

## Context/Intro:

In the framework of the ICaRE4Farms project, this document aims at reviewing the theoretical inner potential of Feng Tech STE system within the agricultural sector of The Netherlands. The current academic example focus on a holding without on-farm processing and set in Overijssel. The assumptions are that it owns a herd of 140 cows for which it needs 16 757 kWh/year for an anaerobic digester to process the produced manure. The anaerobic digester has a heat demand that can be supplied in part by STE. After enumerating the main characteristics of this typical and fictional dairy farm, a simulation with the Feng Tech STE system illustrating expected results will be tackled.

!!!!invent for academic/anonymise for field application case!!!!

## PART I: ACADEMIC CASE

- ▶ *N°/Nickname:* Dutch Dairy Farm
- ▶ *Location (Country/Region):* Overijssel
- ▶ *Type of holding: Dairy Farm (without on-farm processing) & biodigester*
- ▶ *Date:* 15/10/2021

### 1 Initial characteristics of the installation: (Use Market Analysis + Liqun's matrix)

- **Size of the surface/number of animals: 140 cows**
- **Water Use (heating/direct use):** Functioning and heating-up of the biodigester
  - **Frequency:** continuous
  - **Timeframe:** at all times
  - **Quantity:** 659 kWh/day on average, throughout the year
- **Version of FT STE system (ETF 1 / ETF2):** ETF 2 (with pressure)
- **Temperature needed (in °):** 58° (temperature of the water) / 38° (in average)
- **Standard fossil energy used:** Natural gas
- **Price of fossil energy per kWh:** 0.131 €/kWh
- **Energy consumption for the activity (in kWh/year):** 16 757 kWh/year  
*cf. with energy waste and differentiated needs depending on the period of the year, the energy need accounts for 16 757 kWh/year*
- **Expenditure of energy consumption (in EXCL TAX€/year):** 2 195 €/year EXCL TAX  
*cf. 0.131 EXCL.TAX€/kWh x 16 757 kWh/year = 2 195,167 EXCL. TAX €/year*
- **Available subsidies for STE:** SDE++ subsidy can apply. Here, the use of solar thermal systems for energy production can be subsidized. A maximum of 600 full hours per year can be subsidized. Starting the subsidy at a price of 0.0722 €/kWh ("rangschikkingsbedrag), the total subsidy would be €8688.00 (assuming a 50% coverage rate). In addition, 60% of purchasing costs can be covered by the EU during the pilot stage of the project.
- **Amount of CO2 emission:** 3 871 kg CO2/year  
*cf. given that 1kWh produces about 0.231 kg CO2(eq), 0.231 kg CO2/kWh x 16 757 kWh/year = 3 870,867 kg CO2/year*

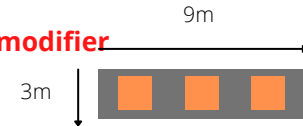
## Prerequisites of installation:

- Located on roof
- Preference = South-West facing
- Not far from the holding to avoid additional energy needs for re-heating

Employed Version of the matrix = V10 Lille Study Case

## ② Simulation with a Feng Tech STE system:

- **Coverage Rate of the installation (Share of utilisation in %):** 65% (GOAL = at least 50%)
- **Number of STE units to reach the energy needs:** 2 units  
cf. potential useful solar thermal energy = 6 853 kWh/year
- **Overall front surface of capture:** 8 m<sup>2</sup>  
cf. 1 FT = 4m<sup>2</sup> ; 4m<sup>2</sup>/unit x 2 units = 8 m<sup>2</sup>
- **Maximum attainable temperature with the current solution (in °):** 100°T (optimal conditions)
- **Power (kW/unit):** 2.5kW/unit
- **Number of sensors needed for remote surveillance and monitoring:**  
Commercial scope = 2 thermometers + 2 flowmeters + gas flow meter

- **Surface requirement for the equipment:** **3m x 6m image à modifier**

- **Irradiance and cold water measurements:**

Solar irradiance value (Calsol INES)	Overijssel	Albedo	0,8											
Unit (kWh / m <sup>2</sup> / day)	January	February	March	April	May	June	July	August	September	October	November	Décember	Year	
Direct irradiance	0,22	0,64	2,52	4,43	3,3	2,54	1,73	2,57	2,29	0,39	0,89	0,24	1,81	
Diffus irradiance	0,79	1,31	1,82	2,09	2,49	2,54	2,59	2,47	2,11	1,32	1,09	0,69	1,78	
Cold water temperature (°C)	6	6,3	6	10,9	13,2	17,7	16,9	20,4	15,2	11,3	8,4	4,9	11	

- **Solar energy contribution (Energy savings in kWh/year):** 10 878 kWh/year
  - **Yearly Basis:** 2 FT STE units' full potential = **10 878 kWh/year** (relating to a specific simulation case)  
cf. it corresponds to 6 853 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
  - **Daily energy consumption saving:** 10 878 kWh / 365 days = **29,80 kWh/day**
- **Savings on energy consumption (in €):** 1 425 € EXCL. TAX/year  
cf. 10 878 x 0,131 €/kWh = 1 425,018 €/year
- **Remaining share of the standard energy used (per year):** 770 €/year (35% ; 5 879 kWh/year)
  - In %: solar thermal energy represents 65% here so, remaining share of **35%**
  - In kWh: 16 757 - 10 878 = **5 879 kWh/year**
  - In €: 5 879 kWh/year x 0,131 €/kWh = **770,149 €/year**
- **Remaining emission of CO<sub>2</sub>:** 1 358 kg CO<sub>2</sub> (CO<sub>2</sub> reduction up to 2 513 kg CO<sub>2</sub>)  
cf. 0,231 x 5 879 = 1 358,049 kg CO<sub>2</sub>

**Hyp = NO AID**

- **Previsionnal Cost (total - subsidies): 12 000 €**

cf. cost of equipment & installation + site preparation - potential aids = previsionnal cost

- **Cost of the equipment & installation: 10 000€**

*Notes:* 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 2 units x 5000€/unit = 10 000 €

- **Cost of the site preparation: 2000€**

cf. in average if not done personally by the holder

- **Aids and subsidies available: 0 €**

cf. average grant = XXX % ;  $X1 \times X2 = XXX \text{ €}$  in the event of approval by regulating authorities

**OPTIONAL COST:** monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)

- **Financial Package : 1 338 €/year for 10 years (in average)**

cf. Total - subsidies ; cash + financial loan (= duration + annuity)

- Previsionnal cost = financial loan = **12 000€**

- Duration: **10 years** / Loan rate = **2.2%** (with yearly increase) / STE Durability = **+30 years**

=> **12 000 € / 10 years = 1 200 €/year** ; taking into account the loan payment: **1 338 €/year** (in average)

- **Return on investment (global expense / annual savings): 8 years & 5 months**

- Global expense = **12 000€**

- Annual energy savings = **1 425 € per year during 30 years so in total : 1 425 €/year x 30 years = 42 750 €**

- ROI = 12 000 € / 1 425 € = **8.42 years**

- ROIC = 1 425 € / 12 000 € = **11.9%**

- **Yearly Earnings (Annual savings and yearly loan payment): 87 €/year (for 10 years, then 1 425 €/year)**

- Annual savings = **1 425 €**

- Yearly loan payment = **1 338 €**

◦ Difference = 1 425 - 1 338 = **87 €/year of earnings on the 10 year-loan period / after = 1 425 €/year**

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1	Costs without STE	2195	2349	2513	2689	2877	3079	3294	3525	3772	4036	4318	4621	4944	5290	5660	6057	6480	6934	7420	7939
2	Loan repayment	1338	1338	1338	1338	1338	1338	1338	1338	1338	0	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	770	824	882	944	1010	1080	1156	1237	1323	1416	1515	1621	1735	1856	1986	2125	2274	2433	2603	2785
4	System maintenance	0	0	0	0	0	200	206	212	219	225	232	239	246	253	261	269	277	285	294	303
5	Costs with STE	2108	2162	2220	2281	2347	2618	2700	2787	2880	2979	1747	1860	1981	2109	2247	2394	2551	2718	2897	3088
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Energy saving (1-5) €HT/Y	87	187	294	408	530	461	595	738	892	1057	2571	2761	2963	3181	3413	3663	3930	4216	4523	4851
7	Energy saving €HT/m	7	16	24	34	44	38	50	62	74	88	214	230	247	265	284	305	327	351	377	404

- **Network of possible installers:** ProfiRNG, Solesta, Dijkman, Leever, Abelenco, ABG Solar, Xperal, Troost installatiebedrijf, ReHeat, A tot Z installatietechniek, Installatiebedrijf Hulsman Lemelerveld, Mathijssen Technics BV, Preuter installatiebedrijf, Dekker techniek, De Vries techniek, Hoogeendam Installatietechniek, Peters installatietechniek zevenaar BV

- **Legislation for installation/Procedures and precautions:** Permit ("omgevingsvergunning") required when installed on the ground rather than a rooftop, which causes additional costs.



## Hyp = 30% AIDS

- Previsional Cost (total - subsidies): 9 000€**

cf. cost of equipment & installation + site preparation - potential aids = previsional cost

- Cost of the equipment & installation: 10 000€**

*Notes:* 3829€ for one stainless steel unit + installation expenses = 4000€/unit / 2 units x 5000€/unit = 10 000 €

- Cost of the site preparation: 2 000€**

cf. in average if not done personally by the holder

- Aids and subsidies available: 3 000 €**

cf. average grant = 30% ;  $0.3 \times 10\,000 = 3\,000$  € in the event of approval by regulating authorities

**OPTIONAL COST:** monitoring = 1200€ (equipment) + 1200€ (installation) + 38 €/year (RESOL subscription)

- Financial Package : 1 003 €/year for 10 years (in average)**

cf. Total - subsidies ; cash + financial loan (= duration + annuity)

- Previsional cost = financial loan = **9 000€**

- Duration: **10 years** / Loan rate = **2.2%** (with yearly increase) / STE Durability = **+30 years**

=> 9 000 € / 10 years = 900 €/year ; taking into account the loan payment: **1 003 €/year** (in average)

- Return on investment (global expense / annual savings): 6 years & 3 months**

- Global expense = **9 000€**

Annual energy savings = 1 425€ per year during 30 years so in total : 1425 €/year x 30 years = **42 750€**

ROI = 9 000 € / 1 425 € = **6.32 years**

ROIC = 1 425 € / 9 000 € = **15.8 %**

- Yearly Earnings (Annual savings and yearly loan payment): 422 €/year (for 10 years, then 1 425 €/year)**

- Annual savings = **1 425 €**

- Yearly loan payment = **1 003 €**

Difference = 1 425 - 1 003 = **422 €/year of earnings on the 10 year-loan period / after = 1 425 €/year**

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Costs without STE	2195	2349	2513	2689	2877	3079	3294	3525	3772	4036	4318	4621	4944	5290	5660	6057	6480	6934	7420	7939
2	Loan repayment	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	770	824	882	944	1010	1080	1156	1237	1323	1416	1515	1621	1735	1856	1986	2125	2274	2433	2603	2785
4	System maintenance	0	0	0	0	0	200	206	212	219	225	232	239	246	253	261	269	277	285	294	303
5	Costs with STE	1774	1828	1885	1947	2013	2284	2365	2452	2545	2645	1747	1860	1981	2109	2247	2394	2551	2718	2897	3088
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Energy saving (1-5) €HT/Y	422	521	628	742	864	795	929	1073	1226	1391	2571	2761	2963	3181	3413	3663	3930	4216	4523	4851
7	Energy saving €HT/m	35	43	52	62	72	66	77	89	102	116	214	230	247	265	284	305	327	351	377	404

- Network of possible installers:** ProfiRNG, Solesta, Dijkman, Leever, Abelenco, ABG Solar, Xperal, Troost installatiebedrijf, ReHeat, A tot Z installatietechniek, Installatiebedrijf Hulsman Lemelerveld, Mathijssen Technics BV, Preuter installatiebedrijf, Dekker techniek, De Vries techniek, Hoogeendam Installatietechniek, Peters installatietechniek zevenaar BV

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## RELEVANT REMARKS & COMMENTS

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