Further technical development and economic sustainability of centralised Co-digestion

Johannes Christensen
Institute of Food and Resource Economics
Copenhagen

The presentation related to a recently finished project

- **Future Biogas Plants – New systems and their economic potential**
- **Published in report 188 from Institute of Food and Resource Economics**
- **Research group:**

  Institute of Food and Resource Economics, KU
  BioCentrum, DTU

  The Veterinary and Food Research Institute, DTU

  The Faculty of Agricultural Science, ÅU

  Danish Agricultural Advisory Service

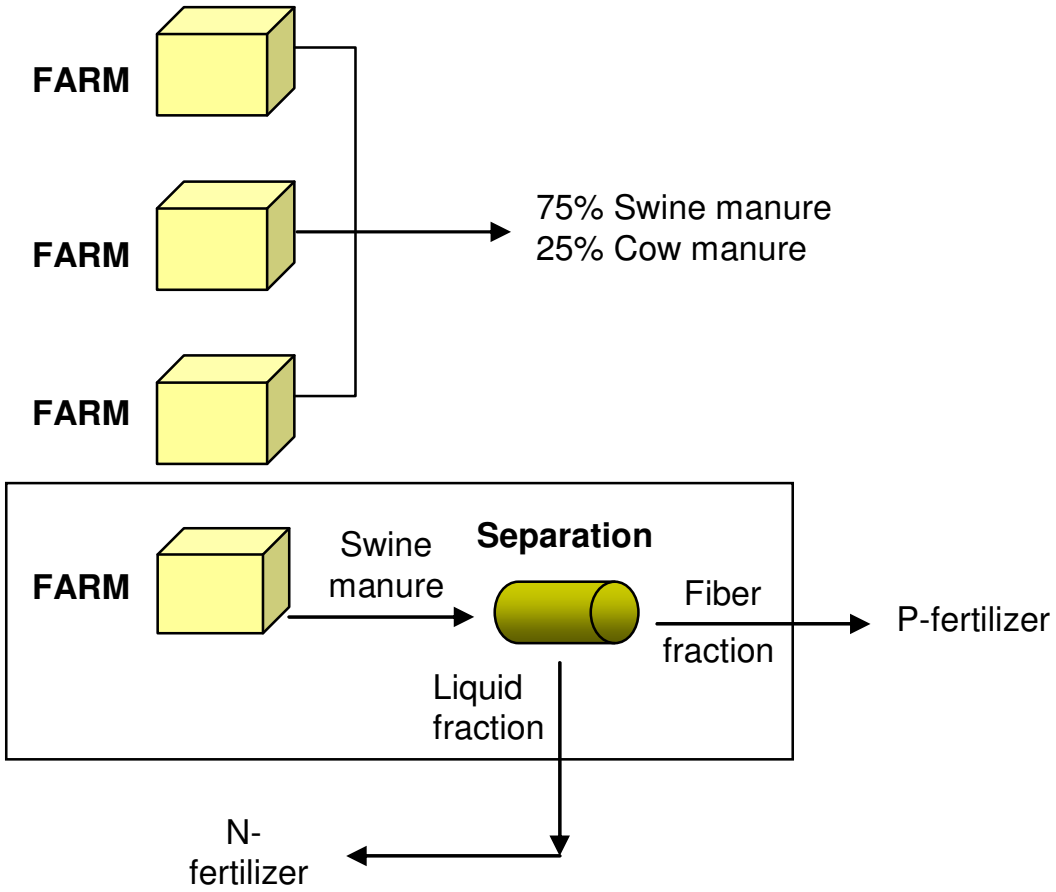
Objectives of the project

- **Identify economic efficient technical concepts and systems**
- **Less dependant on organic waste supplies**
- **Strengthen farmers incentives by solving manure handling problems**
- **Better understanding of complicated systems**

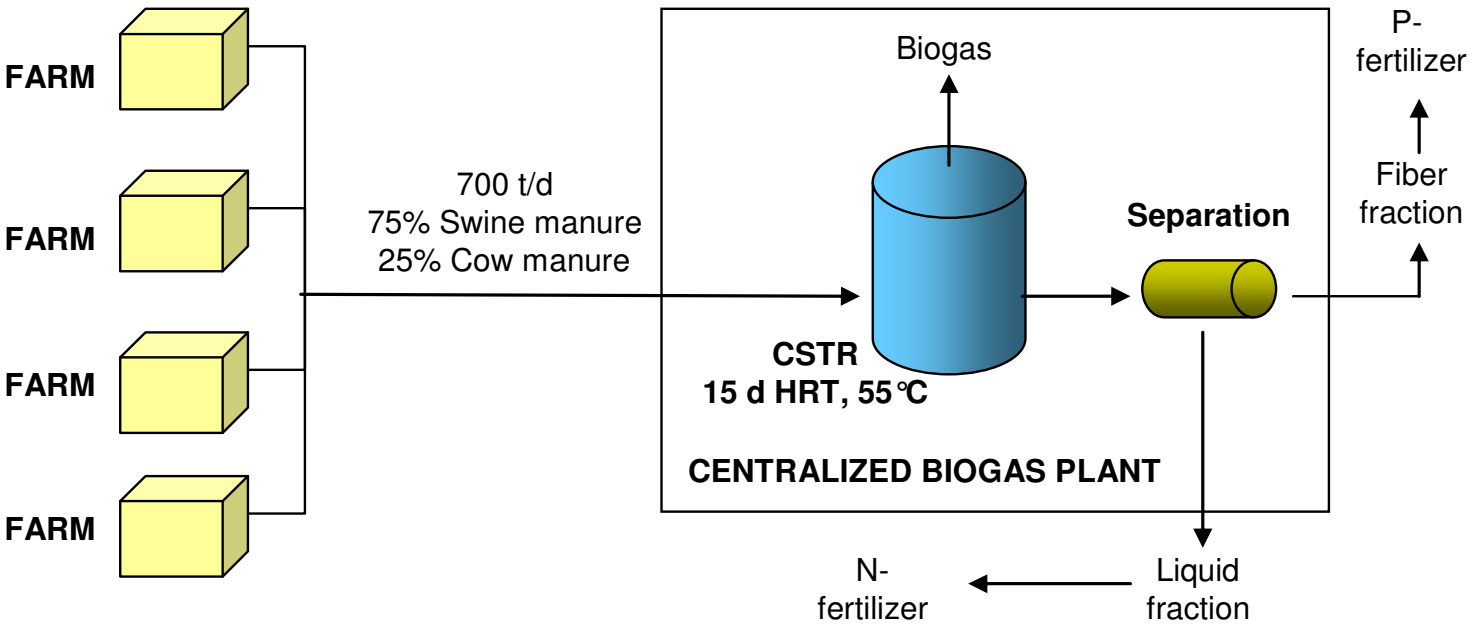
System modelling and economic assessment

- The presentation will concentrate on systems description and economic results
- The technical systems combine pre- and post separation, recycling, wet oxidation and pressure boiling with traditional CSTR biogas technology
- Data based on lab and pilot trials and experiences from conventional full scale plants

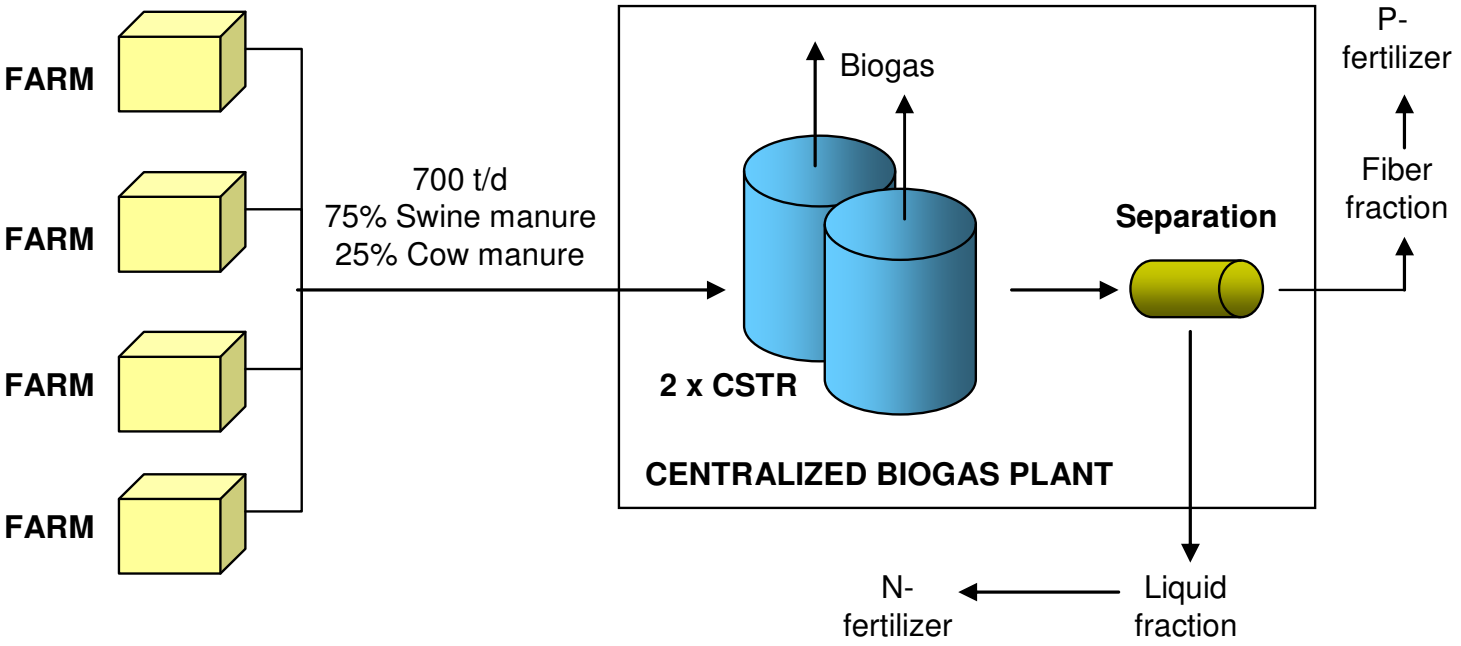
Scenario 0, no biogas plant, separation on farms depending on surplus of phosphorous



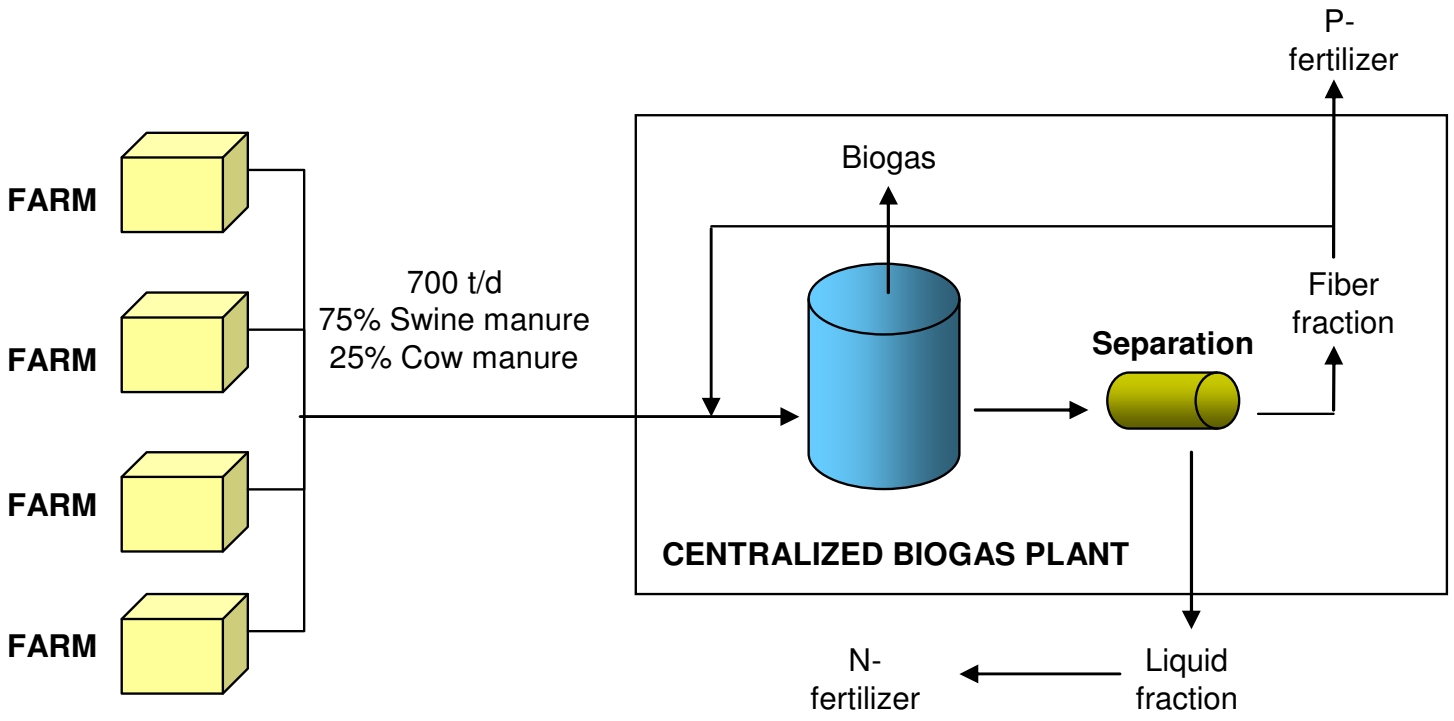
Scenario 1, biogas plant, post separation depending on surplus of phosphorous



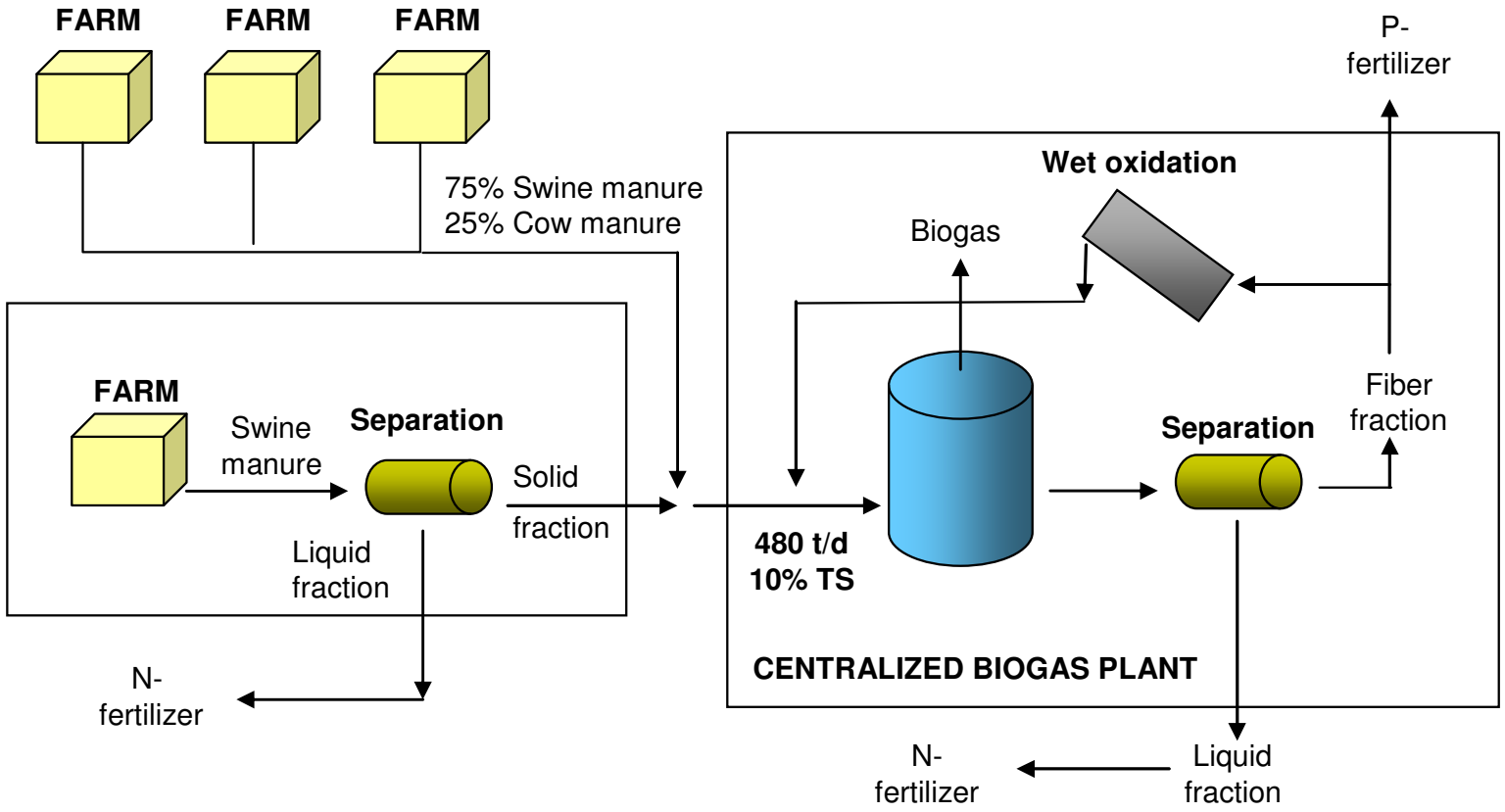
Scenario 1a, serial digestion, post separation depending on surplus of phosphorous



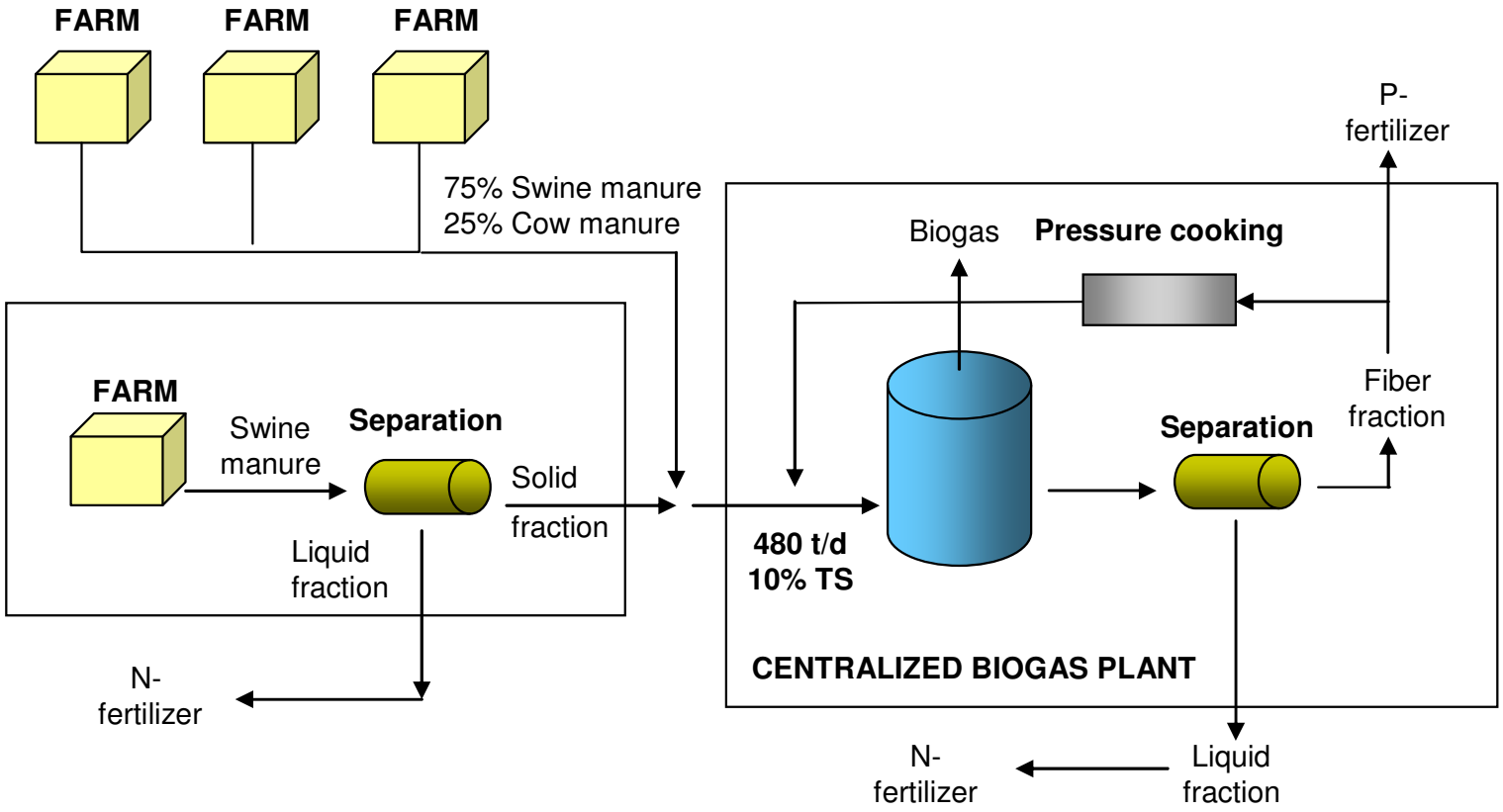
Scenario 1 b, biogas plant, recycling of post separated fibre fraction



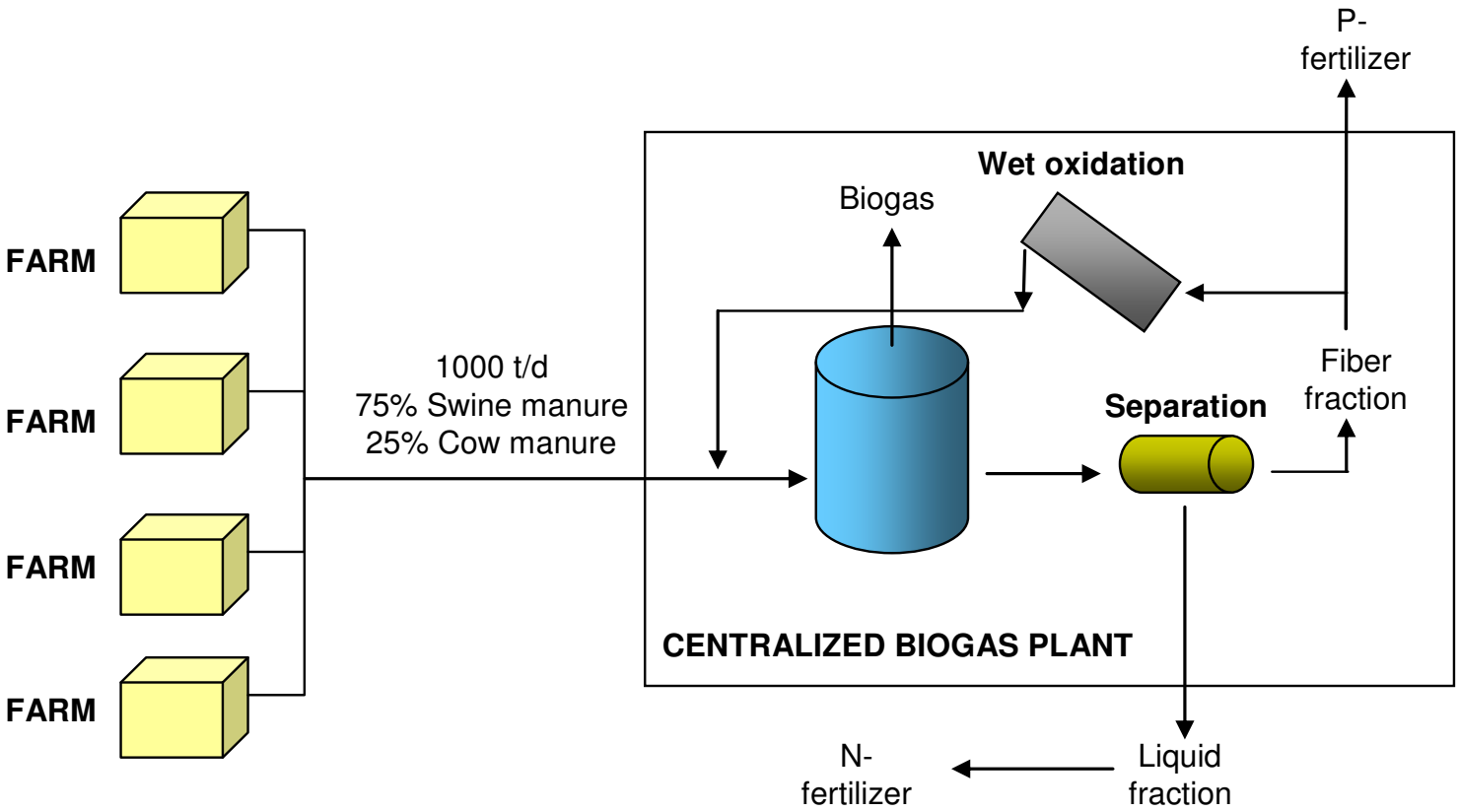
Scenario 2, On farm separation, dry matter content 10%, wet oxidation of post separated fibre fraction



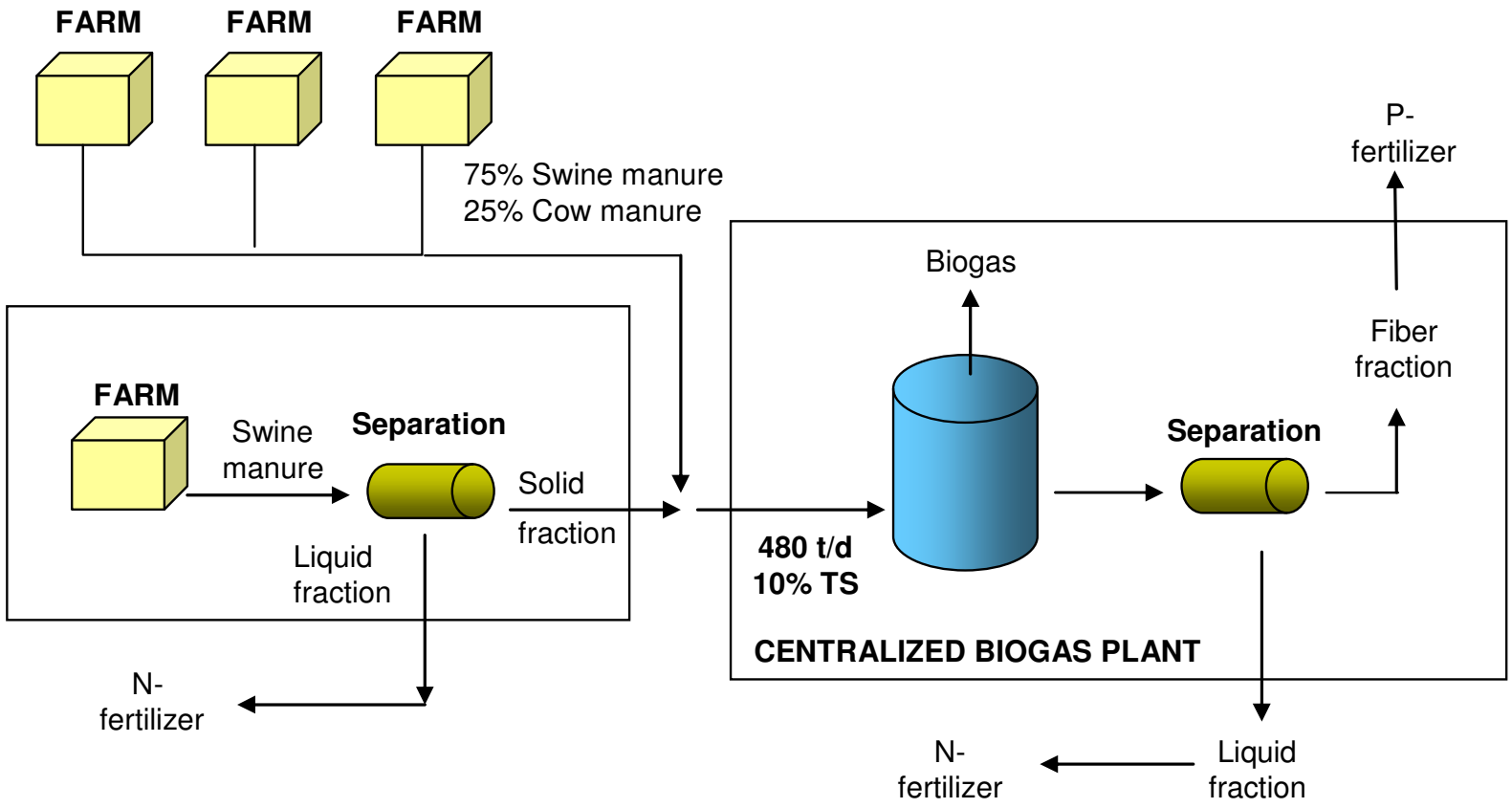
Scenario 2a, On farm separation, dry matter content 10%, pressure boiling of post separated fibre fraction



Scenario 2b, Wet oxidation of post separated fibre fraction



Scenario 2c. On farm separation, dry matter content 10%, post separation depending on surplus of phosphorous



Output of methane per ton input

Scenario	Dry matter in input, %	Treatment	m^3 CH_4/ ton input
1	5,4	None	12,1
1a	5,4	Serial digesters	13,3
1b	5,4	Recycling of fibers	13,2
2	10	Wet oxidation of recycled fibers	25,1
2a	10	Pressure boiling of recycled fibers	24,7
2b	5,4	Wet oxidation of recycled fibers	14,6
2c	10	On farm separation, no treatment	20,8

Results from economic analyses, ranking scenarios and systems

Scenario	On farm separation	Post separation	Pre treatment	Farmer`s part DKK/tonne input	Biogas plant part DKK/tonne input	Total system DKK/tonne input
0	+	-	-	49	-	49
1	-	+	-	39	29	68
1a	-	+	Serial digesters	39	25	65
1b	-	+	Recycling of fibers	40	28	68
2	+	+	Wet oxidation of recycled fibers	49	18	58
2a	+	+	Pressure boiling of recycled fibers	49	24	60
2b	-	+	Wet oxidation of recycled fibers	39	27	66
2c	+	+	On farm separation, no treatment	50	19	59

Main conclusions

- **None of scenarios economic feasible compared to a situation with no biogas (scenario 0)**
- **It means that high yielding waste supply is still important**
- **On farm separation and pre-treatment will improve the economic performance compared with scenario 1, conventional biogas plant**
- **Wet separation and pressure boiling are not convincing economically compared with no treatment (scenario 2c). It means that the higher output of methane can not fully cower the extra treatment costs**

Perspectives for biogas business

- **Wet oxidation and pressure boiling are not ready for market implementation**
- **Pre separation on farms seams to be a good idea to increase dry matter input, reduce transport costs and increase energy production potential**
- **If on farm separation is difficult to organise without a centralised biogas plant it will increase the economic performance of such alternatives as scenario 0 will be more costly in handling the surplus of manure (alternatively reduce the animal production in the area)**