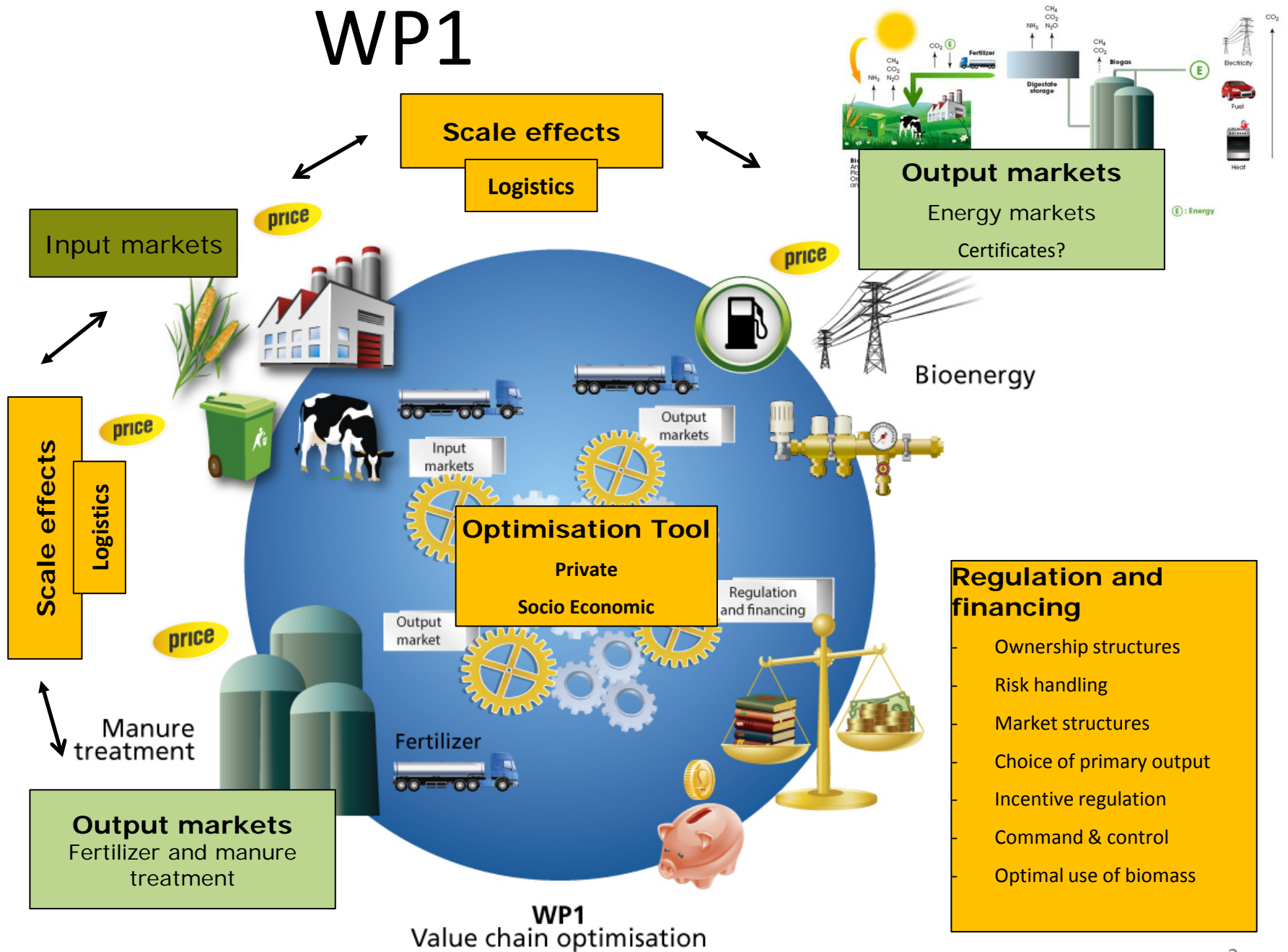


WP1
Value chain optimisation

Work package 1, Value chain modelling and optimisation

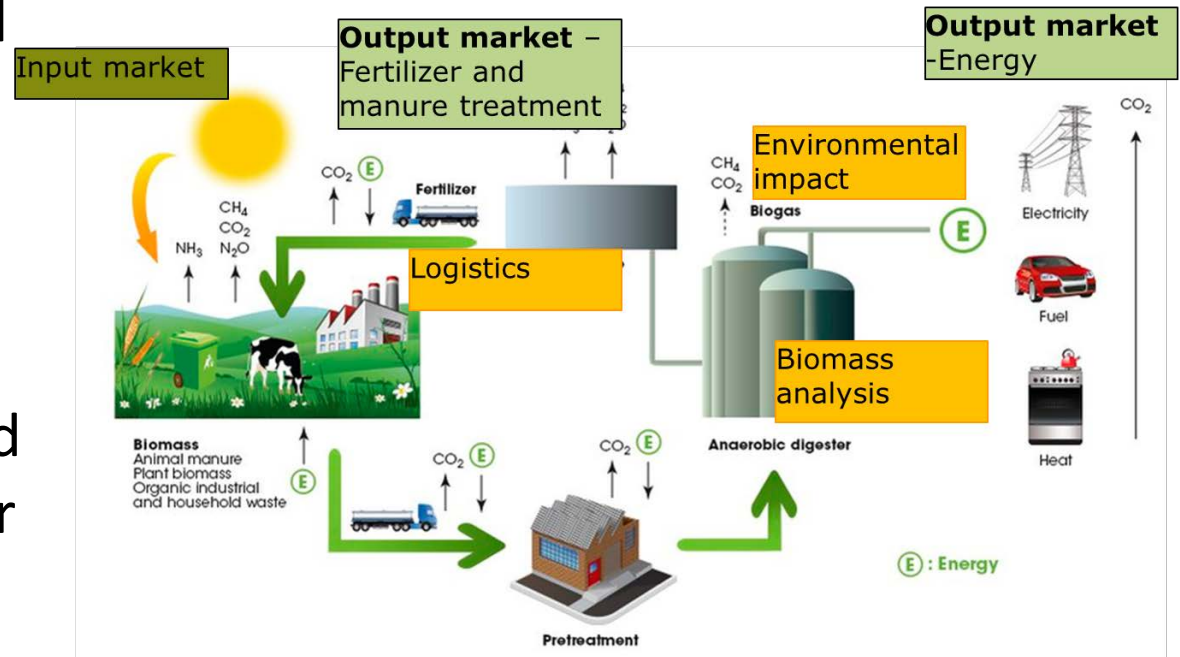
WP1



Objective and results

Objective: Develop a plant level optimisation model for the biogas value chain and expand to a national scale model

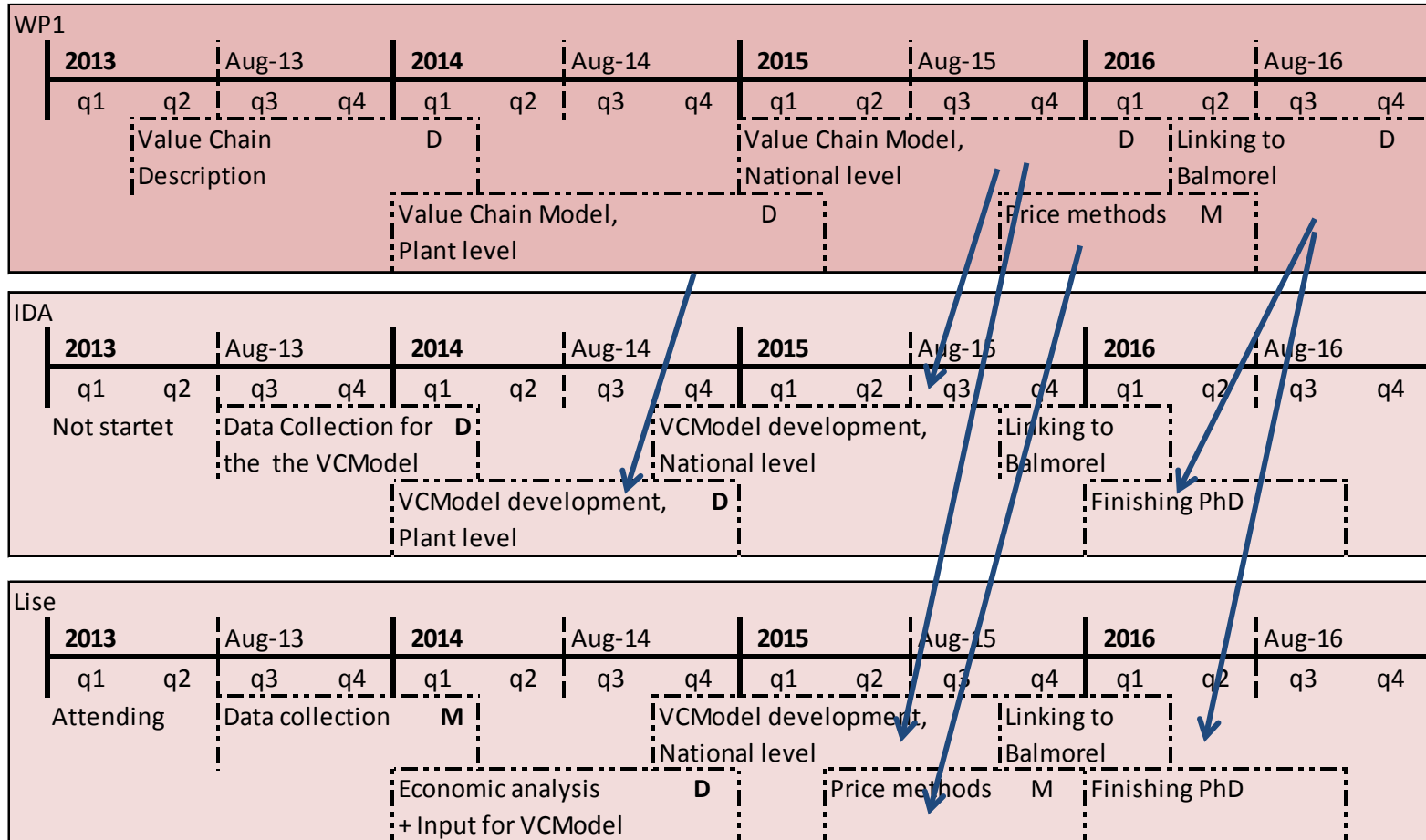
Result: Model setup supporting biogas plant investment decisions and national policy design for the optimal use of resources



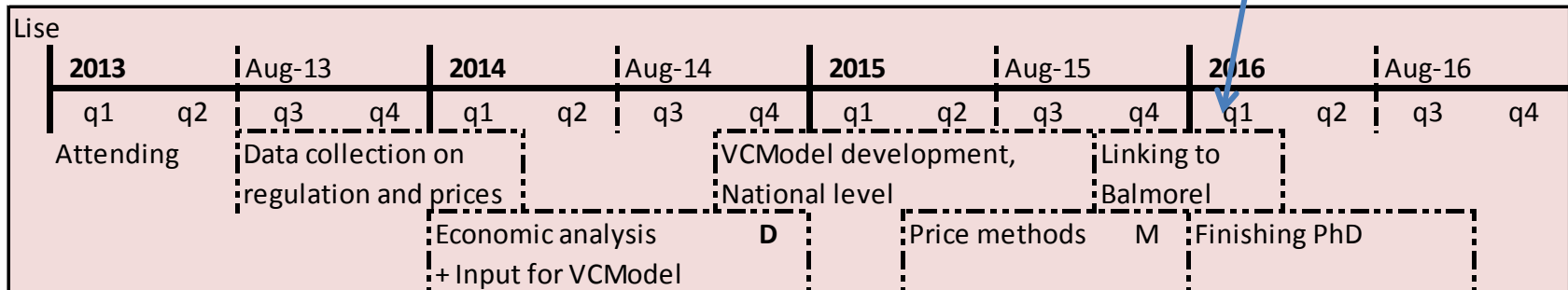
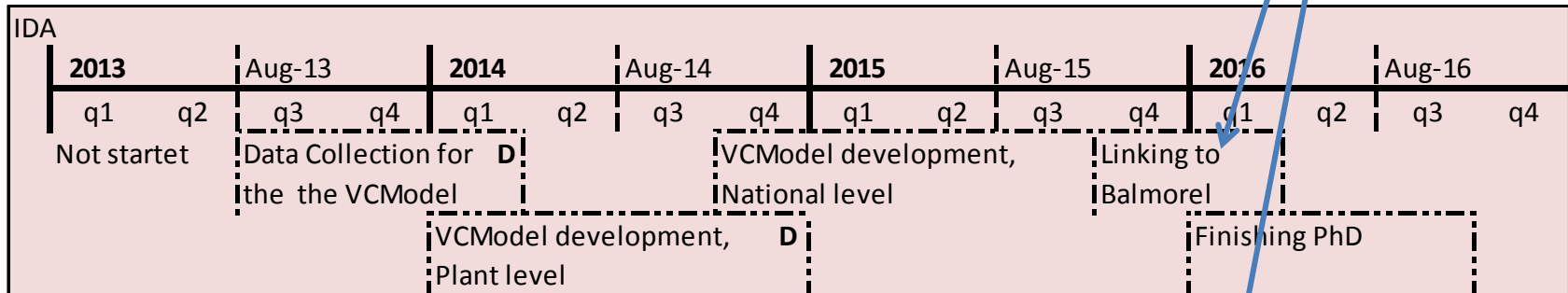
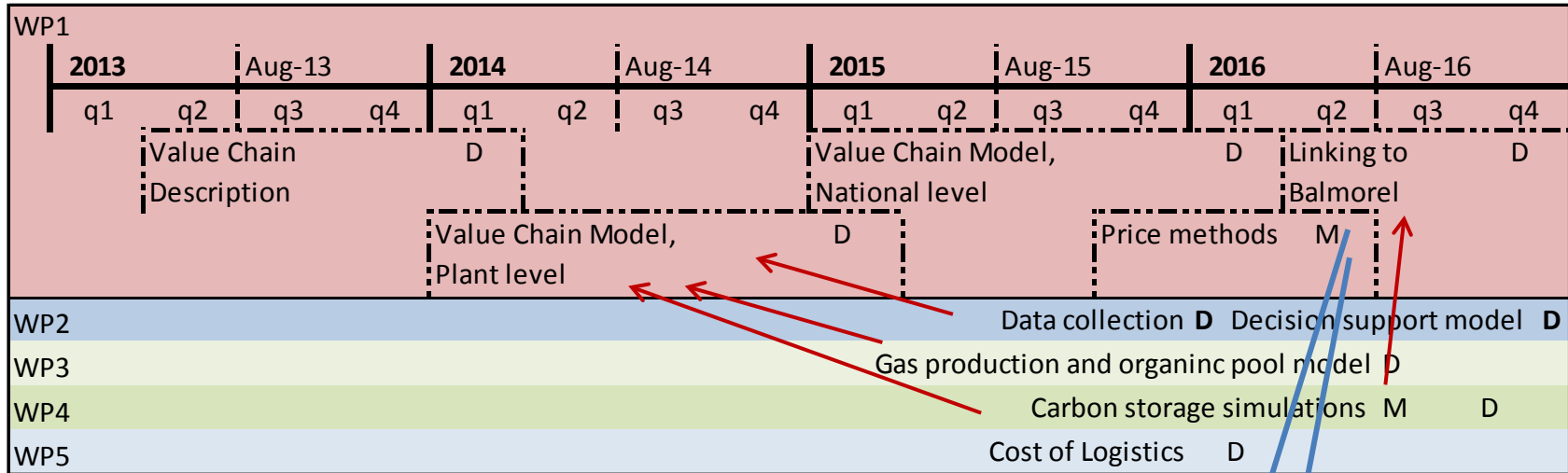
Deliveries (D) and Milestones (M)

- M: 2 PhD students enrolled and started with study plans finalised (Aug 13)
- Value chain description
 - Conceptual description of value chain for biogas (master thesis published, M Sept 13)
 - Value chain described (D Q1-14)
- Model for biogas value chain optimisation at plant level
 - Value chain optimisation model (M Q3-14)
 - Value chain model and analysis reported (D Q1-15)
- National level value chain model
 - Value chain expanded to national level (M Q3-15)
 - National value chain model documented and reported (D Q1-16)
 - National value chain model and energy systems model linked (D Q3-16)

Time schedule, WP1



WP1 deadlines related to other WPs



Achieved






Staff

- 1 PhD: Value chain modelling using operations research including methods from stochastic programming (start August 2013)
- 1 PhD: Modelling and microeconomic analysis of incentives, ownership structure and interaction with national level energy model (start August 2013)

Progress

- Master student thesis defended and published with conceptual plant level value chain modelling, excluding stochastics (input Maabjerg) (Milestone Sept)
- New master student with project linking the value chain to national scale use (optimal use of biogas) Including Fredericia SPV and Grontmij for input
- Several meetings with other partners WP5 (KCA), Østfold Forskning, and Måbjerg (incl Vinderup and suppliers) discussing and collecting inputs for value chain plant level and identifying key risk and regulatory parameters; participating in biogas task force reporting meeting

Risk and distribution of risk is an important element for value and incentives

- **Input costs** – long term contracts for supply (volume and price for manure) (including treatment service)  Risk reduction for risk averse farmers and biogas plant
- **Input costs** - flexible input mix of biomass crops/waste (volume and price)  More flexible inputs (technology+potentials) reduce risk to biogas plant
- **Output biogas**– long term contracts for supply to CHP/upgrading plant or gas grid (volume and/or price)  Reduce risk to biogas plant if price and volume risk covered – risk reduction for CHP only for price contract
- **Output biogas**– long term alternative option for use (access to variable volume - local heat)  Diverse distribution/use channels reduce risk to biogas plant
- **Output** – fertiliser (value) price will be determined by competitive alternative  Risk reduction (volume) for biogas plant

- Måbjerg BioEnergy within a chain.

- Three parts of the chain Organisation and focus of value chain

Optimisation

Suppliers

- Logistics
- Dry matter content
- Fertilizer value content - phosphor
- Incremental investments
- Supply obligations
- Insurance against stricter manure regulation



Måbjerg BioEnergy

- Investment/financing/ ownership
- Risk hedging – input and outputs
- Regulation
- Logistics
- Choice of technology input dependent (mink, mesofilt)
- Number of treatment facilities – input-dependent (Arla)
- Public acceptance

- Vinderup varmeværk

Input markets

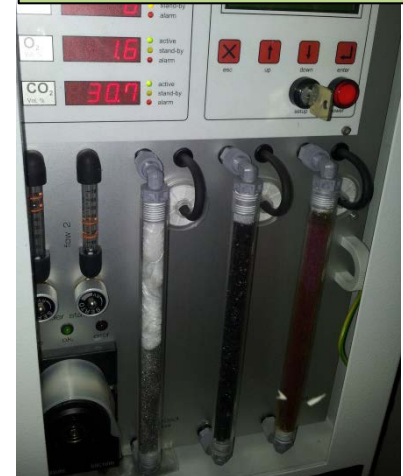


Output markets Fertilizer and manure treatment



Output markets

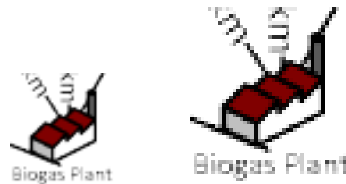
Energy markets



Scale effects – economies of scale

- Collection costs and density of resources
 - trade off between distance and size of resource

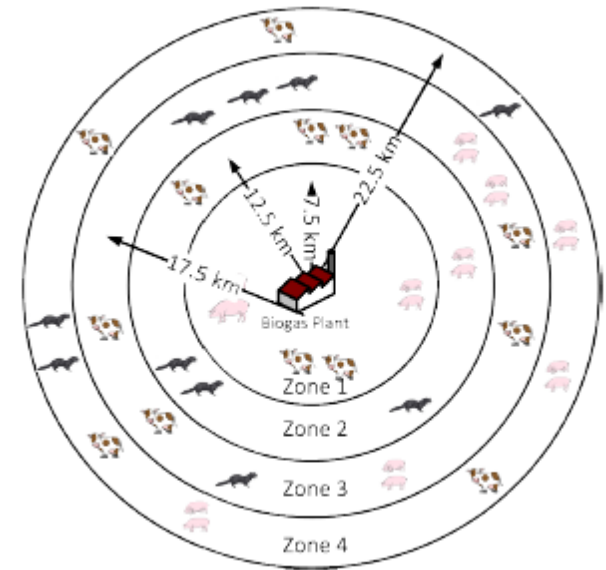
- Scale of biogas plant



- Scale and costs of biogas storage



- Scale of upgrading facility and costs



Questions

- Plant level optimisation model flexibility
 - Capable of analysing scaling of technologies?
 - Uncertainty: – inputs – outputs or technologies?
 - Volume uncertainty versus price uncertainty
 - Regulatory uncertainty on inputs and subsidies on outputs
 - Time constraints on input supply and demand profiles included