



Biogas:

How to build out fast and build out successfully

# Planning for Success with Data Modelling

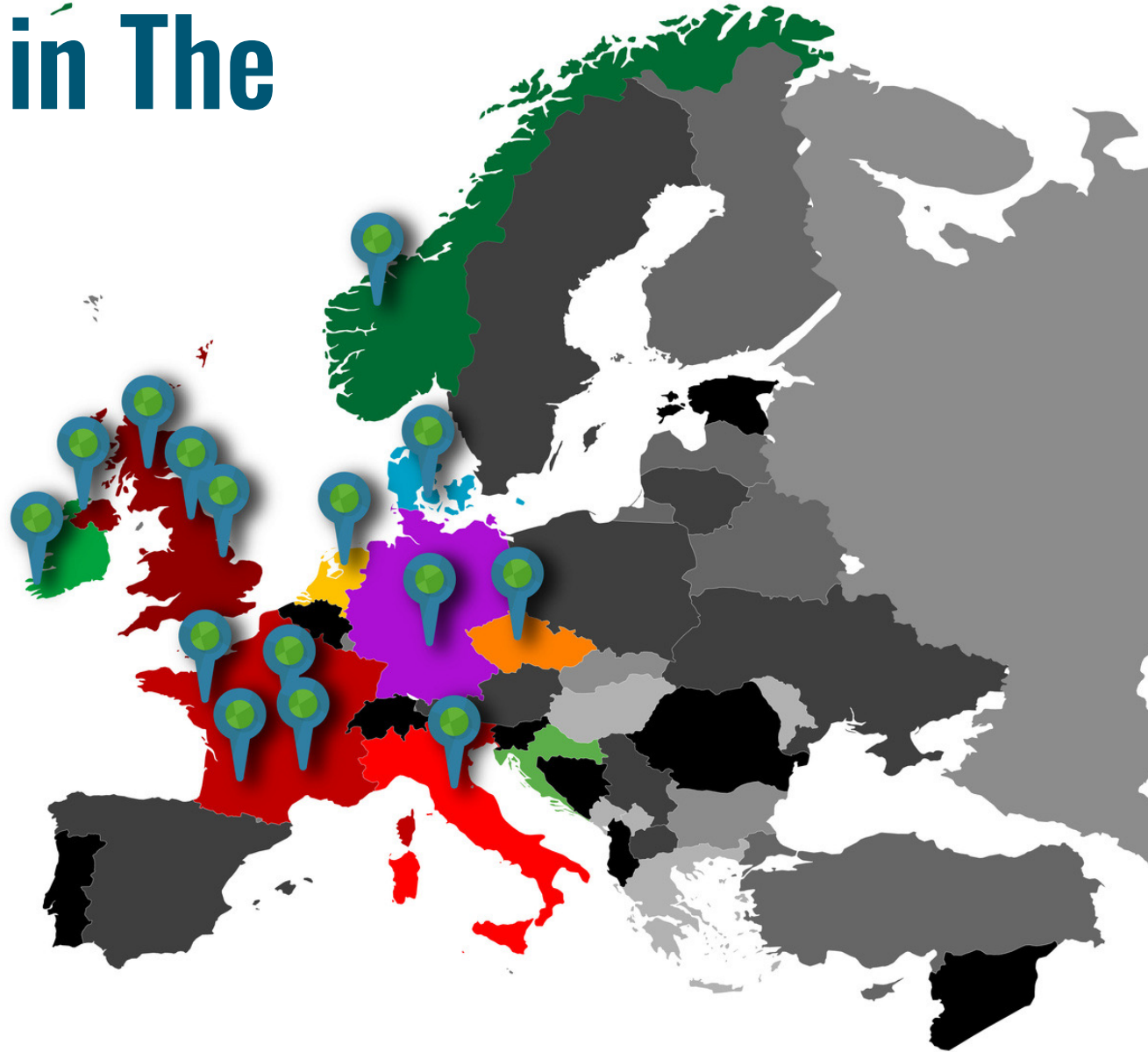
Robert DiDiodato – VP Business Development



# Outline

- Current Market Outlook
- Pitfalls of Data Management and Visualisation
- Planning for Success With Data Modelling

# Variability in The Market



## Incentives

### United Kingdom:

Green Gas Support Scheme (GGSS)  
Renewable Heat Incentive (RHI)  
Smart Export Guarantee (SEG)  
Renewable Transport Fuel Obligation (RTFO)

### France:

Le tarif d'achat (French Feed-in Tariff)  
French Gas Package  
ADEME Financement d'installations de méthanisation

### Denmark:

Danish Feed-in Tariff

### Norway:

Norwegian Bioenergy program

### Poland:

Polish Renewable Energy Act

### Italy:

Italian Feed-in Tariff

### Germany:

EEG (Renewable Energy Sources Act)

### European Union:

EU Modernization Fund

### Ireland:

Renewable Energy Feed-in Tariff (REFIT)

### Netherlands:

KEV



**Proprietary solutions** create variability in projects.

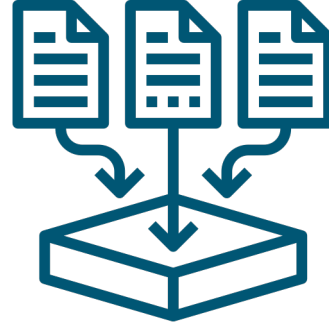
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### Common Challenges

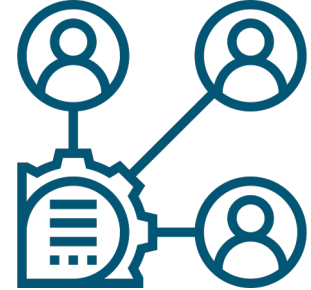
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Managing data throughout the lifecycle of the project.



Offsetting transparency with data overload.



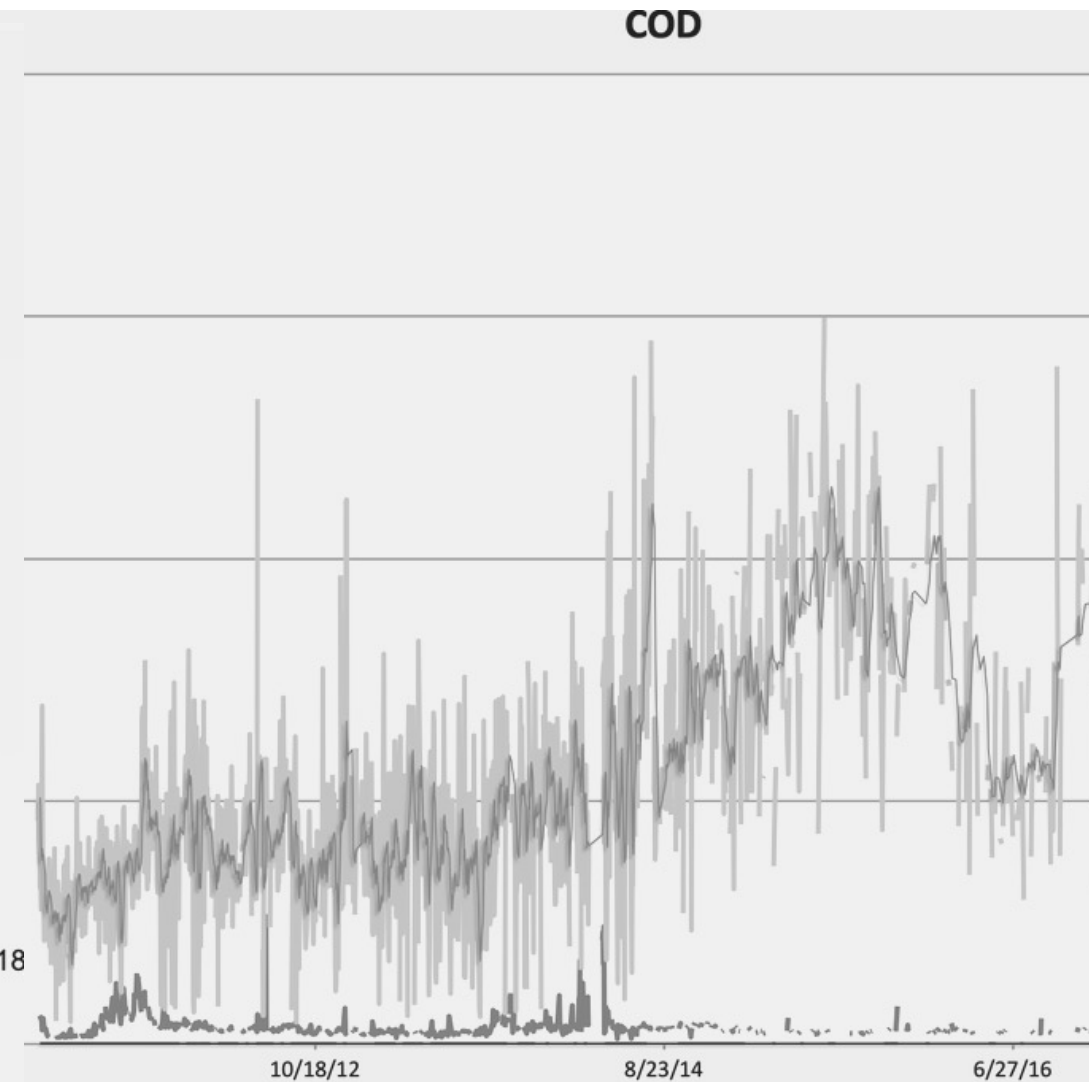
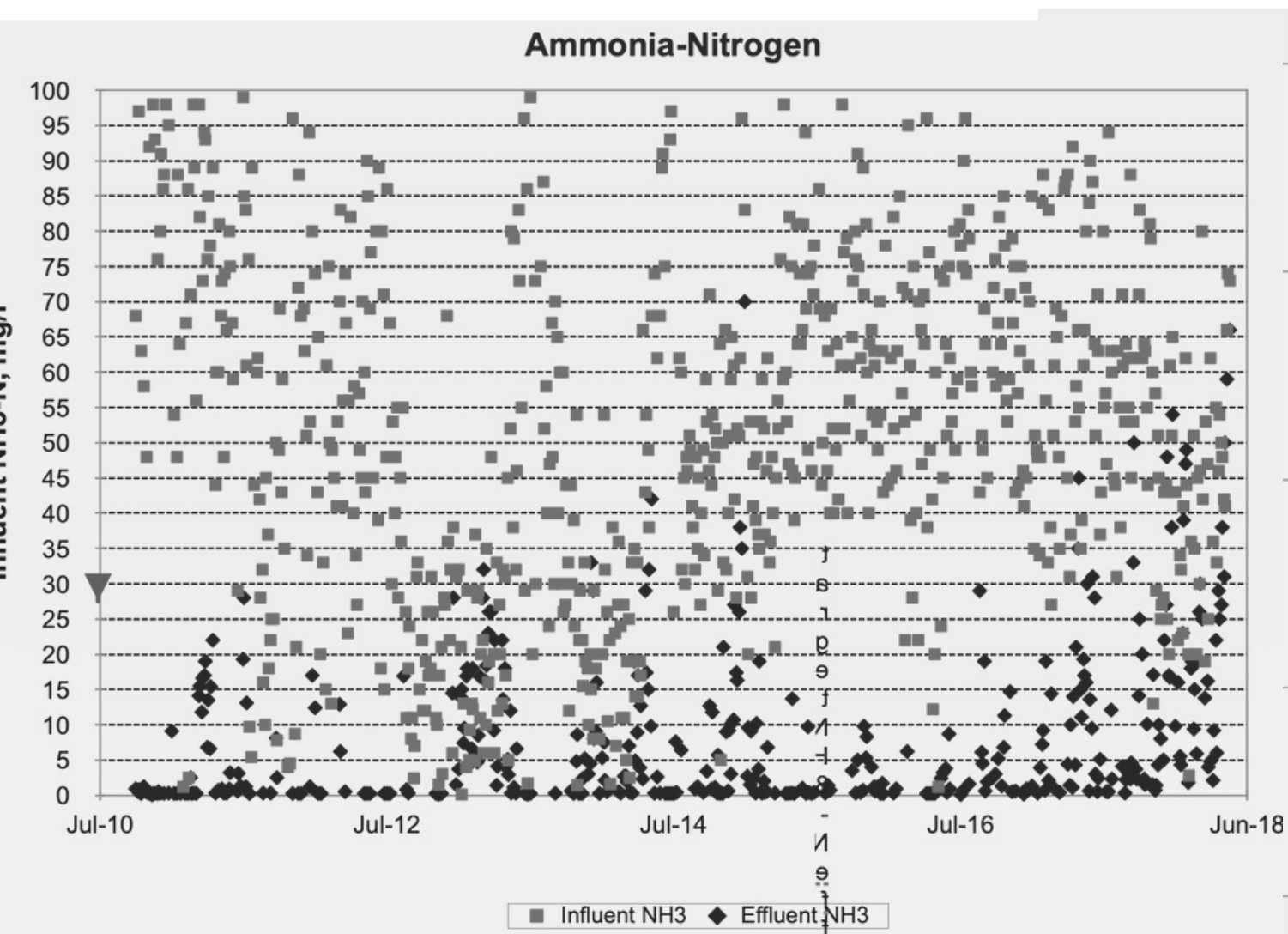
Reporting to stakeholders with different requirements

# The Old Paradigm

This is a year's worth of data, imagine what 7 years can look like...

| Date      | Testing Analyst | EQ Tanks |        | Influent Flow gal | Flow MGD | BVF Reactor HRT (days) | pH   | COD Total (mg/L) | COD Filtered (mg/L) | TSS (mg/L) | VSS (mg/L) | % Volatile (%) | TN (mg/L) | NH <sub>3</sub> -N (mg/L) | NO <sub>x</sub> -N (mg/L) | PO <sub>4</sub> -P (mg/L) | Max COD / Day | COD (lb/d) | TSS (lb/d) |       |
|-----------|-----------------|----------|--------|-------------------|----------|------------------------|------|------------------|---------------------|------------|------------|----------------|-----------|---------------------------|---------------------------|---------------------------|---------------|------------|------------|-------|
|           |                 | Flow gal |        |                   |          |                        |      |                  |                     |            |            |                |           |                           |                           |                           |               |            |            |       |
| 22-Nov-17 |                 |          | 15,000 | 15,000            | 0.02     | 280.0                  | 7.0  | 3,010            | 830                 | 425        |            |                |           |                           |                           |                           |               | 5,500      | 377        | 53    |
| 23-Nov-17 |                 |          | 14,552 | 14,552            | 0.01     | 288.6                  | 7.2  | 6,210            | 1,170               | 625        |            |                |           |                           |                           |                           |               | 5,500      | 754        | 76    |
| 24-Nov-17 |                 |          | 22,398 | 22,398            | 0.02     | 187.5                  | 7.6  | 3,110            | 1,030               | 857        |            |                |           |                           |                           |                           |               | 5,500      | 581        | 160   |
| 25-Nov-17 |                 |          | 50,022 | 50,022            | 0.05     | 84.0                   | 6.9  | 5,950            | 1,890               | 1,764      |            |                |           |                           |                           |                           |               | 5,500      | 2,482      | 736   |
| 26-Nov-17 |                 |          | 16,465 | 16,465            | 0.02     | 255.1                  | 7.2  | 9,260            | 1,390               | 2,142      |            |                |           |                           |                           |                           | 23.3          | 5,500      | 1,272      | 294   |
| 27-Nov-17 |                 |          | 27,644 | 27,644            | 0.03     | 151.9                  | 7.4  | 4,020            | 1,240               | 1,000      |            |                |           |                           |                           |                           | 21.7          | 5,500      | 927        | 231   |
| 28-Nov-17 |                 |          | 16,366 | 16,366            | 0.02     | 256.6                  | 7.0  | 7,420            | 1,290               | 1,562      |            |                |           |                           |                           |                           | 20.2          | 5,500      | 1,013      | 213   |
| 29-Nov-17 |                 |          | 20,699 | 20,699            | 0.02     | 202.9                  | 7.4  | 4,120            | 1,140               | 1,477      |            |                |           |                           |                           |                           | 16.6          | 5,500      | 711        | 255   |
| 30-Nov-17 |                 |          | 14,283 | 14,283            | 0.01     | 294.1                  | 7.1  | 4,360            | 1,780               | 1,786      |            |                |           |                           |                           |                           | 25.8          | 5,500      | 519        | 213   |
| 1-Dec-17  | GMZ             |          | 15,639 | 15,639            | 0.02     | 268.6                  | 7.5  | 2,080            | 1,680               | 379        |            |                |           |                           |                           |                           | 11            | 5,500      | 271        | 49    |
| 2-Dec-17  | GMZ             |          | 63,154 | 63,154            | 0.06     | 66.5                   | 7.3  | 1,060            | 920                 | 69         |            |                |           |                           |                           |                           | 2             | 5,500      | 558        | 36    |
| 3-Dec-17  | GMZ             |          | 0      | 0                 |          | 6.7                    | 6.7  | 2,440            | 1,180               | 513        |            |                |           |                           |                           |                           | 14.6          | 5,500      | 0          | 0     |
| 4-Dec-17  | ZP              |          | 19,900 | 19,900            | 0.02     | 211.1                  | 6.8  | 2,310            | 1,100               | 775        |            |                |           |                           |                           |                           | 15            | 5,500      | 383        | 129   |
| 5-Dec-17  | zp              |          | 68,175 | 68,175            | 0.07     | 61.6                   | 6.9  | 4,240            | 1,460               | 909        |            |                |           |                           |                           |                           | 14.2          | 5,500      | 2,411      | 517   |
| 6-Dec-17  | zp              |          | 16,264 | 16,264            | 0.02     | 258.2                  | 6.9  | 4,320            | 2,070               | 467        |            |                |           |                           |                           |                           | 17            | 5,500      | 586        | 63    |
| 7-Dec-17  | zp              |          | 33,524 | 33,524            | 0.03     | 125.3                  | 7.3  | 2,680            | 960                 | 600        |            |                |           |                           |                           |                           | 10.4          | 5,500      | 749        | 168   |
| 8-Dec-17  | zp              |          | 9,503  | 9,503             | 0.01     | 442.0                  | 6.7  | 6,260            | 2,190               | 1,500      |            |                |           |                           |                           |                           | 17.2          | 5,500      | 496        | 119   |
| 9-Dec-17  | zp              |          | 0      | 0                 |          |                        | 6.3  | 2,700            | 940                 | 338        |            |                |           |                           |                           |                           | 9.84          | 5,500      | 0          | 0     |
| 10-Dec-17 | zp              |          | 14,137 | 14,137            | 0.01     | 297.1                  | 7.1  | 3,090            | 1,200               | 666        |            |                |           |                           |                           |                           | 16.4          | 5,500      | 364        | 79    |
| 11-Dec-17 | zp              |          | 14,379 | 14,379            | 0.01     | 292.1                  | 5.7  | 8,140            | 1,520               | 3,520      |            |                |           |                           |                           |                           | 21.7          | 5,500      | 976        | 423   |
| 12-Dec-17 | zp              |          | 0      | 0                 |          | 6.6                    | 6.6  | 4,440            | 1,100               | 357        |            |                |           |                           |                           |                           | 19.2          | 5,500      | 0          | 0     |
| 13-Dec-17 | zp              |          | 8,430  | 8,430             | 0.01     | 498.2                  | 7.1  | 1,570            | 510                 | 192        |            |                |           |                           |                           |                           | 8.24          | 5,500      | 110        | 13    |
| 14-Dec-17 | zp              |          | 31,886 | 31,886            | 0.03     | 131.7                  | 4.7  | 3,260            | 1,640               | 357        |            |                |           |                           |                           |                           | 12.4          | 5,500      | 867        | 95    |
| 15-Dec-17 | zp              |          | 23,236 | 23,236            | 0.02     | 180.8                  | 5.3  | 1,770            | 1,330               | 168        |            |                |           |                           |                           |                           | 8.74          | 5,500      | 343        | 33    |
| 16-Dec-17 | zp              |          | 14,974 | 14,974            | 0.01     | 280.5                  | 6.6  | 3,540            | 1,160               | 488        |            |                |           |                           |                           |                           | 13.7          | 5,500      | 442        | 61    |
| 17-Dec-17 | zp              |          | 0      | 0                 |          |                        | 7.4  | 3,670            | 1,170               | 628        |            |                |           |                           |                           |                           | 14.1          | 5,500      | 0          | 0     |
| 18-Dec-17 | zp              |          | 29,806 | 29,806            | 0.03     | 140.9                  | 7.6  | 1,290            | 600                 | 214        |            |                |           |                           |                           |                           | 6.82          | 5,500      | 321        | 53    |
| 19-Dec-17 | zp              |          | 29,905 | 29,905            | 0.03     | 140.4                  | 7.1  | 2,720            | 890                 | 500        |            |                |           |                           |                           |                           | 11.7          | 5,500      | 678        | 125   |
| 20-Dec-17 | zp              |          | 29,894 | 29,894            | 0.03     | 140.5                  | 6.9  | 3,080            | 1,060               | 605        |            |                |           |                           |                           |                           | 12.8          | 5,500      | 763        | 156   |
| 21-Dec-17 | zp              |          | 39,146 | 39,146            | 0.04     | 107.3                  | 6.9  | 2,440            | 560                 | 1,200      |            |                |           |                           |                           |                           | 10.1          | 5,500      | 797        | 392   |
| 22-Dec-17 | zp              |          | 30,906 | 30,906            | 0.03     | 135.9                  | 6.6  | 4,170            | 1,000               | 897        |            |                |           |                           |                           |                           | 14.2          | 5,500      | 1,075      | 231   |
| 23-Dec-17 | zp              |          | 39,050 | 39,050            | 0.04     | 107.6                  | 6.8  | 2,200            | 660                 | 638        |            |                |           |                           |                           |                           | 10.9          | 5,500      | 716        | 208   |
| 24-Dec-17 | KL              |          | 38,265 | 38,265            | 0.04     | 109.8                  | 6.3  | 3,290            | 1,410               | 473        |            |                |           |                           |                           |                           | 11.8          | 5,500      | 1,050      | 151   |
| 25-Dec-17 | KL              |          | 39,360 | 39,360            | 0.04     | 106.7                  | 6.1  | 3,030            | 1,500               | 310        |            |                |           |                           |                           |                           | 21.4          | 5,500      | 995        | 102   |
| 26-Dec-17 | zp              |          | 0      | 0                 |          |                        | 12.3 | 3,540            | 1,230               | 1,333      |            |                |           |                           |                           |                           | 15.5          | 5,500      | 0          | 0     |
| 27-Dec-17 | zp              |          | 39,936 | 39,936            | 0.04     | 105.2                  | 6.6  | 4,490            | 1,490               | 906        |            |                |           |                           |                           |                           | 19.1          | 5,500      | 1,495      | 302   |
| 28-Dec-17 | zp              |          | 49,515 | 49,515            | 0.05     | 84.8                   | 6.9  | 5,500            | 2,120               | 1,363      |            |                |           |                           |                           |                           | 19.2          | 5,500      | 2,271      | 563   |
| 29-Dec-17 | zp              |          | 50,259 | 50,259            | 0.05     | 83.6                   | 5.4  | 2,110            | 1,500               | 226        |            |                |           |                           |                           |                           | 16.3          | 5,500      | 884        | 95    |
| 30-Dec-17 | zp              |          | 50,009 | 50,009            | 0.05     | 84.0                   | 6.6  | 12,590           | 1,630               | 932        |            |                |           |                           |                           |                           | 17.8          | 5,500      | 5,251      | 389   |
| 31-Dec-17 | zp              |          | 51,267 | 51,267            | 0.05     | 81.9                   | 6.0  | 5,090            | 1,830               | 743        |            |                |           |                           |                           |                           | 22.3          | 5,500      | 2,176      | 318   |
|           |                 |          |        |                   |          |                        | 7.1  | 2,810            | 810                 | 740        |            |                |           |                           |                           |                           | 17.5          | 5,500      | 0          | 0     |
|           |                 |          |        |                   |          |                        | 7.1  | 7,640            | 1,840               | 2,142      |            |                |           |                           |                           |                           | 25.1          | 5,500      | 3,201      | 898   |
|           |                 |          |        |                   |          |                        | 10.5 | 5,320            | 1,430               | 1,250      |            |                |           |                           |                           |                           | 22.1          | 5,500      | 2,168      | 509   |
|           |                 |          |        |                   |          |                        | 7.5  | 7,650            | 1,300               | 695        |            |                |           |                           |                           |                           | 20.2          | 5,500      | 3,820      | 347   |
|           |                 |          |        |                   |          |                        | 6.3  | 5,330            | 1,220               | 779        |            |                |           |                           |                           |                           | 20.1          | 5,500      | 2,638      | 386   |
|           |                 |          |        |                   |          |                        | 7.0  | 3,560            | 1,150               | 857        |            |                |           |                           |                           |                           | 16.8          | 5,500      | 1,756      | 423   |
|           |                 |          |        |                   |          |                        | 6.6  | 2,790            | 2,010               | 434        |            |                |           |                           |                           |                           | 15.5          | 5,500      | 1,621      | 252   |
|           |                 |          |        |                   |          |                        | 6.4  | 2,850            | 1,400               | 328        |            |                |           |                           |                           |                           | 15.5          | 5,500      | 0          | 0     |
|           |                 |          |        |                   |          |                        | 6.7  | 4,650            | 1,400               | 482        |            |                |           |                           |                           |                           | 18.9          | 5,500      | 2,709      | 281   |
|           |                 |          |        |                   |          |                        | 6.7  | 3,460            | 1,330               | 656        |            |                |           |                           |                           |                           | 14.6          | 5,500      | 2,593      | 492   |
|           |                 |          |        |                   |          |                        | 7.1  | 2,870            | 970                 | 1,975      |            |                |           |                           |                           |                           | 12.1          | 5,500      | 2,140      | 1,473 |
|           |                 |          |        |                   |          |                        | 7.1  | 2,940            | 810                 | 500        |            |                |           |                           |                           |                           | 10.8          | 5,500      | 2,551      | 434   |
|           |                 |          |        |                   |          |                        | 6.8  | 4,260            | 1,070               | 730        |            |                |           |                           |                           |                           | 19            | 5,500      | 2,409      | 413   |
|           |                 |          |        |                   |          |                        | 6.5  | 5,190            | 1,890               | 1,063      |            |                |           |                           |                           |                           | 20.8          | 5,500      | 4,329      | 887   |
|           |                 |          |        |                   |          |                        | 7.4  | 2,340            | 790                 | 416        |            |                |           |                           |                           |                           | 16.3          | 5,500      | 1,954      | 347   |
|           |                 |          |        |                   |          |                        | NA   | NA               | NA                  | NA         |            |                |           |                           |                           |                           | NA            | 5,500      | 0          | 0     |
|           |                 |          |        |                   |          |                        | 7.6  | 2,650            | 850                 | 502        |            |                |           |                           |                           |                           | 26.6          | 5,500      | 2,187      | 414   |
|           |                 |          |        |                   |          |                        | 7.6  | 2,070            | 750                 | 429        |            |                |           |                           |                           |                           | 11.8          | 5,500      | 2,216      | 459   |
|           |                 |          |        |                   |          |                        | 6.6  | 3,640            | 880                 | 656        |            |                |           |                           |                           |                           | 16            | 5,500      | 4,127      | 744   |
|           |                 |          |        |                   |          |                        | 6.7  | 2,500            | 1,010               | 810        |            |                |           |                           |                           |                           | 8.1           | 5,500      | 1,801      | 583   |
|           |                 |          |        |                   |          |                        | 7.8  | 2,870            | 580                 | 748        |            |                |           |                           |                           |                           | 13.6          | 5,500      | 2,898      | 755   |
|           |                 |          |        |                   |          |                        | 9.2  | 1,890            | 650                 | 355        |            |                |           |                           |                           |                           | 10.9          | 5,500      | 2,471      | 464   |
|           |                 |          |        |                   |          |                        | 7.4  | 6,260            | 2,130               | 1,124      |            |                |           |                           |                           |                           | 21.3          | 5,500      | 3,384      | 608   |
|           |                 |          |        |                   |          |                        | 6.6  | 2,630            | 1,200               | 382        |            |                |           |                           |                           |                           | 13.3          | 5,500      | 2,902      | 422   |
|           |                 |          |        |                   |          |                        | 4.7  | 5,960            | 1,720               | 423        |            |                |           |                           |                           |                           | 15            | 5,500      | 5,485      | 389   |
|           |                 |          |        |                   |          |                        | 7.5  | 3,580            | 1,140               | 440        |            |                |           |                           |                           |                           | 11.3          | 5,500      | 2,268      | 279   |
|           |                 |          |        |                   |          |                        | 8.1  | 5,200            | 1,770               | 977        |            |                |           |                           |                           |                           | 20.6          | 5,500      | 3,967      | 745   |
|           |                 |          |        |                   |          |                        | 6.5  | 6,450            | 1,550               | 1,346      |            |                |           |                           |                           |                           | 19.9          | 5,500      | 7,617      | 1,590 |
|           |                 |          |        |                   |          |                        | 7.1  | 5,090            | 1,190               | 768        |            |                |           |                           |                           |                           | 18            | 5,500      | 3,720      | 561   |
|           |                 |          |        |                   |          |                        | 7.2  | 3,770            | 1,120               | 513        |            |                |           |                           |                           |                           | 14.5          | 5,500      | 4,168      | 567   |
|           |                 |          |        |                   |          |                        | 6.7  | 3,550            | 1,250               | 645        |            |                |           |                           |                           |                           | 20.2          | 5,500      | 1,981      | 366   |

# Bad Data Feeds Into Bad Visualization





**How Can Our Industry Convey its Value  
with Variables That Change Constantly?**



# Adaptable & Scalable Models

Make sure you can change variables in your model as your project's reality changes. **Don't let yesterday use up too much of today.**

edit loan

| loan name             |     | loan type               |                     |
|-----------------------|-----|-------------------------|---------------------|
| Loan (EU Bank)        |     | annuity                 |                     |
| loan amount           |     | interest rate           | amortization period |
| 1,350,000             | GBP | 6 %                     | 12 years            |
| <button>save</button> |     | <button>cancel</button> |                     |

financial investment

general information

|                      |                                     |                                   |                                     |
|----------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| discount rate        | <input checked="" type="checkbox"/> | income tax                        | <input checked="" type="checkbox"/> |
| 6                    | %                                   | 20                                | %                                   |
| plant residual value | <input checked="" type="checkbox"/> | dividends and other distributions | <input checked="" type="checkbox"/> |
| 20                   | % of capex                          | 1                                 | % of income                         |

loan financing

|                           |                          |      |        |
|---------------------------|--------------------------|------|--------|
| Loan (World Bank)         | 1,080,000 GBP - 5 years  | edit | remove |
| Loan (EU Bank)            | 1,350,000 GBP - 12 years | edit | remove |
| <button>add loan</button> |                          |      |        |

# Interconnected Models



**Feedstock  
Model**



**Anaerobic Digestion  
Operation Model**



**Greenhouse Gas  
Emission Model**



**Financial  
Assessment Model**

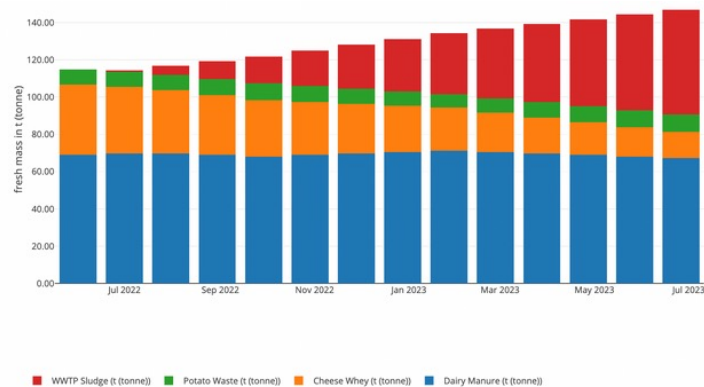
On demand technical and financial reports

# Leading vs Trailing Data



# Proactive Operational Decision Making

Model the future performance of a biogas plant before making changes.



# Robust Stress Testing

The best way to mitigate risk is to identify the values that can make or break the project. At anessa, our sensitivity analysis feature helps users identify the values that cause the highest degree of variability in their project's financial viability.

## scenario comparison results

Scenario 1 - Using Additives, Scenario 2 - More feedstock of lower quality

technical digester output flows biogas production

day metric

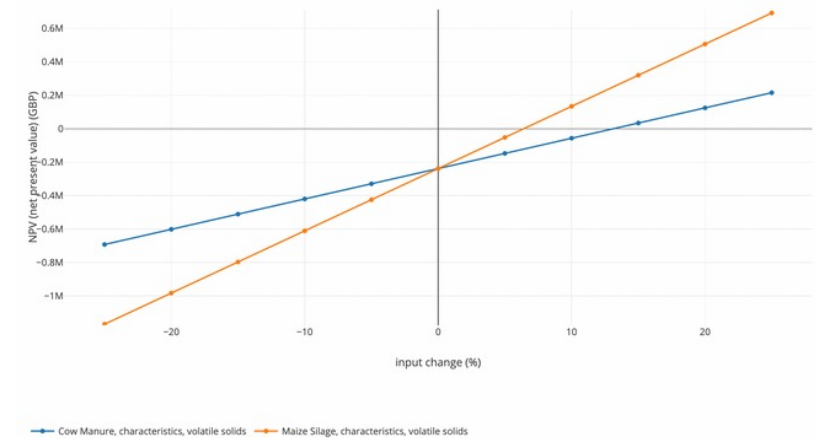
exchange rates from 2022-06-01

|  | value    | unit                 |
|--|----------|----------------------|
| ▼ BASELINE                                     |          |                      |
| biogas production                              | 3,464.50 | Nm <sup>3</sup> /day |
| ▼ SCENARIO 1 - USING ADDITIVES                 |          |                      |
| biogas production                              | 4,330.62 | Nm <sup>3</sup> /day |
| ▼ SCENARIO 2 - MORE FEEDSTOCK OF LOWER QUALITY |          |                      |
| biogas production                              | 3,247.97 | Nm <sup>3</sup> /day |

## sensitivity results

Cow Manure, characteristics, volatile s... NPV (net present value) GBP

exchange rates from 2022-06-01





# Thank You

**Robert DiDiodato**  
**+1 (506) 457-9320 Ext 112**  
[rdidiodato@anessa.com](mailto:rdidiodato@anessa.com)

# Sources; Links to Incentives Mentioned

## United Kingdom:

### Green Gas Support Scheme (GGSS)

- <https://www.ofgem.gov.uk/environmental-and-social-schemes/green-gas-support-scheme-and-green-gas-levy>
- Renewable Heat Incentive (RHI)
  - <https://www.ofgem.gov.uk/environmental-and-social-schemes/domestic-renewable-heat-incentive-domestic-rhi>
- Smart Export Guarantee (SEG)
  - <https://www.ofgem.gov.uk/publications/guidance-anaerobic-digestion-generators-seg-sustainability-criteria-and-reporting-requirements>
- Renewable Transport Fuel Obligation (RTFO)
  - <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-rtfo-guidance-2021>

## France:

- Le tarif d'achat (French Feed-in Tariff)
  - <https://www.grdf.fr/acteurs-biomethane/vente-biomethane>
- French Gas Package
  - [https://www.euractiv.fr/section/energie/news/le-biogaz-allie-sous-estime-de-lindependance-energetique-europeenne/?\\_ga=2.199393262.1113477500.1654170836-1199758416.1654170835](https://www.euractiv.fr/section/energie/news/le-biogaz-allie-sous-estime-de-lindependance-energetique-europeenne/?_ga=2.199393262.1113477500.1654170836-1199758416.1654170835)
- ADEME Financement d'installations de méthanisation
  - <https://agirpoulatransition.ademe.fr/entreprises/aides-financieres/2022/financement-dinstallations-methanisation-injection-cogeneration-chaaleur?cible=77&region=27>

# Sources; Links to Incentives Mentioned

## Denmark:

- Danish Feed-in Tariff
  - <https://www.biocycle.net/deep-dive-danish-biogas/>

## Norway:

- Norwegian Bioenergy program
  - <https://nobio.no/norske-bioenergianlegg/>

## Poland:

- Polish Renewable Energy Act
  - <https://www.europeanbiogas.eu/renewable-energy-act-approved-polish-parliament/>

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# Sources; Links to Incentives Mentioned

## Germany:

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## Ireland

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## Netherlands:

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