



# Zero Discharge: towards full recovery of nutrient and energy from animal manure

**Nigel Penlington**  
**Environment Programme Manager**  
**BPEX, UK**

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[www.nigel.penlington@bpex.ahdb.org.uk](mailto:www.nigel.penlington@bpex.ahdb.org.uk)



## Zero discharge – Why?

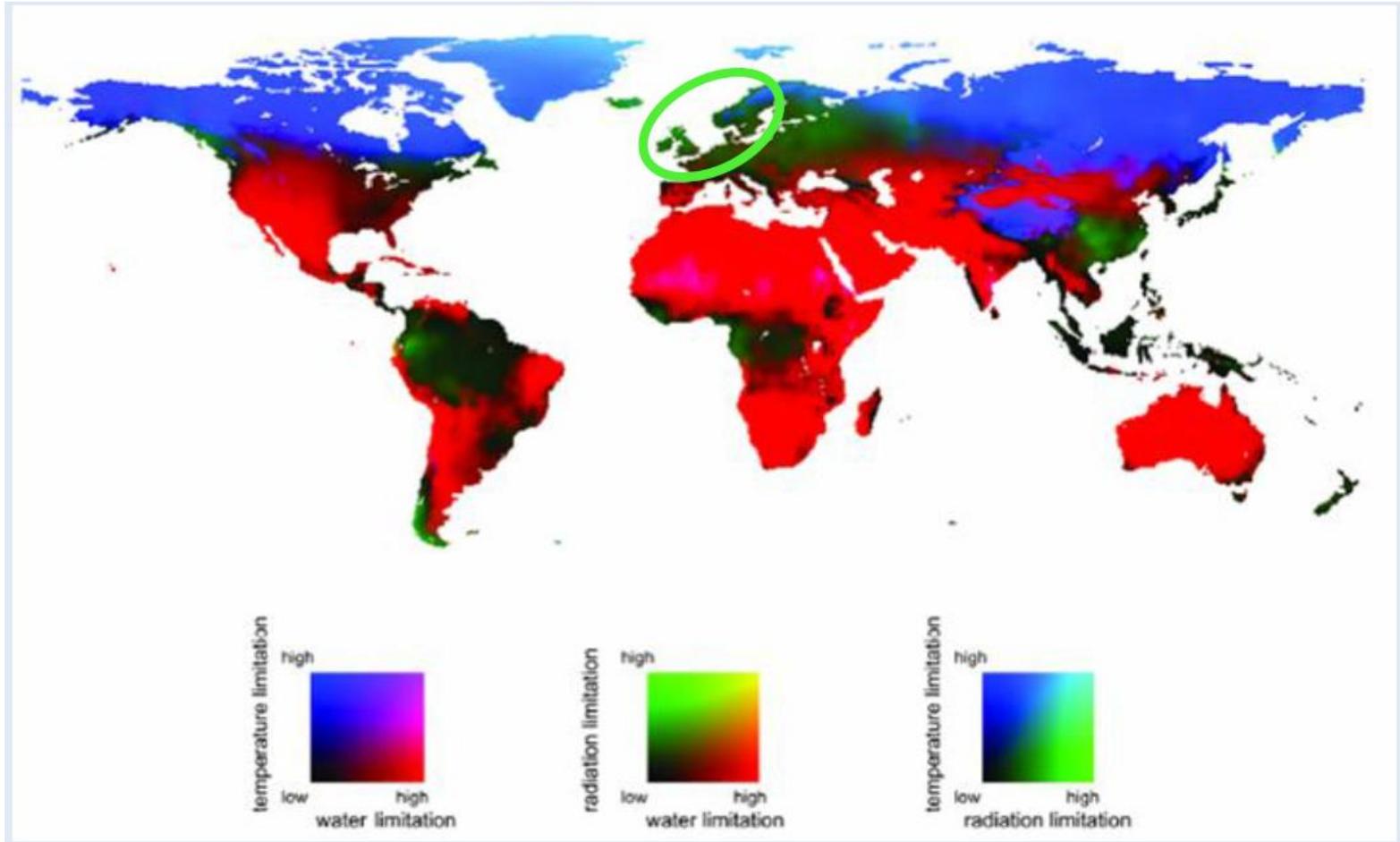
- Why
  - Finite resources vs. increased demand
    - Nitrogen, Phosphate, water, land, etc.
  - Energy hungry production systems
  - Environmental Protection
  - Sustainable food, products and service provision



# Sustainability

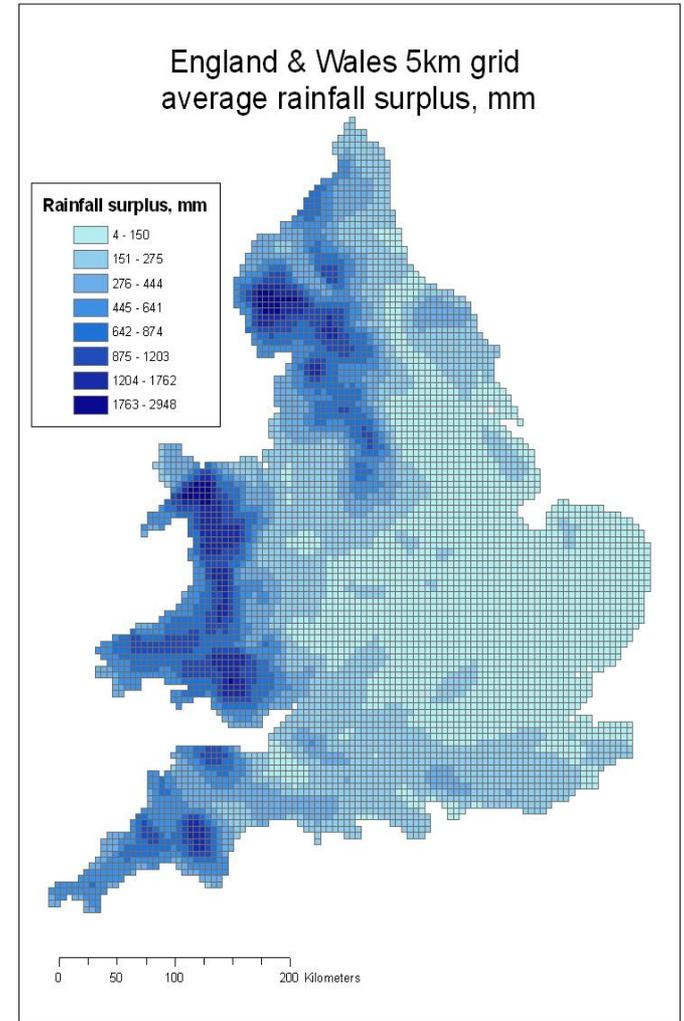
*Meeting the needs of the present generation without compromising the ability of future generations to meet their needs.”*

# Limiting factors for global plant productivity



# Water for life

- Essential for plant growth and livestock
- Changing patterns
- Will dictate what can be grown and produced where



# Protect the Natural Environment

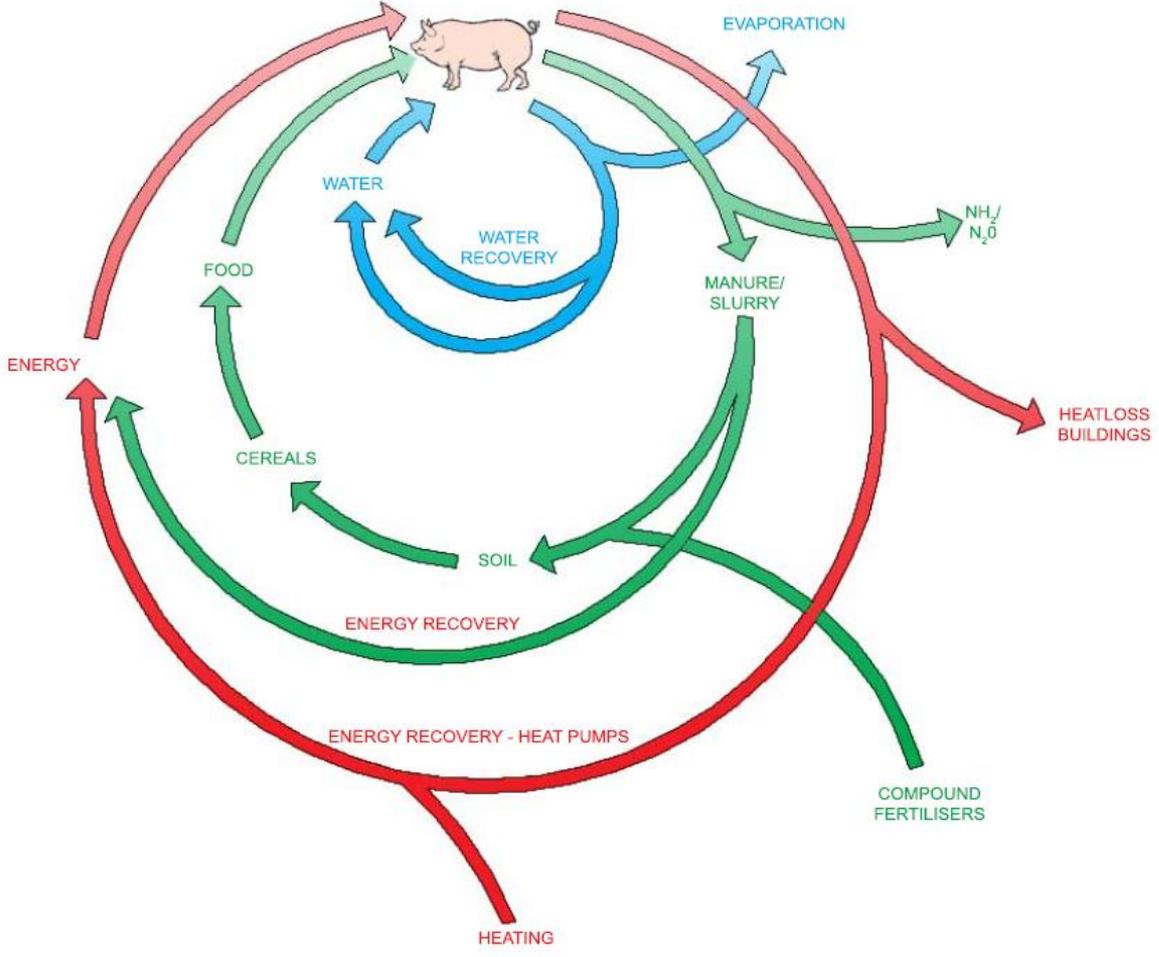
- Resources
- Habitats
- Eco systems
- Getting the balance right



## Zero discharge – How?

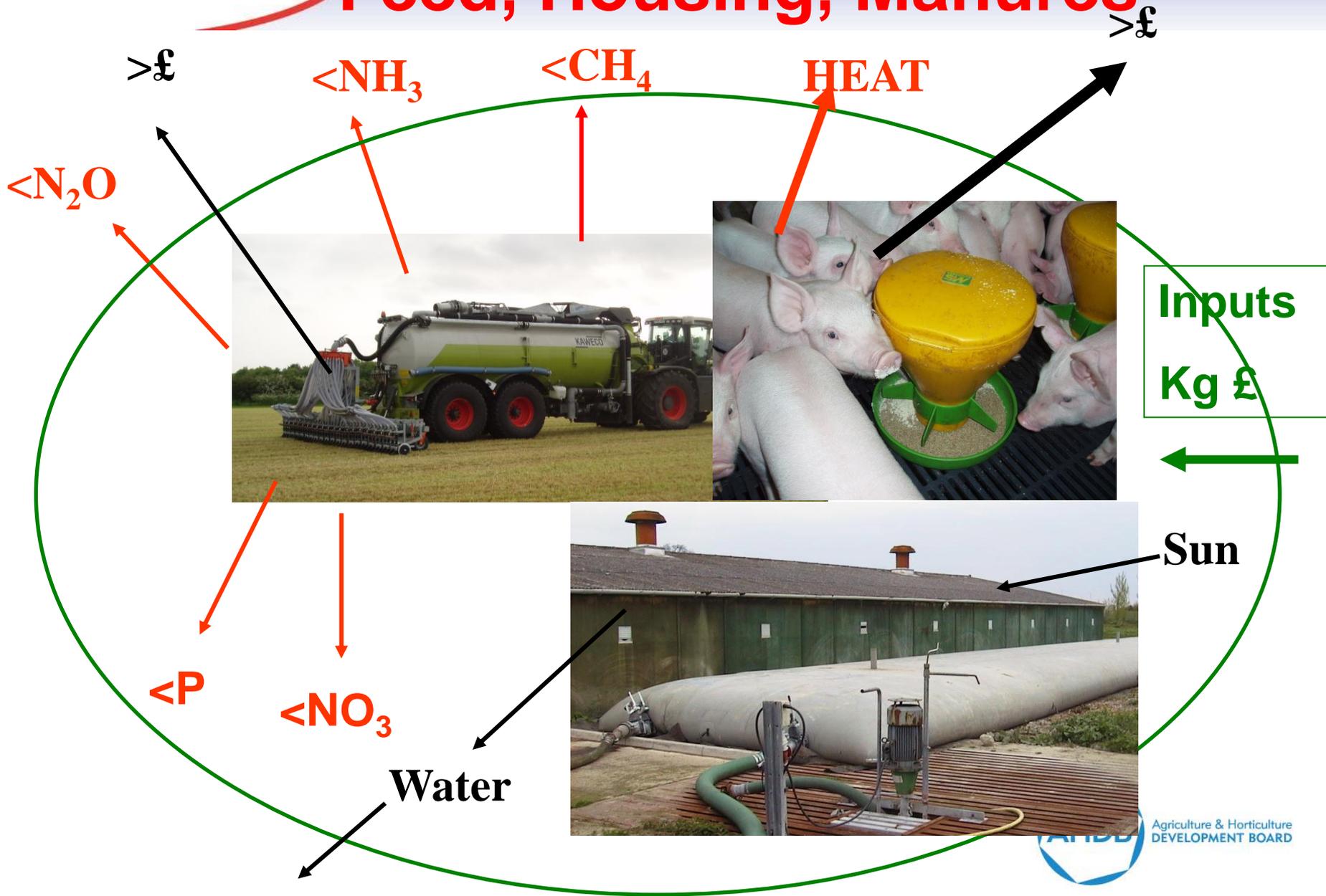
- Consider the full system – integrated approach.
- Don't push losses along the line
- End to Start or Start to End?
  - The product, i.e. the reason
  - Consequences of actions e.g. nutritional strategy
- Applied to;
  - Existing systems
  - New systems
- Windfall Opportunities
  - Counteract inevitable losses

# Integrated Systems





# Feed, Housing, Manures





## Integrated Systems to minimise losses

- Location
- Animal Health
- Feed inputs
- Housing
- Manure storage
- Manure processing
- Manure utilisation
- Product utilisation

## Minimising losses - Location

- Marketable yield
- Recovery
  - Heat
  - Water
  - Manures
  - Generated energy



## Minimising Losses – animal health

- Growth rate
- Resource use
- Product quality & rejections
- Death = waste



# Precision Feeding & Real Time Monitoring

WINCC - peking.merc

SiloVb\_Form

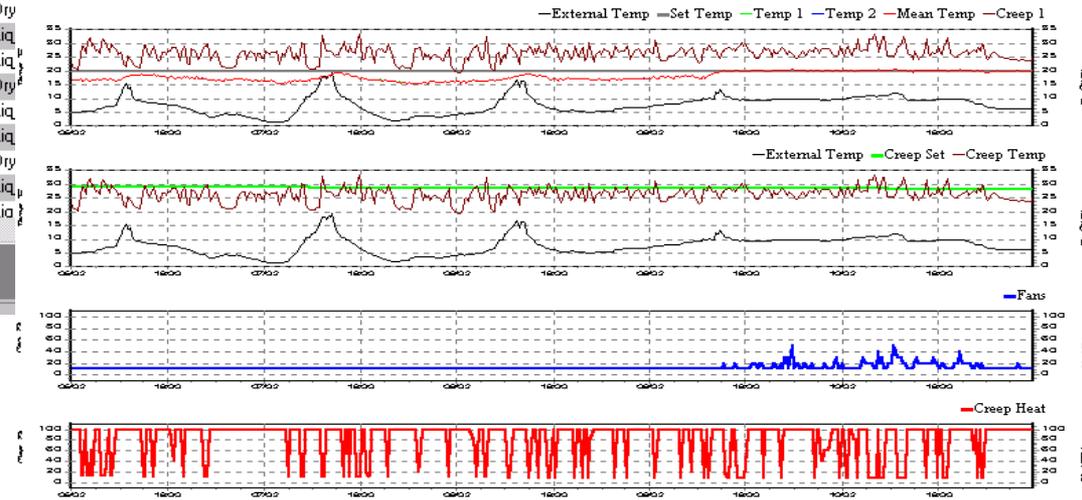
F4 Print Preview F5 schedule F7 F10 to main menu

silos:

22/09/04

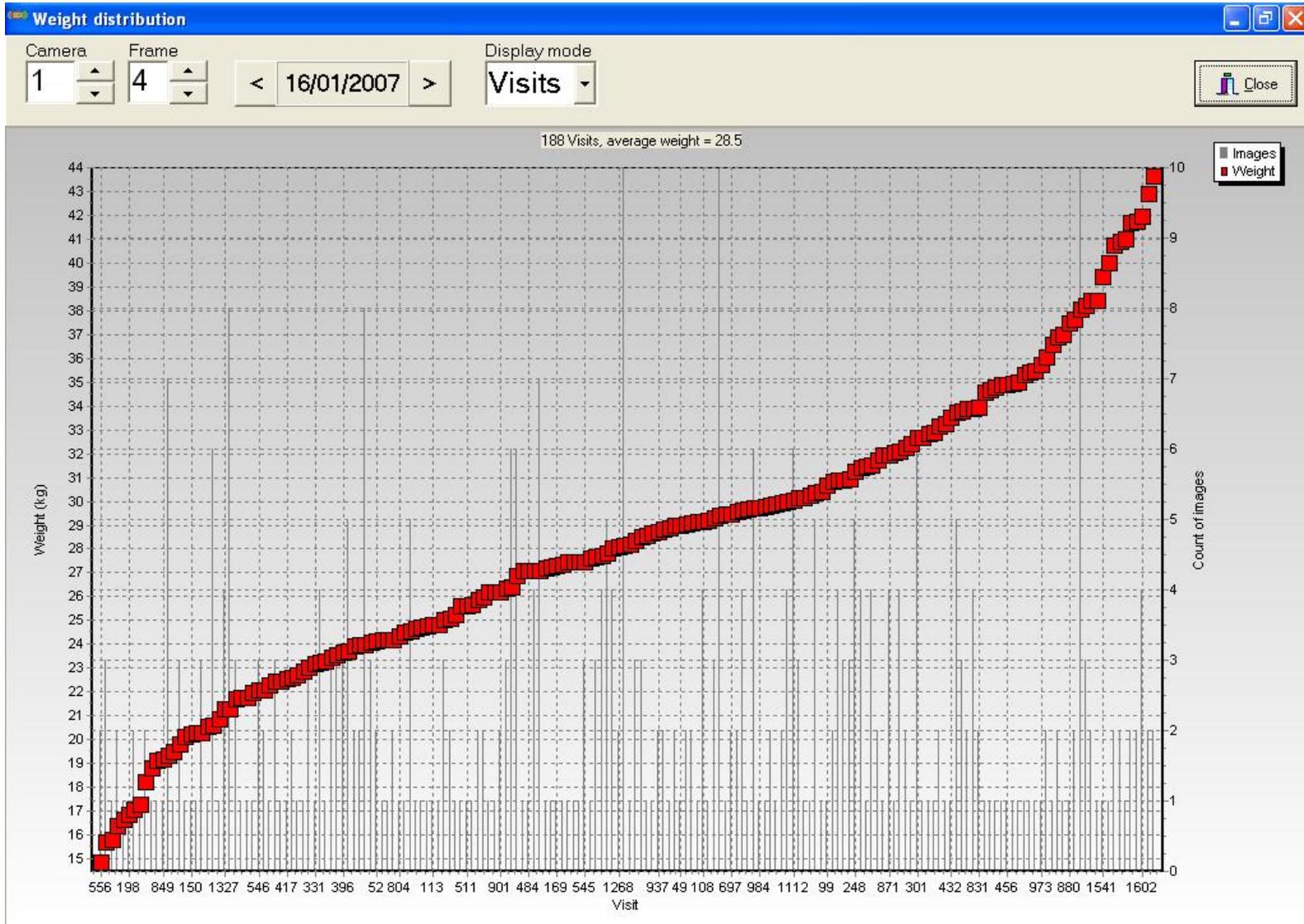
from silo	mix tank	MixNr	Time	Sollkg	Istkg
48	1	1	22/09/04 00:23:00	236.71 kg	235.09 kg
47	2	2	22/09/04 00:23:00	248.8 kg	249.35 kg
5	3	4	22/09/04 01:00:04	7.99 kg	7.42 kg
6	3	4	22/09/04 01:00:04	33.6 kg	33.33 kg
7	3	4	22/09/04 01:00:04	73.43 kg	76.08 kg
8	3	4	22/09/04 01:00:04	23.72 kg	24.17 kg
15	3	4	22/09/04 01:00:04	5.03 kg	4.75 kg
40	3	4	22/09/04 01:00:04	57.32 kg	58.33 kg
41	3	4	22/09/04 01:00:04	388.87 kg	444.92 kg
44	3	4	22/09/04 01:00:04	1.13 kg	1.08 kg
5	3	3	22/09/04 01:35:02	5.52 kg	6 kg
6	3	3	22/09/04 01:35:02	4.99 kg	5.75 kg
7	3	3	22/09/04 01:35:02	65.64 kg	65.08 kg
8	3	3	22/09/04 01:35:02	21.39 kg	20.42 kg
11	3	3	22/09/04 01:35:02	3.34 kg	3.33 kg
40	3	3	22/09/04 01:35:02	38.15 kg	35 kg
41	3	3	22/09/04 01:35:02	260.56 kg	298.42 kg
2	7	15	22/09/04 01:45:15	294.26 kg	294.43 kg
48	1	1	22/09/04 02:11:10	218.38 kg	217.86 kg
47	2	2	22/09/04 02:37:54	210.77 kg	210.39 kg
47	2	2	22/09/04 04:16:21	213.43 kg	212.12 kg
5	3	3	22/09/04 04:18:55	4.86 kg	4.25 kg
6	3	3	22/09/04 04:18:55	4.76 kg	4.92 kg

silo	content	yesterday	today	~days
DS1	22000	0.0	0.0	0.0
DS2	5622	1059.0	839.7	5.3
DS3	0	0.0	0.0	0.0
DS4	14232	506.0	261.8	28.1
DS5	709	95.2	74.8	7.5
DS6	3915	219.1	191.4	17.9
S7_Milled_bin	-1202	1037.8	792.4	-1.2
S8_Milled_bin	-364	247.8	247.9	-1.5
S9_Milled_bin	0	0.0	0.0	0.0
DS10_B_Bin->F0	0.0	0.0	0.0	0.0
DS11_B_Bin->F-43	36.1	27.7	-1.2	
DS12_Dry_S->F0	0.0	0.0	0.0	0.0
S13_Liq_S->Prc0	0.0	0.0	0.0	0.0
S14_Liq_S->Prc0	0.0	0.0	0.0	0.0
DS15_B_bin->P-32	30.0	22.1	-1.1	
S16_free	0	0.0	0.0	0.0
S17_Dry				
S18_Dry				
S19_Liq				
S20_Liq				
S21_Dry				
S22_Liq				
S23_Liq				
S24_Dry				
S25_Liq				
S25_Liq				





# Growth Monitoring - pigs



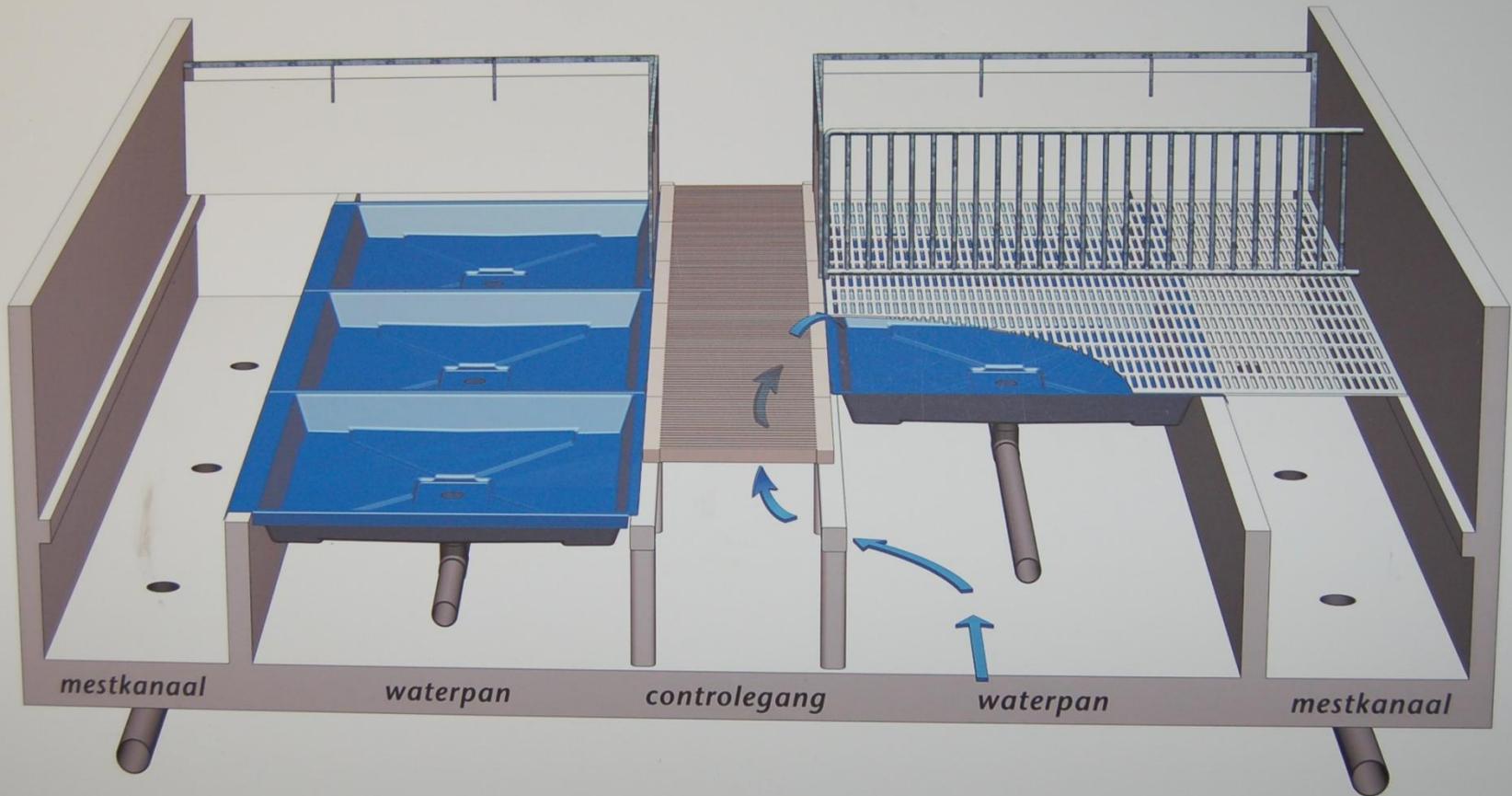
## Minimising losses - Housing

- Low emission housing
- Combine with low protein diets
  - Faeces/urine
  - Frequent manure removal
    - Slats/part solid
    - solid/solid with gutter
    - Scrape
    - Flush
    - Acidification
  - Manure cooling
  - Straw to absorb
- Welfare – loose vs. restrained

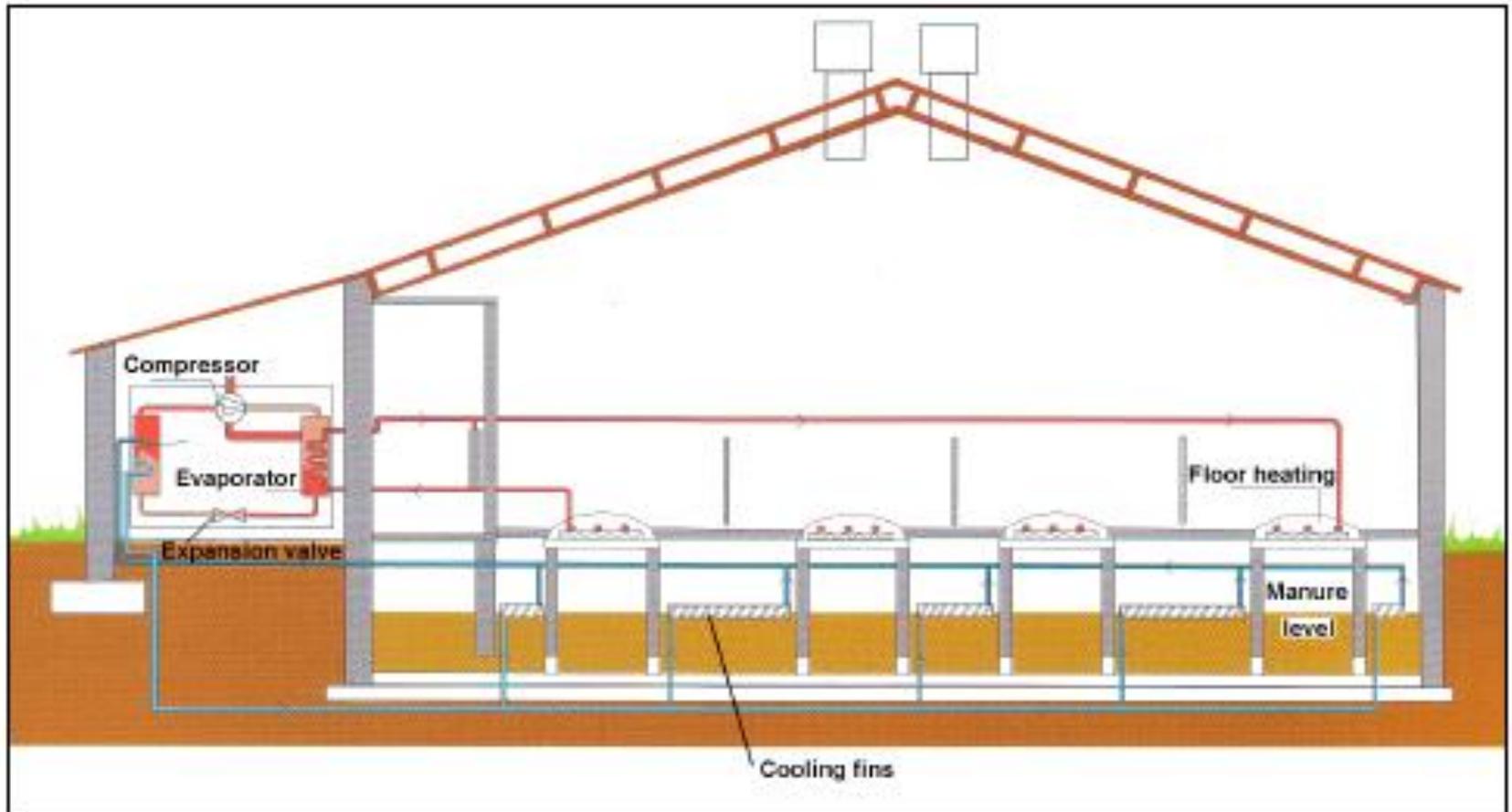
## Minimising losses – housing 2

- Ventilation rate
- Air movement paths
- Heat exchangers
  - 110kg pig = 150W
- Exhaust air cleaning (ammonia & dust)
- Opportunities to offset
  - Solar heat and power
  - Ground source heat
  - Water harvesting



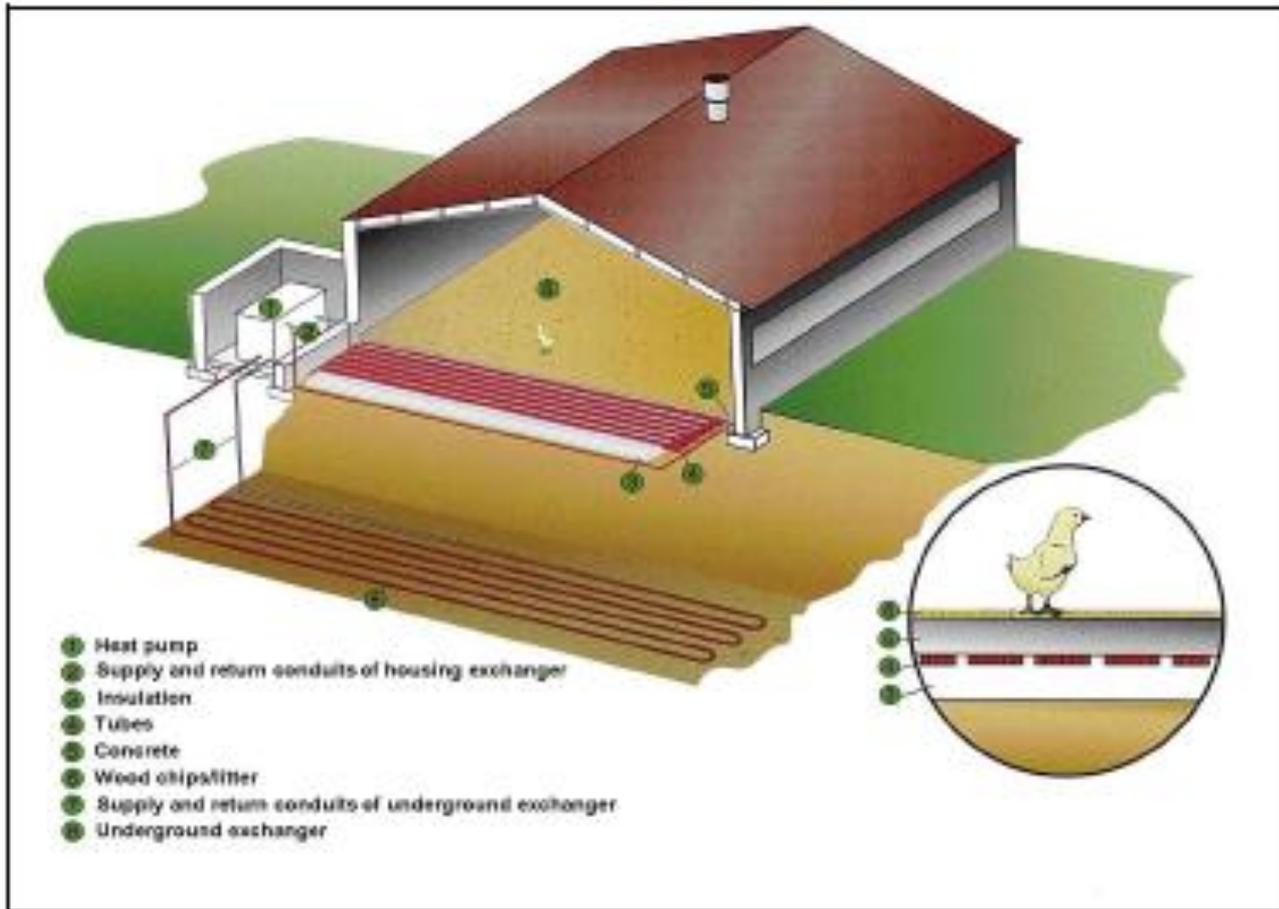


## BAT Part slated floor with manure cooling fins



BREF. Figure 4.23: manure surface cooling fins. Wageningen

# Heat Recovery in a Broiler House



BREF Figure 4.3



## Minimising losses – Manure Storage

- Appropriate storage
- Separation
- Covering
- Diffuse aeration/conditioning
- Use of additives
- Holding capacity matched to application timing

## Minimise Losses – manure processing

- Anaerobic digestion
  - Heat, power
  - Improved N availability, reduced seed and pathogen burdens
- Ammonium extraction
- Phosphate rebalancing and stripping
- Heat from manure stores
- Gasification

# Minimising Losses – manure application

- Analysis
  - Laboratory
    - Chemical
    - Near Infrared Spectrometry
  - On farm test kits
- Planning as part of fertilisation regime
  - Professional advisers
  - Decision support tools (MANNER NPK)
- Homogenous or fractions
- Application techniques



## Minimising losses – manure application

- Application techniques
  - Timing
  - Uniformity
  - Low emissions
  - Low soil losses
  - Minimise crop damage/quality impacts



# Crop nutrients







# Recovering Livestock N

- Treatment
  - Separate
  - De-nitrification
  - Recover
- Transport





# Phosphate Recovery



# Anaerobic Digestion

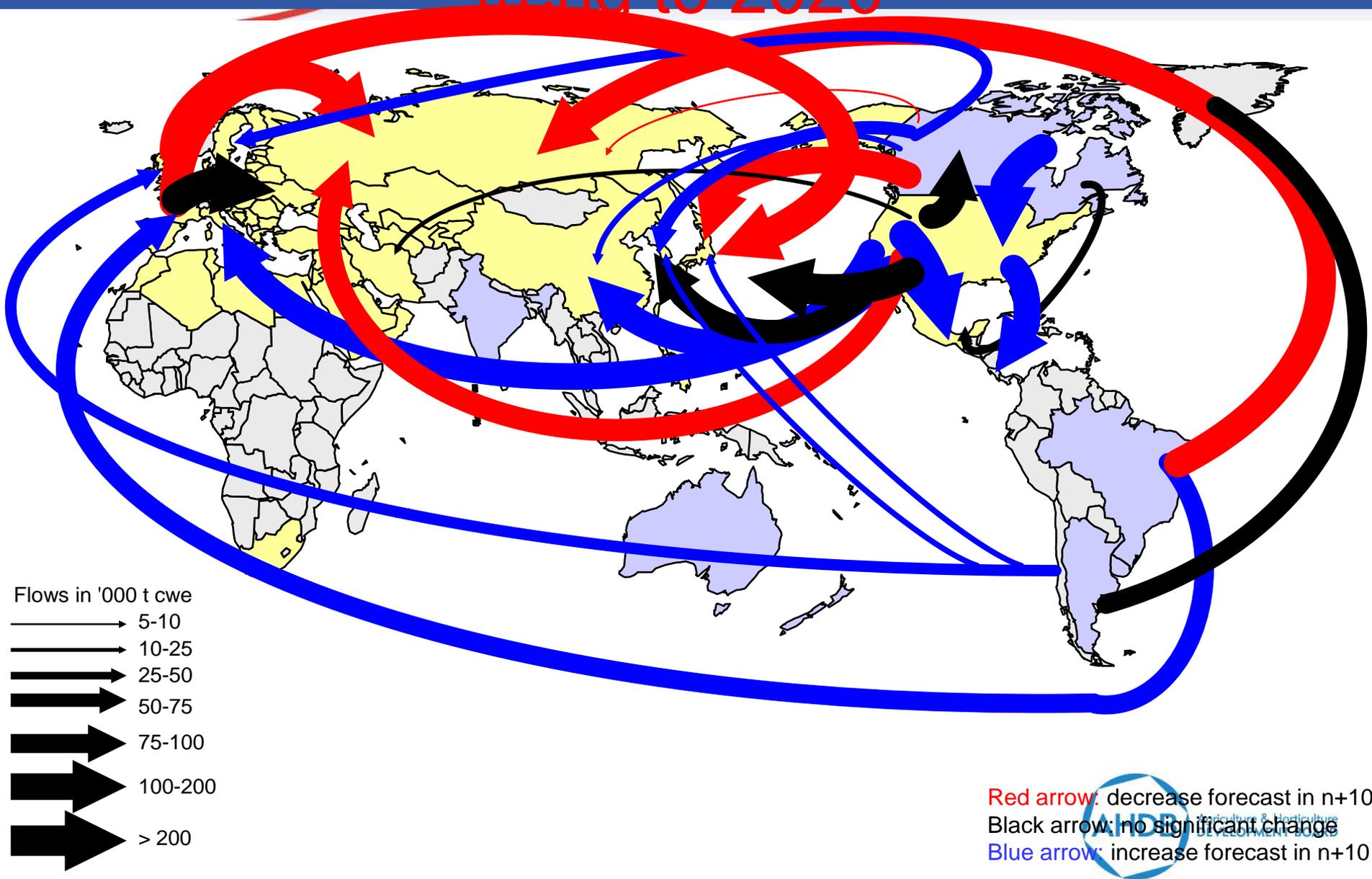




# Minimising losses – product utilisation

- Extract full value
  - Meat cuts
  - Offals
  - Oils & fats
  - Hides, skins, feathers etc
  - Processed animal protein (PAP)

# Pigmeat Trade Flows (incl. live), 2010 with trend to 2020





# Successful sector

Animal Welfare

Customer Aspirations

Meat Quality & Safety

Return on Investment



## Drivers to Change

- Legislation?
- Financial
  - Lean manufacturing
  - Process analysis
  - Adopting technology and improving skills
  - Returns to stimulate investment

*Those who rise to the challenge will not only survive but prosper*



# Thank You



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