Sustainable Pig Production in Denmark

By Chief Advisor Per Tybirk

Pig Research Centre

LANDBRUG FØDEVARER

Agenda

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- **Productivity, Danish Pig Production, 1992-2012**
- **Protein in feed and N in manure, 1992-2012**
  - Potential free amino acids
  - Ammonia emission driven by feed
- **Phosphorus in feed and P in manure, 1992-2012**
  - Phytase
- **Ammonia emission**
  - BAT standards
  - Technical solutions
- **Conclusion**

Feed, content of
Crude protein
Phosphorus

Productivity
Pigs/sow/year
Kg feed/ kg gain
Daily gain
Weight at slaughter

N and P
Ex animal

NH3
evap

N and P
Ex house

NH3 evaporation ->
N and P ex storage

NH3
Evaporation
application

Productivity

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Sows	1992	2002	2012
Weaned Piglet/sow/year	21	24	29
Feed unit/sow/year	1300	1400	1540
Weaning weight, kg	7.5	7.2	7.2

Productivity

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Weaning weight, kg	7.5	7.2	7.2

Weaners 7.2-30 kg	1992	2002	2012
Daily, gain, g	420	420	450
Feed units / kg gain	2.10	2.05	1.95

Productivity

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Kg feed
2012
1465

Weaners 7.2-30 kg	1992	2002	2012
Daily, gain, g	420	420	450
Feed units / kg gain	2.10	2.05	1.95

Kg feed
2012
1.75

Growing/finishing pigs	1992	2002	2012
Slaughter at live weight	98	98	107
Daily gain, 30-100 kg	700	825	890
Feed units/kg gain, Corr. to 30-100 kg	2.98	2.87	2.79

Kg feed
2012
2.63

Productivity, variation 2011

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Sows,	Low 25%	50%	25% best
Weaned Piglet/sow/year	25,9	29,0	31,5
Feed unit/sow/year	1559	1535	1527
Weaning weight, kg	7.5	7.1	6.9

Weaners 7.2-30 kg	Low 25%	50%	25% best
Daily, gain, g	390	435	485
Feed units / kg gain	2.12	1.93	1.79

Growing/finishing pigs	Low 25%	50%	25% best
Daily gain, 30-100 kg	801	894	971
Feed units/kg gain, Corr. to 30-100 kg	2.99	2.77	2.63

Less feed per kg pig

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- **Weaners – some potential**
- **Sows – big potential – but welfare concern**
  - More piglets, less/same feed
- **Slaughter pigs : big potential**
  - Average 2.77 FU/kg gain, 30-100 kg
  - Best 25%, 2.63
  - Breeding stock: 2.2-2.4
  - Management and health is the problem
  - Requirement for protein and phosphorus increases if feed pr kg gain improves

Crude protein in feed

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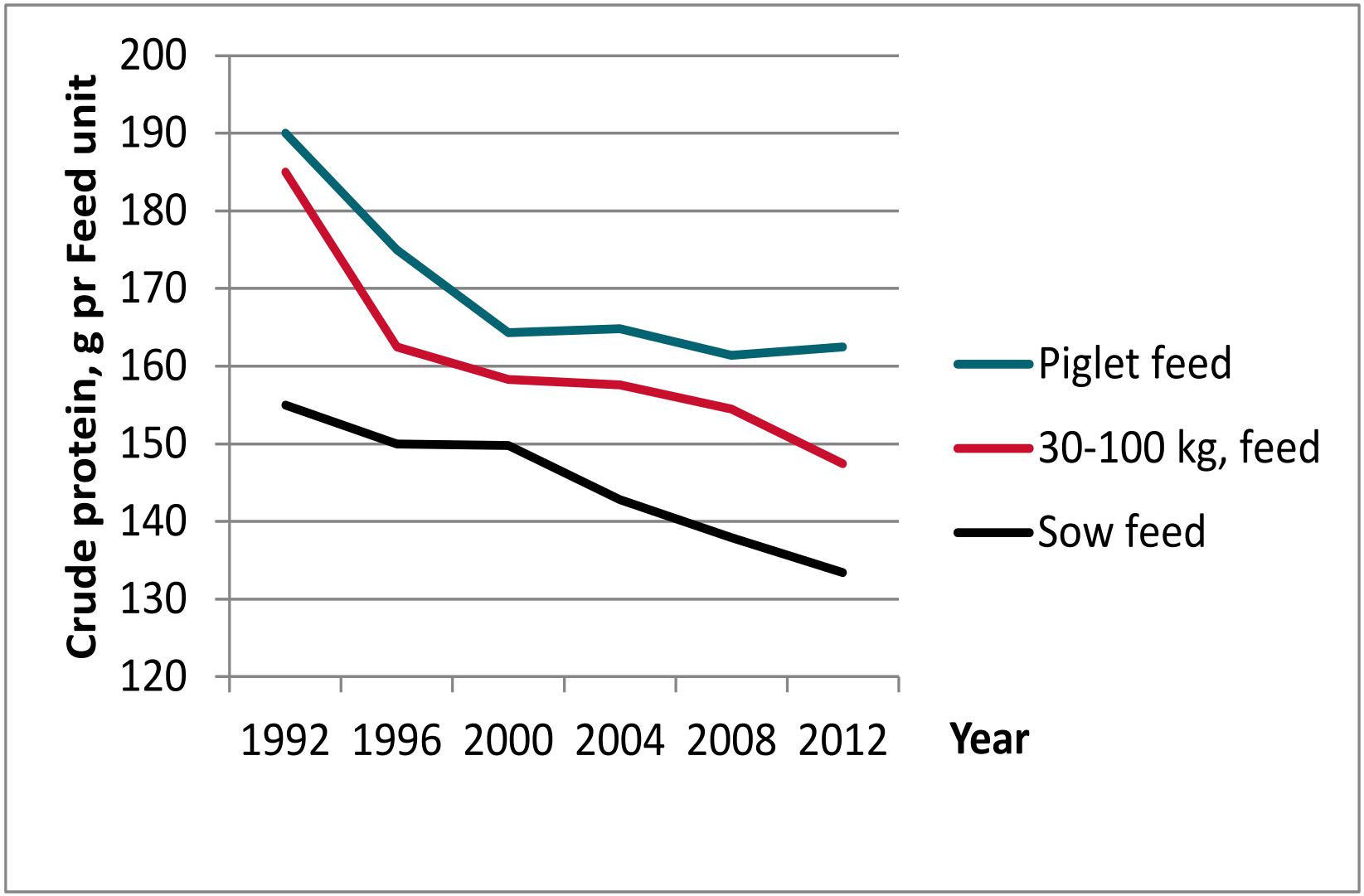

Lower protein level

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1. **Free amino acids becoming cheaper 1992-2000**

2. **Growth promotor ban in Denmark, 1998/2000**
   - Low protein = less diarrhea

3. **New energy evaluation system 2004**
   - Lower energy value of protein 2004

4. **Ammonia regulation from 2007**
   - Use of feed to reach goal of 15-25% reduction

5. **Increased price of protein 2009-2012**
   - Unchanged price amino acids

Danish Feed

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- **Pig Researh Centre makes recommendations**
- **Feed industri and homemixers follow recommendations**
- **Danish pigs all get the ”same” feed**
  - Different raw materials but same nutrional standards

Piglet feed

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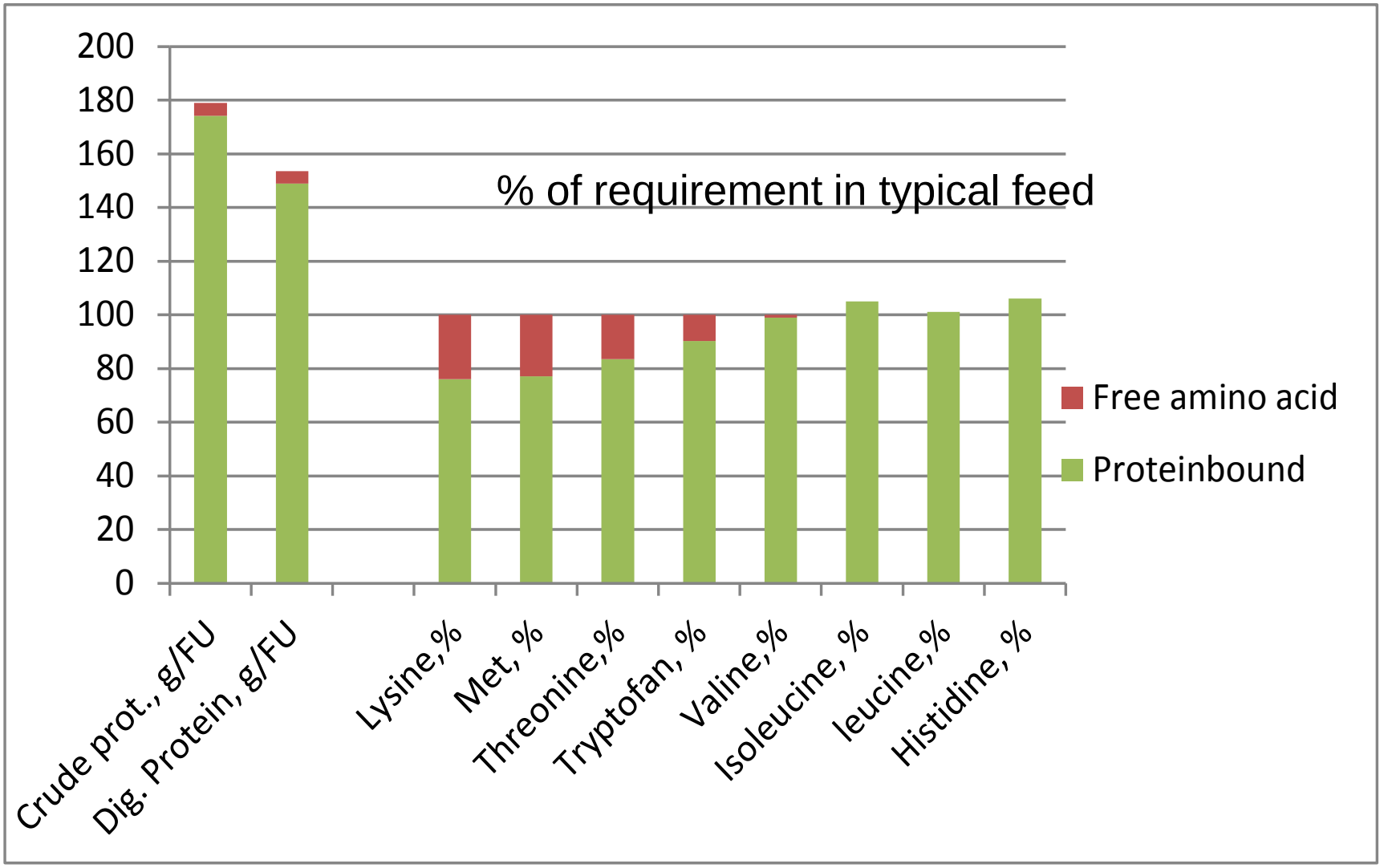

Feed for pigs 30-105 kg

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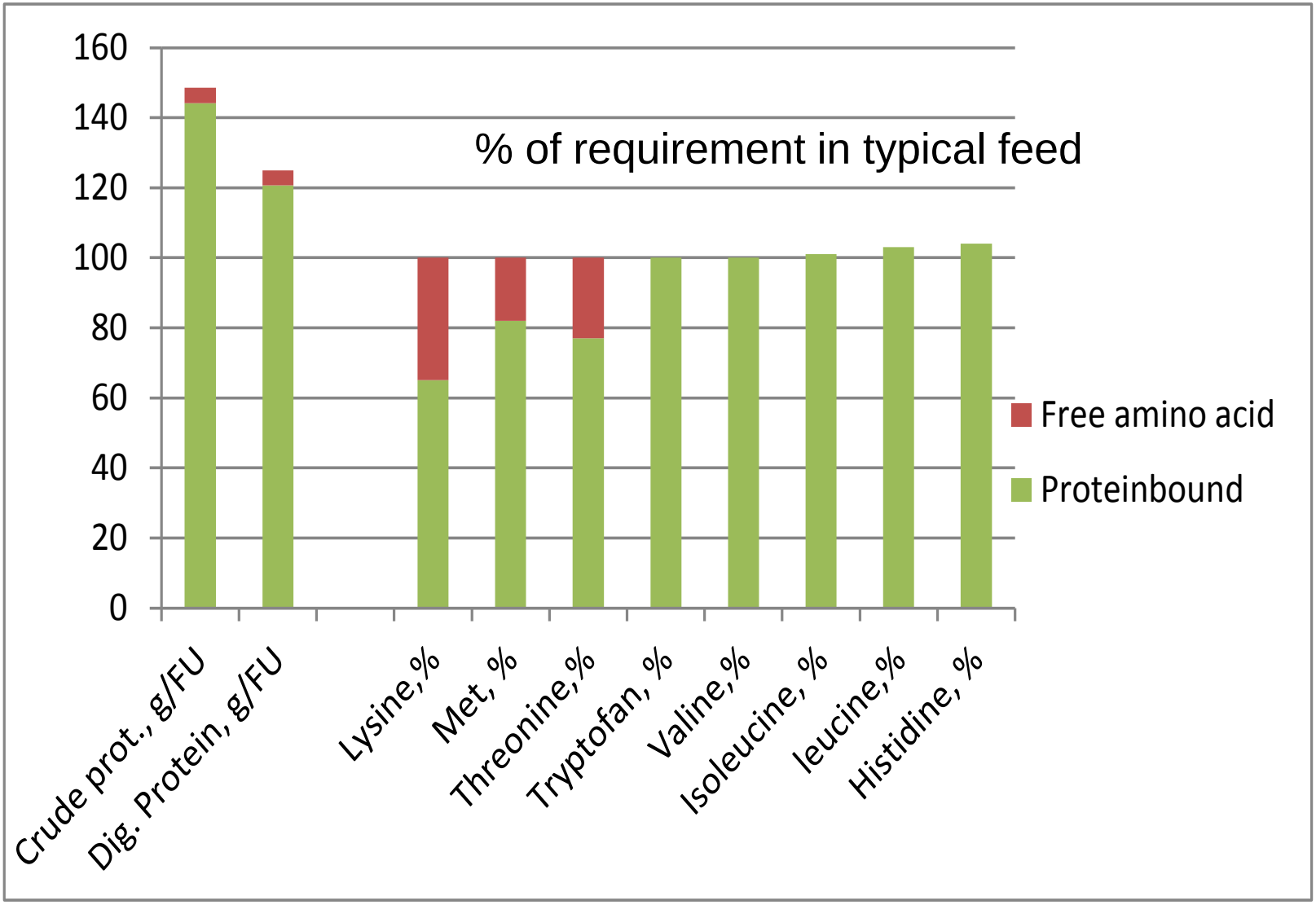

N ex animal per 100 kg liveweight

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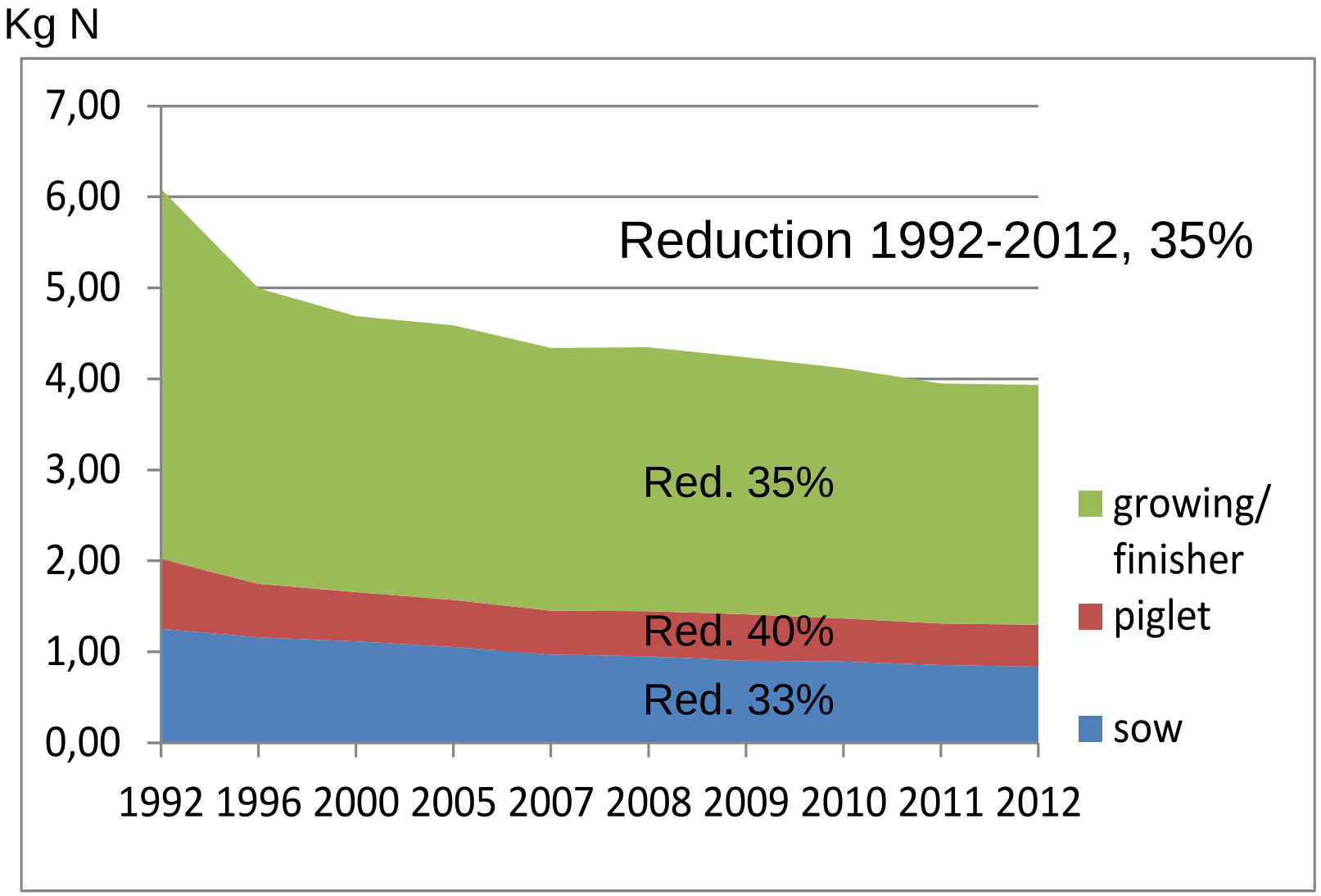

Effect of reduced protein

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- **A reduction of 10% in N ex animal**
  - 11% reduction, TAN-N sows
  - 13% reduction, TAN-N, 30-100 kg pigs
  - 15% reduction, TAN-N, weaners
  - 0.1 lower pH
  - 15% reduction of ammonia emission, average
- **1992-2012 : 35% reduction in N ex animal**
  - Expected around 50% reduction in ammonia emission from housing
  - Coming from less protein and better feed utilization

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The potential of free amino acids is nearly fully exploited already in 2012

– and reduced protein = reduced productivity

Phosphorus in feed

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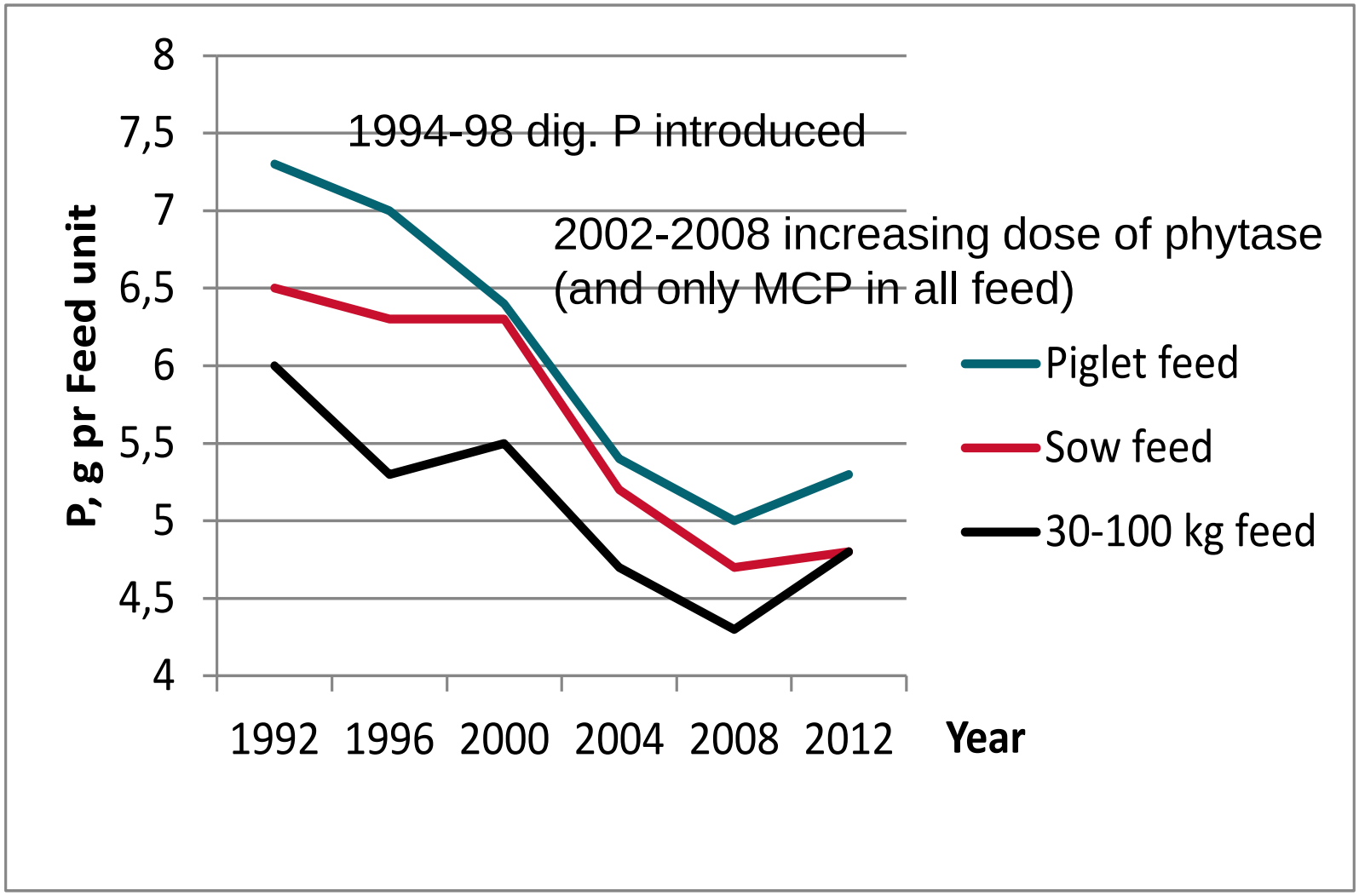

P ex animal per 100 kg liveweight

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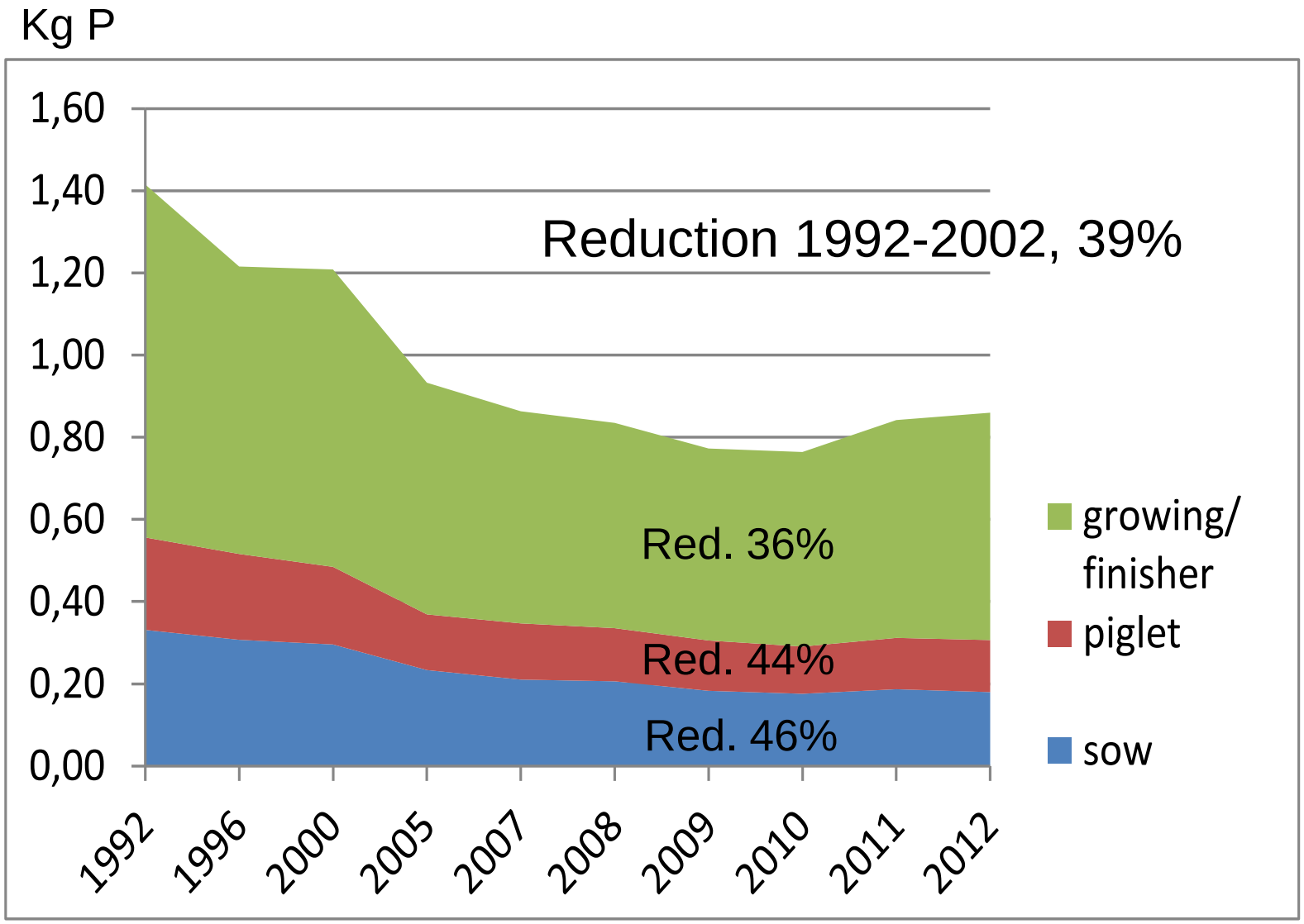

Phytase dose

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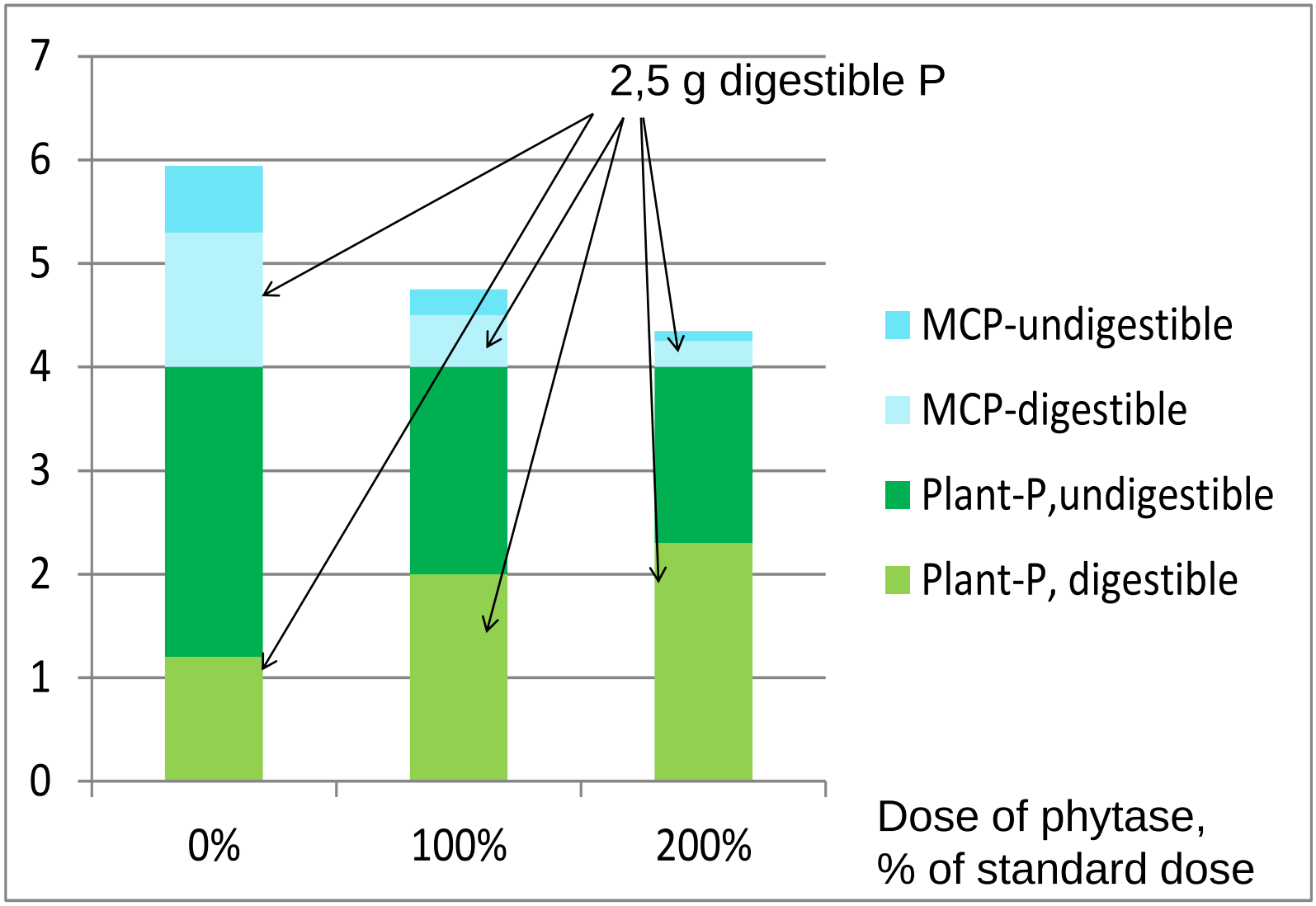
G P per Feed unit



Lower phosporus level

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- **More phytase (300% dose) – marginal effect**
- **No sunflower meal in Danish feed?**
  - Only ingredients with high digestibility?
- **Fermentation of feed before wet feeding**
  - P digestibility -> 70% (without 55-60%)
  - To much lactic acid -> lower feed intake
- **Feeding sligtly below requirement**
  - Not relevant at the moment
  - If supply of MCP runs empty (= P very expensive)
  - Welfare concern

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Mechanical separation of P and fiber
- To biogas plant
- Burning of fiber fraction
- Reutilize P as fertilizer

Danish BAT-standards 2010

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- **P: As low as possible in feed ”without” cost**
  - Phytase and fase feeding is the solution

- **Ammonia: As low as possible for 1.5 euro per pig**
- **Fully drained floor**
  - Cleaning air or acidifikation of slurry (H_2SO_4)
  - Feed : economic optimum (= low protein in 2013)
- **Partly drained floor**
  - Combined solutions
  - Protein below economic optimum (very low)
    - Dokumentation of feed
  - Cooling slurry
  - Minimum surface area slurry

Conclusions

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- **Big reduction from optimizing feed, 1992-2012**
  - N and P
  - Feed Industri and advisers follows our recommendations
- **Difficult to get much further by feed composition**
  - We have already taken 80-90% of the potential
- **Development in feed utilization has some potential**
  - Management, health and breeding – long term
- **Because of BAT standards, new buildings often have:**
  - Air cleaning or slurry acidification
  - Then feed will be ”economic optimal”
  - Protein below economic optimum only with partly drained floor

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You can produce many more pigs with same ammonia emission as in old buildings - with ”old feed”

- But can you get the money and the location?
  - Smell ?
  - Ammonia?
  - P-vulnerable area and recipient?

Danish BAT standard

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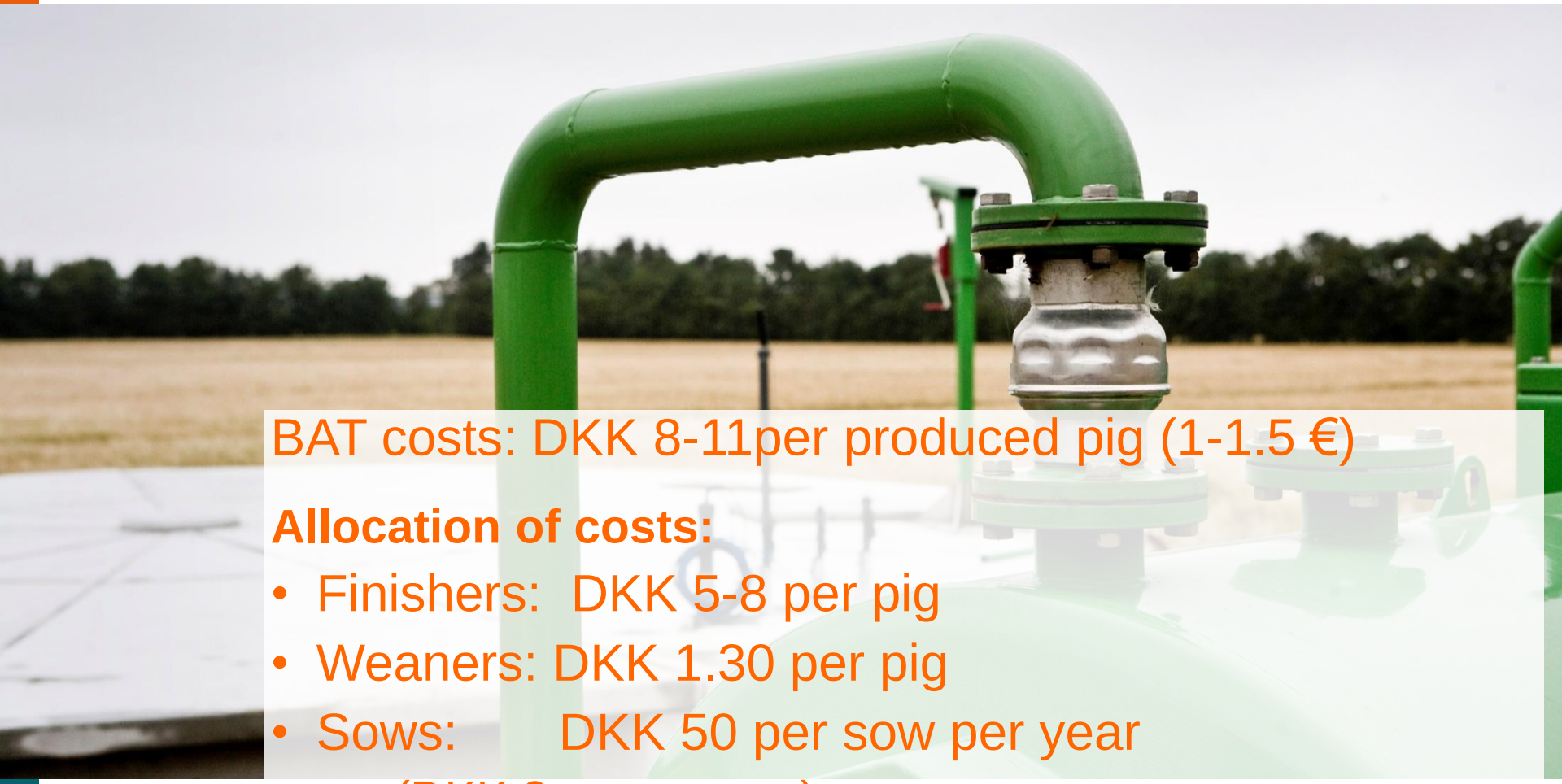

BAT costs: DKK 8-11per produced pig (1-1.5 €)

Allocation of costs:

- Finishers: DKK 5-8 per pig
- Weaners: DKK 1.30 per pig
- Sows: DKK 50 per sow per year
  - (DKK 2 per weaner)

Localized ventilation

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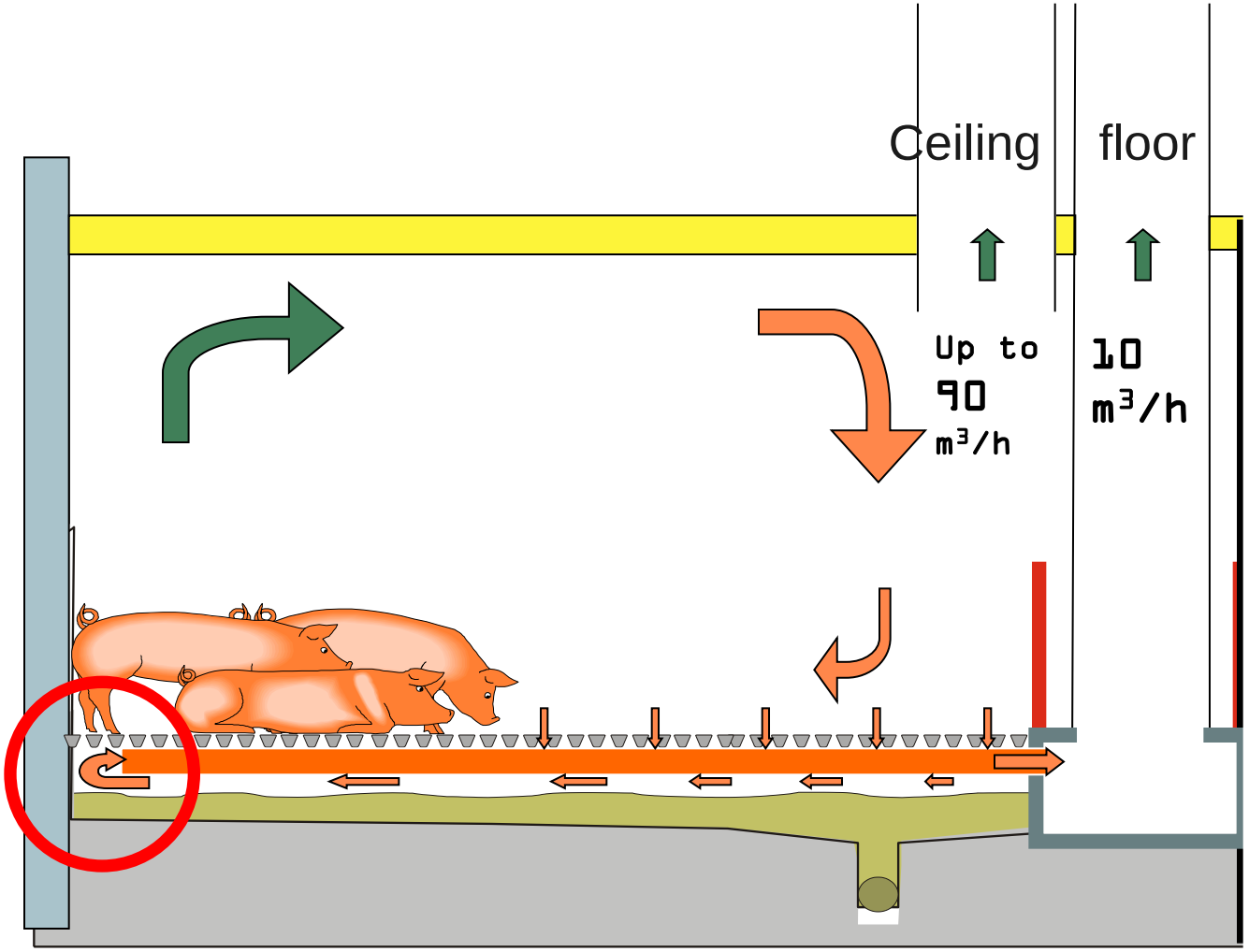

- **Extraction ventilation below the pigs' lying area**
  - area with greatest pollution

Localized ventilation

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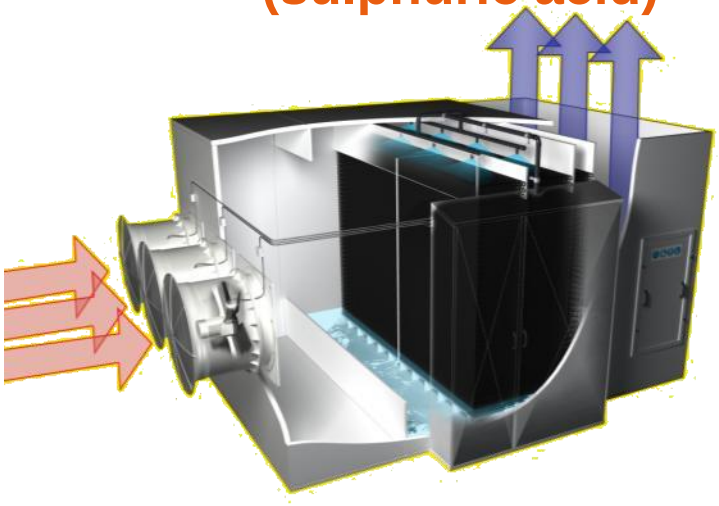
10 % of maximum ventilation capacity

Percentage of emission	Collected	Reduction after cleaning	
		Chemical	Biological
Ammonia	> 70 %	> 65 %	> 50 %
Odour	> 50 %	None	About 35 %

Chemical filter (sulphuric acid)



Biological filter

Acidification of slurry

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- **H_2SO_4 → pH < 5.5**
- **Emission from house reduced 70%**
- **Emission from storage reduced**
- **Emission from application reduced 70%**

- **If same level of Nitrogen is allowed, it will give more grain /rapeseed per ha, because N per ha is 15% below optimum**

- **Problems:**
  - Big investment and cost of H_2SO_4
  - Smell from storage tank
  - H_2S from H_2SO_4

Future development ?

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Handling of slurry

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- Compulsory yearly manure accounts
- Allocation of fertilizer: 15 % below economic optimum
- Hamony - Balance between land and animal units or written contracts – maximum application of 140 kg nitrogen from pig slurry per hectare
- Requirements for utilization of nitrogen in slurry equal to 75 %
- No broad spreading of slurry allowed (injected)
- Spreading of slurry only allowed from February to October
- Stricter regulation for vulnerable areas