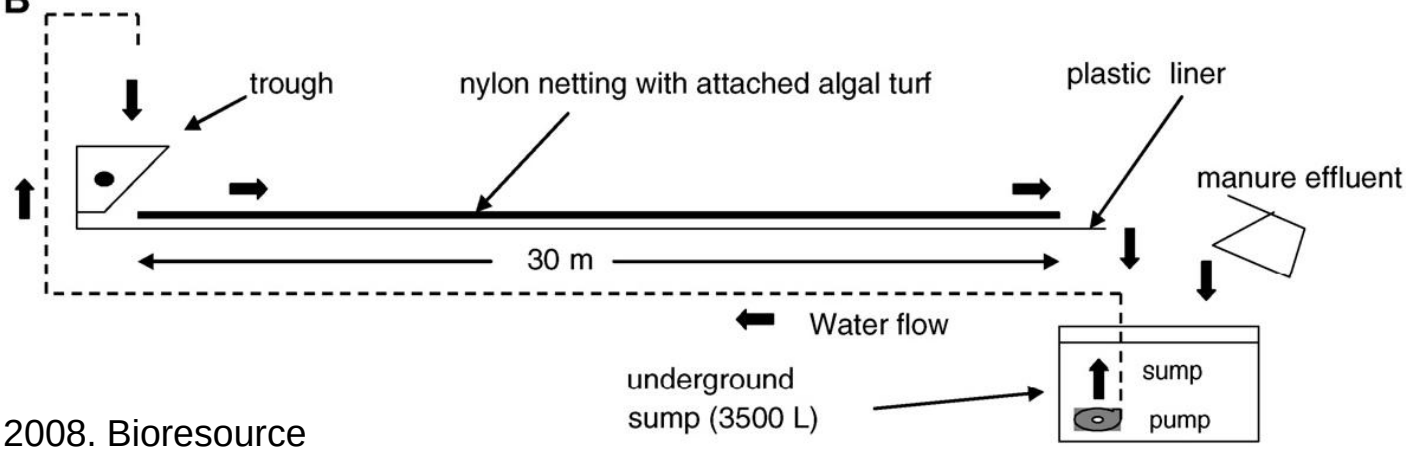
Modified plug-flow digester highlighting various components.

Source : Dr. Lansing, 2012, University of Maryland, Dept. of Environmental Science & Technology, http://www.enst.umd.edu/people/lansing/Small-scale%20digestion%20in%20Maryland.cfm

Algal turf scrubbers can recover 60-90% of N & 70-100% on P from dairy manure effluents (USDA-ARS)

A

B



Mulbry et al., 2008. Bioresource Technology 99 : 8137-8142

Nutrient recovery from dairy manure in Korea

Bedded pack dairy barn
(More than 93% of total dairy farms)

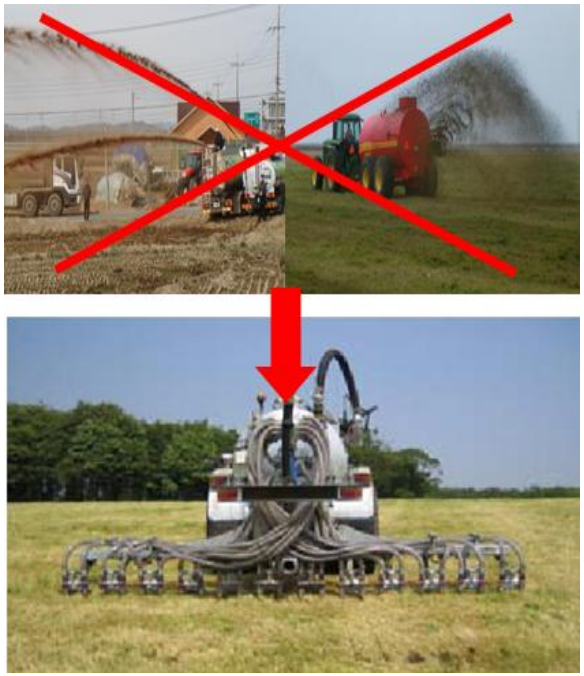
Nutrient loss during the storage and application of dairy manure

Table 5. Nitrogen losses in storage.

Method of Storage	% N Loss
Daily scrape and haul	15-35%
Open lot	40-60%
Earthen storage	20-40%
Lagoon	70-80%

Table 6. Nitrogen losses during application.

Method of Application	% N Loss
Broadcast liquid (spread)	10-25%
Broadcast solid	15-30%
Inject in soil	1-5%
Sprinkler-liquid	30-40%



Summary of what we learned

- Huge diversity of situations generates different challenges and opportunities.
- Technological solutions fit for different production conditions exist and the question should be how to implement them the best.
- Environmentally-wise manure management has an economic sense for farmers in all production situations.

Thank you for your attention !