A Spatial Investment Model for Anaerobic Digestion (SIMAD)

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1 Problem setup

Consider a single investor with ownership or access to multiple locations that are suitable for establishing combined heat and power (CHP) anaerobic digestion (AD) plants and multiple locations from which to source AD feedstock. Let i represent the set of all locations where feedstocks are to be sourced from and j represent the set of all suitable locations for establishing AD plants. Also let f represent the set of feedstock types and t represent the set of time periods making up CHP AD plant life. These are summarised as follows;

Table 1: Set of locations, time periods and feedstock types

Set	Definition	Domain	Number
i	Feedstock source locations	$i \in \{i_1, i_2, ..., i_m\}$	m
j	Suitable AD plant locations	$j \in \{j_1, j_2, ..., j_n\}$	n
f	Feedstock types	$f \in \{f_1, f_2, ..., f_w\}$	w
t	Time periods	$t \in \{1, 2, ..., T\}$	T

In the above summary, there are m set of feedstock locations and n set of suitable locations for establishing AD plants. There are also w types of feedstocks to source and T years of CHP AD plant life (i.e. planning horizon of investment). The objective of the investor is to determine the AD investment strategy that would maximise their overall returns over T years. In doing so the investor aims to simultaneously optimise the following set of decisions;

- The number of AD plants to establish
- The (subset of) suitable locations in which to establish the AD plants
- The size of AD plant to establish in each location
- The optimum quantity (kg) of each feedstock type to source from each feedstock source location, taking into consideration the transportation costs from the feedstock source locations to the established AD plant locations

In optimising the above decisions, the investor achieves the overall objective of maximising their returns from investment in AD plants.

2 Mathematical formulation

2.1 Objective function

Let $npvOverall$ (£) represent an endogenous variable indicating the overall net present value (NPV) of investment from establishing AD plants in all or a subset of the suitable AD plant locations and let $npvAtPlant(j)$ (£) represent an endogenous variable indicating the NPV of establishing an AD plant at suitable plant location j. Also let $establish(j)$ represent an endogenous binary variable that is equal to 1 if an AD plant is established in location j and 0 otherwise. Now let $cashFlow(j,t)$(£) represent an endogenous variable indicating cashflow of an AD plant in location j in period t and let $totalCapitalInvestment(j)$ (£) represent an endogenous variable indicating the total capital investment cost (i.e. machinery and building capital costs) of establishing an AD plant in suitable location j.

The objective of the investor is to maximise the $npvOverall$ (£) of investments over all plants in T years as follows;

$$\max\ npvOverall = \sum_{j}\left(npvAtPlant(j)\times establish(j)\right) \quad \textbf{(1)}$$

where

$$npvAtPlant(j) = \begin{cases} -totalCapitalInvestment(j) + \sum_{t=1}^{T} cashFlow(j,t)\big/(1+discountRate)^{t-1} & if\ establish(j)=1 \\ 0 & if\ establish(j)=0 \end{cases} \quad \textbf{(2)}$$

In the above formulation, the investor aims to maximise the net present value of investments in all established plants. Note that although there are n locations exogenously identified as suitable for establishing AD plants, the decision to establish a plant (or not) at each suitable location j is endogenously determined in the variable $establish(j)$. This means that the final solution could be to establish plants in all suitable locations or a subset of the suitable locations only or none at all. Also note that $cashFlow(j,t)$ (£) and $totalCapitalInvestment(j)$ (£) are only positive if a plant is established in location j (i.e. if $establish(j)=1$) and 0 if a plant is not established at location j (i.e. if $establish(j)=0$).

2.2 Cashflow

In equation **(2)**, cashflow at plant location j in period t is determined as follows;

$$cashFlow(j,t) = postTaxProfit(j,t) + machineryDepreciationCost(j,t) + buildingDepreciationCost(j,t) \quad \textbf{(3)}$$

where

$$postTaxProfit(j,t) = preTaxProfit(j,t) - tax(j,t) \quad \textbf{(4)}$$

$$preTaxProfit(j,t) = annualRevenue(j,t) - annualCost(j,t) \quad \textbf{(5)}$$

$$tax(j,t) = taxRate \times preTaxProfit(j,t) \quad \text{if} \quad preTaxProfit(j,t) > 0 \quad \textbf{(6)}$$

$$annualRevenues(j,t) = electricityRevenue(j,t) + heatRevenue(j,t) + gateFeeRevenue(j,t) \quad \textbf{(7)}$$

$$\begin{aligned} annualCost(j,t) = {} & opexCost(j,t) + transportCost(j,t) + loanRepaymentCost(j,t) \\ & + machineryDeprecicationCost(j,t) + buildingDepreciationCost(j,t) \end{aligned} \quad \textbf{(8)}$$

2.2.1 Determining Revenues

2.2.1.1 Calculating electricity revenue

Let $elecPrice(t)$ (£/kWh) represent an exogenous parameter indicating the market price of electricity in period t and let $FIT_{small}(t)$, $FIT_{medium}(t)$ and $FIT_{large}(t)$ (£/kWh) represent an exogenous parameter indicating Feed-in-Tariff (FIT) payments for electricity produced by small, medium and large sized AD plants respectively in period t. Also let $elecCapacity(j)$ (kW) represent an endogenous variable indicating electricity production capacity of plant in location j and $elecEnergy(j,t)$ (kWh) represent an endogenous variable indicating the amount of electricity produced at location j in period t. Then if a plant is established in location j (i.e. if $establish(j) = 1$), the electricity revenue $electricityRevenue(j,t)$ (£) for the plant in period t (i.e. $electricityRevenue(j,t)$) is calculated as follows;

$$electricityRevenue(j,t) = \begin{cases} (elecPrice(t) + FIT_{small}(t)) \times elecEnergy(j,t) & if\ 0 < elecCapacity(j) \leq 250\text{kW} \\ (elecPrice(t) + FIT_{medium}(t)) \times elecEnergy(j,t) & if\ 250 < elecCapacity(j) \leq 500\text{kW} \\ (elecPrice(t) + FIT_{large}(t)) \times elecEnergy(j,t) & if\ 500 < elecCapacity(j) \leq 5000\text{kW} \\ elecPrice(t) \times elecEnergy(j,t) & elecCapacity(j) > 5000\text{kW} \end{cases} \quad \textbf{(9)}$$

Note in equation **(9)** above that if the effective electricity production capacity of plant in location j is less than or equal to 250kW, the plant is deemed to be small and is eligible for FIT payments in that category. This is in addition to the market price. The same applies to medium and large sized plants. If the plant capacity is above 5000kW however, no FIT payments are made. The plant receives market prices only.

2.2.1.2 Calculating heat revenue

Let $heatPrice(t)$ (£/kWh) represent an exogenous parameter indicating the market price of heat in period t and let $RHI_{small}(t)$, $RHI_{medium}(t)$ and $RHI_{large}(t)$ (£/kWh) represent an exogenous parameter indicating Renewable Heat Incentive (RHI) payments for heat produced by small, medium and large sized AD plants respectively in period t. Also let $heatCapacity(j)$ (kW) represent an endogenous variable indicating heat production capacity of plant in location j and $heatEnergy(j,t)$ (kWh) represent an endogenous variable indicating the amount of heat produced at location j in period t. Then if a plant is established in location j

(i.e. if $establish(j)=1$), the heat revenue $heatRevenue(j,t)$ (£) for the plant in period t (i.e. $heatRevenue(j,t)$) is calculated as follows;

$$heatRevenue(j,t)=\begin{cases}\left(heatPrice(t)+RHI_{small}(t)\right)\times heatEnergy(j,t) & if\ 0<heatCapacity(j)<200\text{kW}\\ \left(heatPrice(t)+RHI_{medium}(t)\right)\times heatEnergy(j,t) & if\ 200\le heatCapacity(j)<600\text{kW}\\ \left(heatPrice(t)+RHI_{large}(t)\right)\times heatEnergy(j,t) & if\ heatCapacity(j)\ge 600\text{kW}\end{cases} \quad \textbf{(10)}$$

Note in equation (10) above that if the effective heat capacity of plant in location j is less than or equal to 200kW, the plant is classified as small and is eligible for RHI tariff payments in the small plant size category only (i.e. receives RHI_{small}), in addition to the market prices received for heat sales (i.e. $heatPrice(t)$). The same applies to medium and large sized plants.

2.2.1.3 Calculating gate fee revenues

Let $gateFee(f,t)$ (£) represent an exogenous parameter indicating the gate fee for feedstock type f in period t. Also let $optmlFdStckAmt(i,j,f,t)$ (kg) represent an endogenous variable indicating the optimal amount of feedstock of type f that is sourced from feedstock source location i to plant location j in period t. Then we calculate the total gate fee revenues for plant j in period t $gateFeeRevenue(j,t)$ (£) (i.e. if $establish(j)=1$) as follows;

$$gateFeeRevenue(j,t)=\sum_{i,f}\left(gateFee(f,t)\times optmlFdStckAmt(i,j,f,t)\right) \quad \textbf{(11)}$$

2.2.2 Determining Costs

2.2.2.1 Calculating overhead costs

Let $totalCapacityAtPlant(j)$ (kW) represent an endogenous variable indicating the total capacity in kW of plant in location j (i.e. electricity production capacity $elecCapacity(j)$ (kW) plus heat production capacity $heatCapacity(j)$ (kW)). Also let $opexCostPerKW(t)$ (£) represent an exogenous parameter indicating the operations cost per kW of power in period t. The total operations cost of plant in location j in period t (i.e. if $establish(j)=1$) is given by;

$$operationsCost(j,t)=opexCostPerKW(t)\times totalCapacityAtPlant(j) \quad \textbf{(12)}$$

2.2.2.2 Calculating transport costs

Let $distance(i,j)$ (km) represent an exogenous parameter indicating the distance from feedstock source location i to suitable plant location j. Also let $transportCostPerKmPerKg(f,t)$ (£/km.kg) represent an

exogenous parameter indicating the transport cost per km per kg of feedstock type f in period t. We calculate the total transport cost of plant in location j in period t (i.e. if $establish(j)=1$) as follows;

$$transportCost(j,t)=\sum_{i,f}\left(transportCostPerKmPerKg(f,t)\times distance(i,j)\times optmlFdStckAmt(i,j,f,t)\right) \quad \textbf{(13)}$$

2.2.2.3 Calculating loan repayment costs

Let $loanPercent$ (%) represent an exogenous parameter indicating the percentage of total capital investment that is loaned from banks, the rest being equity. Then the total loan amount $loanAmount(j)$ (£) that is loaned from banks to plant in location j is given by

$$loanAmount(j)=loanPercent\times totalCapitalInvestment \quad \textbf{(14)}$$

Now let $interestRateLoan$ (%) and $loanRepaymentTerm$ (years) represent exogenous parameters indicating the interest rate of loans and the loan repayment terms respectively. We assume that interest and principal payments are made annually so that at the end of the loan repayment term the total loans owed are cleared. The annual loan cost $loanRepaymentAmount(j,t)$ (£) of plant in location j in period t is given by

$$loanRepaymentAmount(j,t)=\left(interestRateLoan\times loanAmount(j)\right)\Big/\left(1-\left(1+interestRateLoan\right)^{-loanRepaymentTerm}\right) \quad \textbf{(15)}$$

with payments made up to $loanRepaymentTerm$ years only.

2.2.2.4 Calculating machinery and building depreciation costs

Let $capitalCostMachinery(j)$ (£) and $capitalCostBuilding(j)$ (£) represent the endogenous variables indicating the capital cost of machinery and buildings respectively in plant location j so that the sum of the two is the total capital investment $totalCapitalInvestment(j)$ (£). We assume straight line depreciation of both machinery and building capital costs so that the total annual depreciation costs of machinery $depreciationCostMachinery(j,t)$ (£) and buildings $depreciationCostBuilding(j,t)$ (£) (i.e. if $establish(j)=1$) are given as follows;

$$depreciationCostMachinery(j,t)=capitalCostMachinery(j)/T \quad \textbf{(16)}$$

$$depreciationCostBuilding(j,t)=capitalCostBuilding(j)/T \quad \textbf{(17)}$$

where T is the project planning horizon as previously defined.

2.3 Energy production and plant capacity

Let $feedstockYield(f)$ (m^3/kg) represent the exogenously determined feedstock yield of feedstock type f. Then the annual biogas production of plant in location j in period t $annualBiogasProduction(j,t)$ (m^3) (i.e. if $establish(j)=1$) is given by

$$annualBiogasProduction(j,t)=\sum_{i,f}\left(optmlFdStckAmt(i,j,f,t)\times feedstockYield(f)\right) \quad \textbf{(18)}$$

Now let $elecEnergyInBiogas$ (kWh/m^3) represent an exogenous parameter indicating the amount of electricity energy in a m^3 of biogas. Also let $heatEnergyInBiogas$ (kWh/m^3) represent the amount of heat energy in a m^3 of biogas. Then the annual electricity energy $elecEnergy(j,t)$ (kWh) and heat energy $heatEnergy(j,t)$ (kWh) produced in plant location j (i.e. if $establish(j)=1$) is given by

$$elecEnergy(j,t)=elecEnergyInBiogas\times annualBiogasProduction(j,t) \quad \textbf{(19)}$$

$$heatEnergy(j,t)=heatEnergyInBiogas\times annualBiogasProduction(j,t) \quad \textbf{(20)}$$

The electricity capacity $elecCapacity(j)$ (kW) and heat capacity $heatCapacity(j)$ (kW) of plant in location j (i.e. if $establish(j)=1$) is given by

$$elecCapacity(j)=\max\left\{elecEnergy(j,t)/annualHours\right\}_{t=1}^{T} \quad \textbf{(21)}$$

$$heatCapacity(j)=\max\left\{heatEnergy(j,t)/annualHours\right\}_{t=1}^{T} \quad \textbf{(22)}$$

3 Summary of endogenous variables

Table 2: Summary of endogenous variables

Variables	Unit	Definition
Objective:		
$npvOverall$	£	Overall NPV from investment in AD plants
$npvAtPlant(j)$	£	NPV from investment in AD plant in location j
Revenues:		
$electricityRevenue(j,t)$	£	Revenue from sale of electricity for plant in location j in period t
$heatRevenue(j,t)$	£	Revenue from sale of heat for plant in location j in period t
$gateFeeRevenue(j,t)$	£	Gate fee revenues for plant in location j in period t
$annualRevenue(j,t)$	£	Total revenues for plant in location j in period t
Cost:		
$opexCost(j,t)$	£	Operations cost for plant in location j in period t
$transportCost(j,t)$	£	Transportation cost for plant in location j in period t
$loanRepaymentCost(j,t)$	£	Loan repayment costs for plant in location j in period t
$machineryDeprecicationCost(j,t)$	£	Machinery depreciation costs for plant in location j in period t
$buildingDepreciationCost(j,t)$	£	Building depreciation costs for plant in location j in period t
$annualCost(j,t)$	£	Total annual costs for plant in location j in period t
Cashflow:		
$preTaxProfit(j,t)$	£	Pre-tax profit for plant in location j in period t
$tax(j,t)$	£	Tax billing for plant in location j in period t
$postTaxProfit(j,t)$	£	Post-tax profit for plant in location j in period t
$cashFlow(j,t)$	£	Cashflow for plant in location j in period t
Generation and capacity:		
$elecEnergy(j,t)$	kWh	Amount of electricity energy produced at plant in location j in period t
$elecCapacity(j)$	kW	CHP capacity for electricity production at plant in location j

Variables	Unit	Definition
$heatEnergy(j,t)$	kWh	Amount of heat energy produced at plant in location j in period t
$heatCapacity(j)$	kW	CHP capacity for heat production at plant in location j
$totalCapacityAtPlant(j)$	kW	Total CHP capacity for plant in location j
$optmlFdStckAmt(i,j,f,t)$	kg	Optimal amount of feedstock type f to be sourced from feedstock source location i to plant in location j in period t
$annualBiogasProduction(j,t)$	m^3	for plant in location j in period t
Binary variables:		
$establish(j)$	-	Binary indicator showing whether to establish a plant in location j or not
$elecCapacity\_small(j)$	-	Binary indicator showing whether the electricity production capacity of plant in location j is small
$elecCapacity\_medium(j)$	-	Binary indicator showing whether the electricity production capacity of plant in location j medium
$elecCapacity\_large(j)$	-	Binary indicator showing whether the electricity production capacity of plant in location j is large
$elecCapacity\_gt\_Large(j)$	-	Binary indicator showing whether the electricity production capacity of plant in location j is greater than 5000kW
$heatCapacity\_small(j)$	-	Binary indicator showing whether the heat production capacity of plant in location j is of the small size category
$heatCapacity\_medium(j)$	-	Binary indicator showing whether the heat production capacity of plant in location j is of the medium size category
$heatCapacity\_large(j)$	-	Binary indicator showing whether the heat production capacity of plant in location j is of the large size category

4 Summary of exogenous parameters

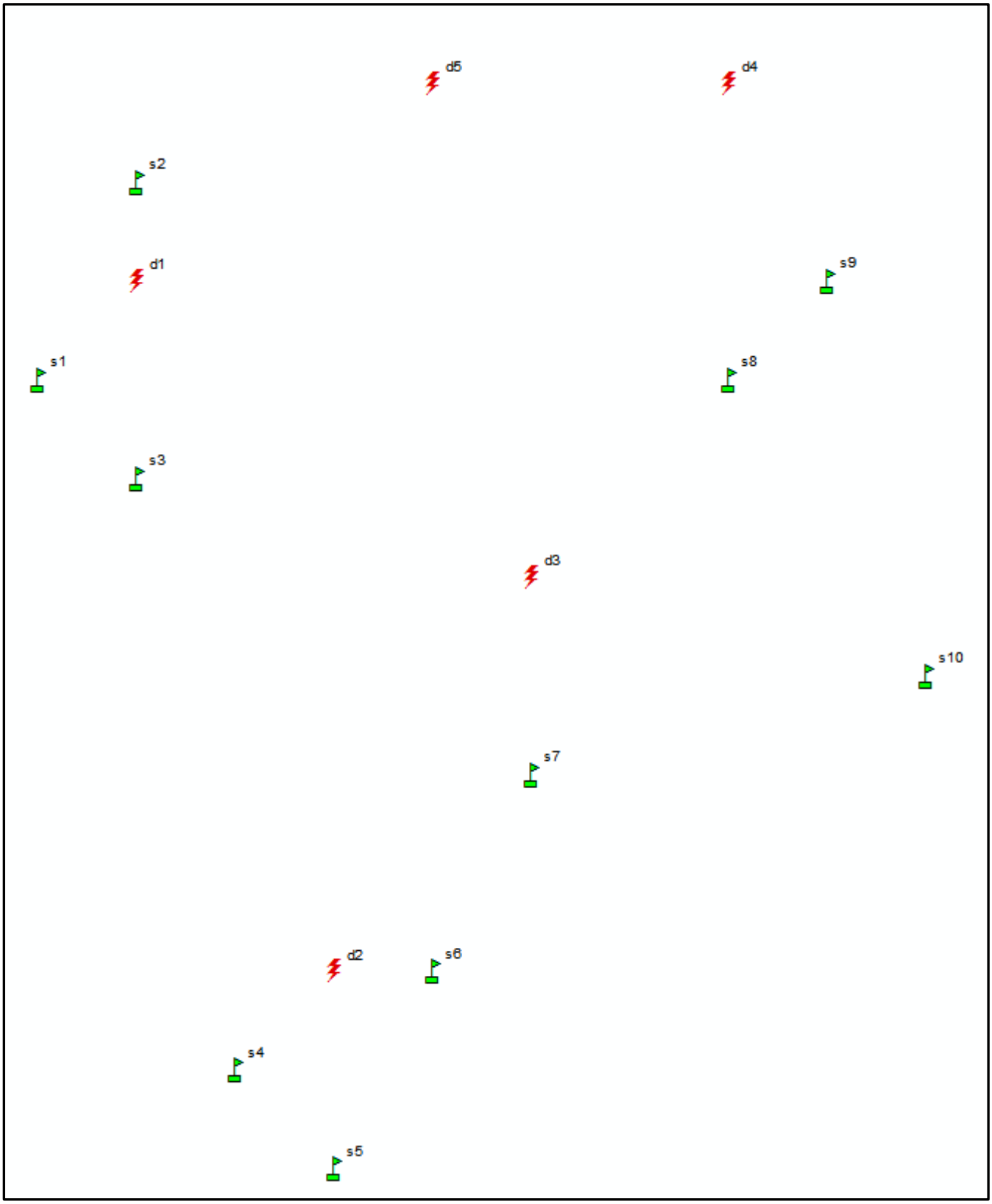
Table 3: Summary of exogenous parameters

Parameter	Unit	Definition
Money and finance:		
discountRate	%	Discount rate
inflationRate	%	Inflation rate
interestRateLoan	%	Interest rate of loans
taxRate	%	Corporate tax rate
loanPercent	%	The proportion of total capital costs that is loaned from banks
loanRepaymentTerm	years	The loan repayment term
lifetimeBuilding	years	Duration over which buildings depreciate to scrap. If *lifetimeBuilding* is less than T years, buildings are replaced and their capital costs re-incurred
lifetimeMachinery	years	Duration over which machinery depreciate to scrap. If *lifetimeMachinery* is less than T years, machinery is replaced and capital costs of machinery re-incurred
Prices and costs:		
$elecPrice(t)$	£/kWh	The market price of electricity in period t
$FIT_{small}(t)$	£/kWh	The FIT of electricity in period t for small sized plants
$FIT(t)_{medium}$	£/kWh	The FIT of electricity in period t for medium sized plants
$FIT_{large}(t)$	£/kWh	The FIT of electricity in period t for large sized plants
$heatPrice(t)$	£/kWh	The market price of heat in period t
RHI_{small}	£/kWh	RHI tariff of heat in period t for small sized plants
RHI_{medium}	£/kWh	RHI tariff of heat in period t for medium sized plants
RHI_{large}	£/kWh	RHI tariff of heat in period t for large sized plants
$transportCostPerKmPerKg(f,t)$	£/km.kg	The cost per km per kg of transporting feedstock type f in period t
$gateFee(f,t)$	£/kg	The gate fee of feedstock type f in period t

Parameter	Unit	Definition
capitalCostBuildingPerKW	£/kW	Capital cost of buildings for a kW of plant capacity
capitalCostMachineryPerKW	£/kW	Capital cost of machinery for a kW of plant capacity
opexCostPerKW	£/kW	Annual operations cost for a kW of plant capacity
Efficiency:		
energyInUnitMethane	kWh/m^3	The amount of energy in a m^3 of methane
methaneInUnitBiogas	%	The proportion of methane in a m^3 of biogas
$CHP\_elec\_efficiency$	%	The CHP plant efficiency with respect to conversion of biogas to electricity
$CHP\_heat\_efficiency$	%	The CHP plant efficiency with respect to conversion of biogas to heat
$CHP\_efficiency\_losses$	%	CHP loss of energy to the environment
parasiticLoadElec	%	Amount of electricity that is internally consumed as parasitic load, hence unavailable for sale
parasiticLoadHeat	%	Amount of heat that is internally consumed as parasitic load hence unavailable for sale
annualHours	hours	Total hours of operation in a year
Other:		
$feedstockSupply(i, f, t)$	kg	Amount of feedstock type f that is available at feedstock location i in period t
$feedstockYield(f)$	m^3/kg	Amount of biogas yielded per kg of feedstock type f
$latitude(i)$, $latitude(j)$	degrees	Latitude of feedstock source locations i and suitable plant location j
$longitude(i), longitude(j)$	degrees	Longitude of feedstock source locations i and suitable plant location j
$distance(i, j)$	km	Distance from feedstock source location i to suitable plant location j

5 Example problem

Here we set up a small example problem involving 10 feedstock source locations and 5 locations identified as suitable for setting up an AD plant. The geographic distribution of these locations is shown below;



Legend

AD feedstock sources

AD plant locations

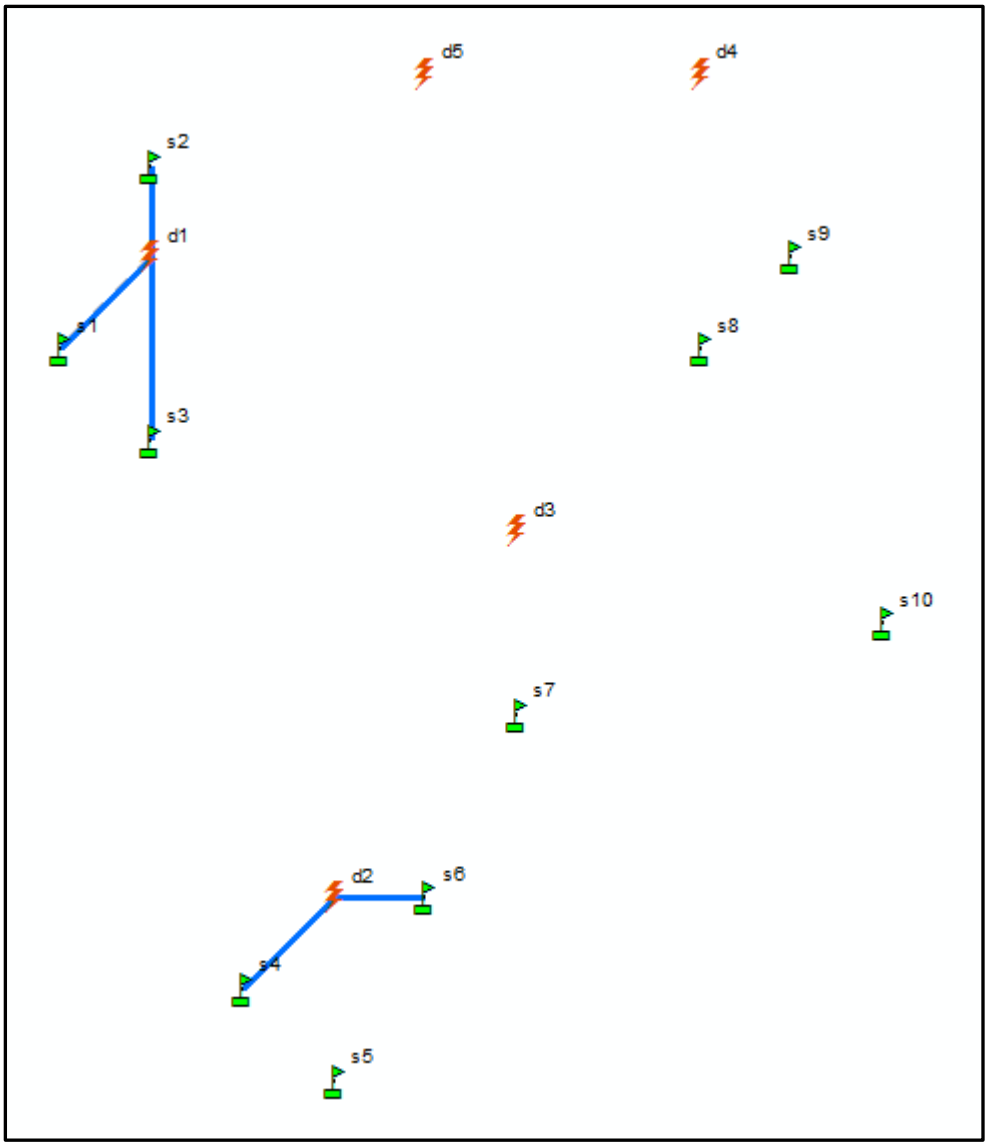
The latitude and longitudinal positioning of all nodes are randomly generated and the distance between nodes is calculated as Euclidean (i.e. straight line distances). The annual availability of feedstocks of all types in the feedstock source locations are randomly assigned. The feedstock types considered in this example are pig manure, food waste, poultry manure and flower bulbs. The parameters used to calibrate this example problem are summarised in Table 4 below;

Table 4: Summary of parameters for example problem

Parameter	Base value
Money and finance:	
discountRate, %	6.0
inflationRate, %	3.0
interestRateLoan, %	6.5
taxRate, %	0.0
loanPercent, %	10
loanRepaymentTerm, years	10
lifetimeBuilding, years	20
lifetimeMachinery, years	10
Prices and costs:	
$elecPrice(t)$, £/kWh	0.0503 in Year 1, inflated annually
$FIT_{small}(t)$, £/kWh	0.0557 in Year 1, inflated annually
$FIT_{medium}(t)$, £/kWh	0.0527 in Year 1, inflated annually
$FIT_{large}(t)$, £/kWh	0.0199 in Year 1, inflated annually
$heatPrice(t)$, £/kWh	0.06 in Year 1, inflated annually
RHI_{small}, £/kWh	0.0288 in Year 1, inflated annually
RHI_{medium}, £/kWh	0.0226 in Year 1, inflated annually
RHI_{large}, £/kWh	0.0086 in Year 1, inflated annually
$transportCostPerKmPerKg(f,t)$, £/km.kg	In Year 1: Pig manure: 0.005 Food waste: 0.004 Poultry manure: 0.005 Flower bulbs: 0.002 All costs inflated annually
$gateFee(f,t)$, £/kg	In Year 1: Pig manure: 0.008 Food waste: 0.041 Poultry manure: 0.008 Flower bulbs: 0.024 All costs inflated annually
capitalCostBuildingPerKW, £/kW	2000
capitalCostMachineryPerKW, £/kW	3000
opexCostPerKW, £/kW	500
Efficiency:	
energyInUnitMethane, kWh/m^3	11.2
methaneInUnitBiogas, %	45
$CHP\_elec\_efficiency$, %	33

Parameter	Base value
$CHP\_heat\_efficiency$, %	38
$CHP\_efficiency\_losses$, %	5
$parasiticLoadElec$, %	6
$parasiticLoadHeat$, %	20
$annualHours$, hours	8760
Other:	
$feedstockSupply(i, f, t)$, kg	Randomly generated
$feedstockYield(f)$, m^3/kg	Pig manure: 0.356 Food waste: 0.500 Poultry manure: 0.410 Flower bulbs: 0.500
$latitude(i)$, $latitude(j)$, degrees	Randomly generated
$longitude(i)$, $longitude(j)$, degrees	Randomly generated
$distance(i, j)$, km	Based on randomly generated latitude and longitudinal node positions

The spatial solution to the example problem is presented below, showing the suitable plant locations where plants were actually established (i.e. d1 and d2) and the source of feedstock for these plants. Suitable plant locations d3, d4 and d5 were not optimal for establishing a plant, whilst feedstock in locations s5, s7, s8, s9 and s10 were unsourced. The availability/supply of each feedstock type in each feedstock location, and the actual amounts used in electricity and heat generation at the established plant locations is summarised in Table 8 Appendix B. The overall net present value of investment in the 2 established AD plants is £792,197.74.



5.1 Established plant in location d1

The total capital cost of investment in the plant established in location d1 is £2,930,100. The net present value of investment in the plant is £343,763. The capacity of electricity and heat generation at the plant are 204kW and 200kW respectively. The annual generation of electricity and heat are 1787MWh and 1752MWh respectively. Table 5 below shows a truncated annual income statement and cashflows of the plant over 20 years.

Table 5: Truncated annual income statement and cashflows of AD plant established in location d1

Variables, ***1000 £**	Year 1	2	3…	9	10	11…	18	19	20
Revenues									
Electricity	189.50	195.18	201.04	240.05	247.25	254.67	313.21	322.61	332.29
Heat	155.58	160.24	165.05	197.08	202.99	209.08	257.15	264.86	272.81
Gate fee	63.38	94.37	110.90	157.31	166.75	176.76	265.78	281.73	298.63
Total	408.46	449.80	476.99	594.45	617.00	640.51	836.14	869.20	903.72
Costs									
Operations	202.04	208.10	214.34	255.94	263.62	271.52	333.94	343.96	354.28
Transport	28.74	42.60	27.05	52.45	40.67	43.11	64.82	116.15	72.84
Loan repay	40.76	40.76	40.76	40.76	40.76				
Depr. Machinery	106.10	106.10	106.10	106.10	106.10	106.10	106.10	106.10	106.10
Depr. Buildings	40.41	40.41	40.41	40.41	40.41	40.41	40.41	40.41	40.41
Total	418.04	437.97	428.66	495.65	491.55	461.14	545.27	606.61	573.62
Profits/loss									
Pre-tax profit	-9.58	11.83	48.34	98.79	125.45	179.37	290.87	262.59	330.10
Post-tax profit	-9.58	11.83	48.34	98.79	125.45	179.37	290.87	262.59	330.10
Cashflow	120.92	143.07	180.34	235.90	263.49	359.14	478.29	451.23	520.01

In the income statements above, note that pre-tax and post-tax profits are equal since tax rate is 0% (see Table 4). Also note that cashflows are the sum of post-tax profits and depreciation costs. Loan costs terminate in Year 10 as the loan repayment term is 10 years. Annual feedstock sourcing locations and amounts for the plant is summarised in Appendix A Table 7.

5.2 Established plant in location d2

The total capital cost of investment in the plant established in location d2 is £2,930,100. The net present value of investment in the plant is £448,434. The capacity of electricity and heat generation at the plant are 204kW and 200kW respectively. The annual generation of electricity and heat are 1787MWh and 1752MWh respectively. Table 6 below shows a truncated annual income statement and cashflows of the plant over 20 years.

Table 6: Truncated annual income statement and cashflows of AD plant established in location d2

	Year								
Variables, ***1000 £**	1	2	3…	9	10	11…	18	19	20
Revenues									
Electricity	189.50	195.18	201.04	240.05	247.25	254.67	313.21	322.61	332.29
Heat	155.58	160.24	165.05	197.08	202.99	209.08	257.15	264.86	272.81
Gate fee	98.70	104.62	110.90	157.31	166.75	176.76	265.78	281.73	298.63
Total	443.78	460.05	476.99	594.45	617.00	640.51	836.14	869.20	903.72
Costs									
Operations	202.04	208.10	214.34	255.94	263.62	271.52	333.94	343.96	354.28
Transport	24.07	25.52	27.05	38.37	40.67	43.11	64.82	68.71	72.84
Loan repay	40.76	40.76	40.76	40.76	40.76				
Depr. Machinery	106.10	106.10	106.10	106.10	106.10	106.10	106.10	106.10	106.10
Depr. Buildings	40.41	40.41	40.41	40.41	40.41	40.41	40.41	40.41	40.41
Total	413.38	420.88	428.66	481.57	491.55	461.14	545.27	559.18	573.62
Profit/loss									
Pre-tax profit	30.40	39.17	48.34	112.88	125.45	179.37	290.87	310.02	330.10
Post-tax profit	30.40	39.17	48.34	112.88	125.45	179.37	290.87	310.02	330.10
Cashflow	176.91	185.67	194.84	259.38	271.95	325.88	437.37	456.52	476.61

In the income statements above, note that pre-tax and post-tax profits are equal since tax rate is 0% (see Table 4). Also note that cashflows are the sum of post-tax profits and depreciation costs. Loan costs terminate in Year 10 as the loan repayment term is 10 years. Annual feedstock sourcing locations and amounts for the plant is summarised in Appendix A Table 7.

Appendix A

Table 7: Annual feedstock sourcing for established AD plants, tonnes

Established plant location	Year	Feedstock source	Feedstock type		
			Pig manure	Food waste	Flower bulbs
d1	1	s1			727.67
d1	1	s2	805.53	514.07	
d1	1	s3		246.34	345.71
d1	2	s1			569.02
d1	2	s2		60.08	
d1	2	s3		1778.23	
d1	3	s2		2407.33	
d1	4	s2		2407.33	
d1	5	s2		2407.33	
d1	6	s2		2257.50	
d1	6	s3		149.84	
d1	7	s2		2407.33	
d1	8	s2		2407.33	
d1	9	s2		1523.73	
d1	9	s3		883.61	
d1	10	s2		2407.33	
d1	11	s2		2407.33	
d1	12	s2		1346.63	
d1	12	s3		1060.70	
d1	13	s2		2407.33	
d1	14	s2		2407.33	
d1	15	s2		2407.33	
d1	16	s2		2407.33	
d1	17	s2		1889.40	
d1	17	s3		517.93	
d1	18	s2		2407.33	
d1	19	s2		745.53	
d1	19	s3		1661.81	
d1	20	s2		2407.33	
d2	1	s6		2407.33	
d2	2	s6		2407.33	
d2	3	s6		2407.33	
d2	4	s6		2407.33	
d2	5	s6		2407.33	
d2	6	s6		2407.33	
d2	7	s6		2407.33	
d2	8	s6		2407.33	
d2	9	s6		2407.33	
d2	10	s6		2407.33	
d2	11	s6		2407.33	
d2	12	s6		2407.33	
d2	13	s4		259.45	
d2	13	s6		2147.88	
d2	14	s4		667.76	

d2	14	s6	1739.57
d2	15	s6	2407.33
d2	16	s6	2407.33
d2	17	s6	2407.33
d2	18	s6	2407.33
d2	19	s6	2407.33
d2	20	s6	2407.33

Appendix B

Table 8: Availability of feedstock at feedstock locations, and the proportions sourced for AD electricity and heat generation, tonnes

Feedstock source	Feedstock type		Year 1	2	3	4	5	6	7	8	9	10
s1	Pig manure	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Food waste	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Poultry manure	Available	4133.07	1176.95	3142.12	465.52	3385.50	1821.00	6457.27	5607.46	7699.62	2978.06
s1	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Flower bulbs	Available	727.67	1756.61	5256.33	7502.08	1781.24	341.41	5851.31	6212.30	3893.62	3587.14
s1	Flower bulbs	Percent sourced	100.00	32.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Pig manure	Available	2020.16	50.66	2696.13	4998.51	1512.86	1741.69	3306.38	3169.06	3220.87	9639.77
s2	Pig manure	Percent sourced	39.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Food waste	Available	514.07	60.08	4012.28	5198.81	6288.77	2257.50	3961.21	2760.06	1523.73	9363.23
s2	Food waste	Percent sourced	100.00	100.00	60.00	46.31	38.28	100.00	60.77	87.22	100.00	25.71
s2	Poultry manure	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Flower bulbs	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Pig manure	Available	8458.12	6127.21	9759.72	268.89	1874.49	871.19	5404.01	1268.64	7339.99	1132.32
s3	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Food waste	Available	246.34	1778.23	613.19	166.44	8356.55	6016.59	270.17	1960.94	9507.11	3355.42
s3	Food waste	Percent sourced	100.00	100.00	0.00	0.00	0.00	2.49	0.00	0.00	9.29	0.00
s3	Poultry manure	Available	9327.61	3487.66	82.87	9488.36	5719.24	3336.26	9837.48	7664.58	1100.95	9948.04
s3	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Flower bulbs	Available	345.71	8418.20	9320.81	5079.65	2995.97	4966.23	449.30	7737.03	5329.70	7467.67
s3	Flower bulbs	Percent sourced	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Pig manure	Available	7907.03	6102.25	543.13	4851.76	525.48	6985.81	1947.84	2260.34	8136.35	9917.31
s4	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Food waste	Available	3230.02	4398.77	3153.29	1347.66	8109.56	4167.92	1417.81	4655.35	2829.94	8956.82

s4	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Poultry manure	Available	9188.66	4517.54	899.31	3741.99	4149.90	4041.95	1116.69	7511.29	8034.04	236.58
s4	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Flower bulbs	Available	5042.14	8312.65	6021.38	822.46	5777.57	5931.76	6837.73	1587.71	3317.77	3158.55
s4	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Pig manure	Available	7100.49	1555.09	6107.14	6615.53	1943.67	3635.19	6238.97	7313.89	4139.73	1574.94
s5	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Food waste	Available	9941.66	8090.88	3062.07	874.02	4305.03	3496.85	1173.40	5859.81	4455.27	4123.19
s5	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Poultry manure	Available	3101.44	401.97	8211.66	2309.61	4100.28	3025.81	4449.22	7160.02	5931.55	1311.94
s5	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Flower bulbs	Available	6824.80	6729.90	8312.14	5151.70	2830.32	5554.20	4139.92	734.08	8060.07	3327.16
s5	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Pig manure	Available	7715.23	1401.25	2645.15	6825.55	4498.04	9655.25	9578.95	8992.27	3275.46	4570.99
s6	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Food waste	Available	3362.62	5886.43	5743.92	5434.21	5781.62	9772.16	3214.66	7629.72	9625.14	9489.90
s6	Food waste	Percent sourced	71.59	40.90	41.91	44.30	41.64	24.63	74.89	31.55	25.01	25.37
s6	Poultry manure	Available	77.63	8665.10	151.41	4282.84	3586.49	7048.71	4158.71	5497.98	3450.37	6995.78
s6	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Flower bulbs	Available	5295.45	5890.87	3458.03	2528.82	5476.57	5474.82	582.67	3777.22	9740.67	3798.19
s6	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Pig manure	Available	721.16	7606.49	2901.46	2449.50	4359.80	3688.08	5534.23	746.63	9094.42	486.98
s7	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Food waste	Available	3710.20	4198.48	853.03	8145.44	5091.97	7344.17	8243.83	4145.29	9244.26	3941.48
s7	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Poultry manure	Available	8911.92	4427.65	1143.17	9036.19	3338.51	9960.23	4644.95	5304.92	1903.81	1990.58
s7	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Flower bulbs	Available	30.92	6180.23	66.55	4055.75	6562.89	6155.02	2634.05	704.48	459.67	1602.70
s7	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Pig manure	Available	4049.99	8588.30	1103.76	3659.39	7977.31	6328.39	7874.27	4996.21	2300.64	2332.59
s8	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Food waste	Available	3664.05	1454.61	7755.75	3399.41	7997.48	2429.81	6996.49	3805.07	3868.69	2241.59
s8	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

s8	Poultry manure	Available	3438.80	8756.85	6037.50	8560.31	6464.30	3992.37	7917.57	4228.27	4174.66	3342.90
s8	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Flower bulbs	Available	2823.01	718.93	8407.37	4448.29	6110.21	6224.08	492.68	2161.82	7944.73	905.26
s8	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Pig manure	Available	158.18	100.66	805.51	398.69	117.09	874.35	144.86	177.74	545.20	468.60
s9	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Food waste	Available	311.10	578.51	809.80	679.20	735.67	338.61	224.24	900.03	829.38	316.22
s9	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Poultry manure	Available	595.18	606.38	633.65	958.24	82.26	125.37	605.22	741.48	847.52	352.46
s9	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Flower bulbs	Available	284.73	222.24	574.84	509.50	557.48	344.17	398.27	776.23	28.23	362.38
s9	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Pig manure	Available	3558.21	7610.81	1363.62	7166.32	9637.01	4419.18	2644.78	4441.78	3967.05	3669.24
s10	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Food waste	Available	352.17	4074.33	574.25	5319.69	1124.07	8938.49	2416.89	6422.43	2907.80	8135.64
s10	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Poultry manure	Available	9444.62	2488.38	8864.65	8844.27	9649.48	7491.44	6476.04	7483.78	5231.69	6861.12
s10	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Flower bulbs	Available	3248.24	3901.25	2993.23	2189.64	8217.20	1526.63	9505.48	319.17	7344.63	1104.93
s10	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8 Continued (Year 11 to Year 20):

Feedstock source	Feedstock type		Year 11	12	13	14	15	16	17	18	19	20
s1	Pig manure	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Food waste	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Poultry manure	Available	6611.06	7558.22	6274.47	2838.64	864.25	1025.15	6412.51	5453.09	315.25	7923.61
s1	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s1	Flower bulbs	Available	2430.35	2464.22	1305.03	9334.50	3799.38	7834.00	3000.34	1254.83	7488.74	692.32
s1	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Pig manure	Available	9936.02	3699.03	3728.89	7719.78	3966.84	9130.96	1195.78	7354.79	554.18	5763.00
s2	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Food waste	Available	4226.61	1346.63	3860.56	3746.33	2684.81	9483.71	1889.40	2975.10	745.53	4013.46
s2	Food waste	Percent sourced	56.96	100.00	62.36	64.26	89.66	25.38	100.00	80.92	100.00	59.98
s2	Poultry manure	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Flower bulbs	Available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s2	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Pig manure	Available	4883.54	7956.00	4920.47	5335.61	106.24	5438.70	4511.29	9753.28	1838.47	1635.32
s3	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Food waste	Available	5942.62	2591.91	6406.34	1552.49	4600.17	3933.40	8054.62	5409.92	3907.22	5578.19
s3	Food waste	Percent sourced	0.00	40.92	0.00	0.00	0.00	0.00	6.43	0.00	42.53	0.00
s3	Poultry manure	Available	5803.25	1664.16	6433.57	3443.12	9123.26	9000.63	162.58	3686.31	6643.80	5933.81
s3	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s3	Flower bulbs	Available	7200.50	6316.01	1149.17	9711.60	7067.43	9862.72	8548.21	6214.41	7013.15	7008.89
s3	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Pig manure	Available	7506.70	7183.44	5.91	2638.58	8238.20	8195.29	8604.12	2126.87	4567.89	383.63
s4	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Food waste	Available	644.08	4145.99	3416.14	4682.86	6426.70	6435.76	3376.06	1008.16	9058.27	2173.51
s4	Food waste	Percent sourced	0.00	0.00	7.59	14.26	0.00	0.00	0.00	0.00	0.00	0.00
s4	Poultry manure	Available	4808.79	2785.86	9016.14	175.86	6810.39	9509.07	9001.75	8988.03	8744.62	3909.95

s4	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s4	Flower bulbs	Available	5199.32	3637.88	1677.56	6830.86	5053.93	5762.35	7198.27	6837.28	198.49	8397.96
s4	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Pig manure	Available	125.19	101.72	9520.31	9766.79	9663.19	8562.79	1416.10	497.34	5530.33	1840.29
s5	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Food waste	Available	9145.15	2137.84	2241.73	5423.34	6310.56	3274.34	1487.85	9291.48	2510.32	625.87
s5	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Poultry manure	Available	1612.45	3156.32	5720.60	2687.21	363.92	6863.92	6746.31	3321.28	7599.39	1767.80
s5	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s5	Flower bulbs	Available	846.90	5721.64	220.56	7420.39	9051.00	5608.17	4728.26	7175.64	5130.10	8870.81
s5	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Pig manure	Available	5961.80	8786.24	1706.73	6336.02	7715.90	5694.46	276.78	8109.94	2789.30	4333.49
s6	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Food waste	Available	2558.89	3249.46	2147.88	1739.57	7312.53	2701.61	7584.75	6174.30	2909.97	7406.98
s6	Food waste	Percent sourced	94.08	74.08	100.00	100.00	32.92	89.11	31.74	38.99	82.73	32.50
s6	Poultry manure	Available	9334.75	4692.80	2136.11	5107.83	3657.15	9354.00	680.08	5038.67	3924.09	2048.55
s6	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s6	Flower bulbs	Available	1562.93	4722.58	3970.02	2055.22	6273.43	35.46	5039.53	22.27	5213.66	8361.23
s6	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Pig manure	Available	8203.57	7929.50	6595.35	3917.71	4131.53	8656.81	9753.17	5723.76	3139.67	4550.30
s7	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Food waste	Available	4443.15	6954.70	6766.93	5715.43	1735.16	6043.49	5859.95	7277.81	2462.27	1420.82
s7	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Poultry manure	Available	6448.96	7990.82	5863.57	9715.68	4910.86	3725.38	8271.74	8208.66	313.39	9251.97
s7	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s7	Flower bulbs	Available	4524.81	1688.72	5715.98	8587.07	358.65	3553.55	3378.68	4864.90	2593.69	8911.92
s7	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Pig manure	Available	3196.11	1231.96	7263.59	2933.80	3859.52	80.63	2018.61	5946.02	2586.63	1180.06
s8	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Food waste	Available	3435.93	638.83	6440.66	6326.14	631.43	8716.58	2430.17	2863.34	7950.46	5276.02
s8	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s8	Poultry manure	Available	1065.08	8688.43	7591.91	6491.97	8679.99	3281.15	6914.77	2992.28	4878.71	1245.93
s8	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

s8	Flower bulbs	Available	6105.25	912.40	385.28	6781.09	8883.34	133.55	1321.75	8918.82	1189.74	768.84
s8	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Pig manure	Available	909.18	723.09	166.35	327.55	581.35	577.54	627.58	26.73	129.42	64.13
s9	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Food waste	Available	952.22	256.69	626.12	971.26	962.08	425.28	105.39	77.08	644.13	312.22
s9	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Poultry manure	Available	641.41	895.73	388.17	273.40	970.40	346.21	409.59	939.86	602.93	899.54
s9	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s9	Flower bulbs	Available	755.82	474.91	76.19	97.50	329.67	200.61	90.75	448.77	462.81	811.96
s9	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Pig manure	Available	6212.63	8597.31	7550.07	9008.15	4380.45	690.99	9385.75	8439.68	9504.41	5793.84
s10	Pig manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Food waste	Available	1861.41	5006.76	9388.21	6815.66	1852.32	8728.84	1650.08	4308.30	7717.31	9780.50
s10	Food waste	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Poultry manure	Available	6910.68	8656.48	7957.57	2175.51	5896.22	9226.16	6029.03	357.04	9111.20	5650.13
s10	Poultry manure	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s10	Flower bulbs	Available	4877.53	3610.37	2163.92	9237.07	4499.63	9710.83	963.35	4789.19	7221.66	4332.05
s10	Flower bulbs	Percent sourced	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00