

## 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 Dairy Farms. The current academic example focus on a holding without on-farm processing and set in Flanders. The assumptions are that it owns a herd of 200 cows for which it needs 24 623 kWh of energy supply per year in order to clean its milking parlours and milk tanks. After enumerating the main characteristics of this typical and fictional dairy farm, a simulation with the Fengtech STE system illustrating expected results will be tackled. This file will be completed and crossed with a real-life case with similar attributes.

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

## PART I: ACADEMIC CASE

- |   |   |
|---|---|
| ▶ <i>N°/Nickname:</i> Flemish Dairy Farm                                  | ▶ <i>Location (Country/Region):</i> Flanders, Belgium |
| ▶ <i>Type of holding:</i> Flemish Dairy Farm (without on-farm processing) | ▶ <i>Date:</i> 20/10/2021                             |

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

- **Number of animals: 200 cows**
- **Water Use (heating/direct use): Cleaning of Milking Parlours & Milk Storage**
  - **Frequency:** Once
  - **Timeframe:** Night
  - **Quantity:** 600 L/day (average)
- **Version of FT STE system (ETF 1 / ETF2):** ETF 2 (with pressure)
- **Temperature needed (in °):** 90°C
- **Standard fossil energy used:** Electric Boiler
- **Price of fossil energy per kWh:** 0.14 €/kWh
- **Energy consumption for the activity (in kWh/year):** 24 623 kWh/year  
*cf. with energy waste and differentiated needs depending on the period of the year, the energy need accounts for 24 623 kWh/year*
- **Expenditure of energy consumption (in EXCL TAX€/year):** 3 447 €/year  
*cf. 0.14 EXCL.TAX€/kWh x 24 623 kWh/year = 3 447.22 EXCL. TAX €/year*
- **Available subsidies for STE:** only for STE systems that have been approved/certificated in Flanders - no subsidy then for FT
- **Amount of CO2 emission:** 3 447 kg CO2/year  
*cf. given that 1kWh produces about 0.140 kg CO2(eq), 0.140 kg CO2/kWh x 24 623 kWh/year = 3 447 kg CO2/year*

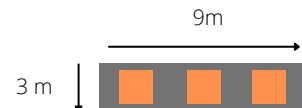
## Prerequisites of installation:

- Located on floor or 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 %):** 59% (GOAL = at least 50%)
- **Number of STE units to reach the energy needs:** 3 units  
cf. potential useful solar thermal energy = 9 204 kWh/year
- **Overall front surface of capture:** 12 m<sup>2</sup>  
cf. 1 FT = 4m<sup>2</sup> ; 4m<sup>2</sup>/unit x 3 units = 12 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
- **Surface requirement for the equipment:** 3x9 = 27m<sup>2</sup>
- **Irradiance and cold water measurements:**



| Solar irradiance value (Calsol INES) | GEEL | Albedo |      |      |      |      |      |      |      |      |      |      |      |  |  |  |
|--------------------------------------|------|--------|------|------|------|------|------|------|------|------|------|------|------|--|--|--|
| Unit (kWh / m <sup>2</sup> / day)    |      |        | 0,8  |      |      |      |      |      |      |      |      |      |      |  |  |  |
|                                      | Jan. | Feb.   | Mar. | Apl. | May  | Juin | Luly | Aug  | Sep  | Oct. | Nov. | Dec. | Year |  |  |  |
| Direct irradiance                    | 0,41 | 0,62   | 2,56 | 4,31 | 4,16 | 2,68 | 2,31 | 2,4  | 2,69 | 0,44 | 0,97 | 0,31 | 1,99 |  |  |  |
| Diffus irradiance                    | 0,95 | 1,39   | 1,85 | 2,12 | 2,24 | 2,58 | 2,61 | 2,5  | 2,11 | 1,46 | 1,24 | 0,83 | 1,82 |  |  |  |
| Cold water temperature (°C)          | 6,2  | 7      | 6,6  | 12,4 | 14,6 | 17,6 | 17,9 | 21,1 | 16,5 | 11,9 | 9,1  | 5,6  | 12   |  |  |  |

- **Solar energy contribution (Energy savings in kWh/year):** 14 609 kWh/year
  - Yearly Basis: 3 FT STE units' full potential = **14 609 kWh/year** (relating to a specific simulation case)  
cf. it corresponds to 9 204 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
  - Daily energy consumption saving: 14 609 kWh/year / 365 days = **40.02 kWh/day**
- **Savings on energy consumption (in €):** 2 045.26€ EXCL. TAX/year  
cf. the energy saving accounts for 14 609 kWh/year x 0.14 €/kWh = 2 045.26 €/year
- **Remaining share of the standard energy used (per year):** 1 402 €/year (41 % ; 10 014 kWh/year)
  - In %: solar thermal energy represents 59% here so, remaining share of **41%**
  - In kWh: 24 623 - 14 609 = **10 014 kWh/year**
  - In €: 10 014 kWh/year x 0.14 €/kWh = **1 401.96 €/year**
- **Remaining emission of CO<sub>2</sub>:** 1 402 kg CO<sub>2</sub> (CO<sub>2</sub> reduction up to 2045 kg CO<sub>2</sub>)  
cf. 10 014 kWh/year x 0.140 kg CO<sub>2</sub> = 1401.96 kg CO<sub>2</sub>

## Hyp = No AIDS

- **Previsionnal Cost (total - subsidies): 20 000 €**

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

- **Cost of the equipment & installation: 15 000€**

*Notes:* 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 3 units x 5000€/unit = 15 000 €

- **Cost of the site preparation: 5 000€**

cf. in average if not done personally by the holder

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

cf. average grant = XXX % ; X1 x X2 = XXX € *in the event of approval by regulating authorities*

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

- **Financial Package : 2 208 €/year for 10 years (in average)**

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

- Previsionnal cost = financial loan = **20 000 €**

- Duration: **10 years** / Loan rate = **2%** (with yearly increase) / STE Durability = **+30 years**

=> **20 000 € / 10 years = 2 000 €/year** ; taking into account the loan payment: **2 208 €/year** (in average)

- **Return on investment (global expense / annual savings): 9 years & 9.5 month**

- Global expense = **20 000 €**

- Annual energy savings = **2 045.26 € per year** during 30 years so in total : 2 045.26 €/year x 30 years = **61 350 €**

- ROI = 20 000 € / 2045.26 € = **9.78 years**

- ROIC = 2 045.26 € / 20 000 € = **10.2%**

- **Yearly Earnings (Annual savings and yearly loan payment): -162.74€/year (for 10 years, then 2356€/year)**

cf. good if savings > loan

- Annual savings = **2 045.26 €**

- Yearly loan payment = **2 208 €**

- Difference = 2 045.26 - 2 208 = **-162.74 €/year of earnings during the 10 year-loan period / after = 2 045.26 €/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          | 3447 | 3689 | 3947 | 4223 | 4519 | 4835 | 5173 | 5536 | 5923 | 6338 | 6781 | 7256 | 7764 | 8307 | 8889 | 9511 | 10177 | 10889 | 11651 | 12467 |
| 2 | Loan repayment             | 2208 | 2208 | 2208 | 2208 | 2208 | 2208 | 2208 | 2208 | 2208 | 2208 | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     |
| 3 | Gas remaining to buy       | 1402 | 1500 | 1605 | 1717 | 1838 | 1966 | 2104 | 2251 | 2409 | 2577 | 2758 | 2951 | 3157 | 3379 | 3615 | 3868 | 4139  | 4429  | 4739  | 5070  |
| 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             | 3610 | 3708 | 3813 | 3926 | 4046 | 4375 | 4518 | 4672 | 4836 | 5011 | 2990 | 3190 | 3403 | 3632 | 3876 | 4137 | 4416  | 4714  | 5032  | 5373  |
| 6 | Energy saving (1.5) €/HT/y | -163 | -20  | 133  | 297  | 473  | 460  | 655  | 864  | 1087 | 1327 | 3792 | 4066 | 4360 | 4675 | 5013 | 5374 | 5761  | 6176  | 6619  | 7094  |
| 7 | Energy saving €/HT/m       | -14  | -2   | 11   | 25   | 39   | 38   | 55   | 72   | 91   | 111  | 316  | 339  | 363  | 390  | 418  | 448  | 480   | 515   | 552   | 591   |

- **Network of potential installers:** Rexel, Cebeo, Remeha, Buderus, Vaillant, Viessmann, Desco, STG, Vanoirschot, ESTG, Van Marcke Pro, Aosmith International, Leenaerts Agrotechniek, Verbeke Machines, Schippers, ATTB, Belsolar, the Belgian federation of STE systems suppliers (<https://www.infozonneboiler.be/nl/>)

- **Legislation for installation/Procedures and precautions:** In Flanders, installation on a flat roof is exempt from permit if the installation is no higher than 1m above the roof edge. On a sloping roof, the installation of solar panels is exempt if they are integrated into the sloping roof surface: on the roof covering or replacing it. The installation must not conflict with the requirements of a special plan of action (BPA), municipal spatial implementation plan (RUP) or subdivision permit.



## Hyp = 30% AIDS

- **Previsionnal Cost (total - subsidies): 15 500 €**  
cf. cost of equipment & installation + site preparation - potential aids = previsionnal cost
  - **Cost of the equipment & installation: 15 000€**  
*Notes:* 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 3 units x 5000€/unit = 15 000 €
  - **Cost of the site preparation: 5 000€**  
cf. in average if not done personally by the holder
  - **Aids and subsidies available: 4 500 €**  
cf. average grant = 30% ;  $0.30 \times 15\ 000 = 4\ 500\ €$  *in the event of approval by regulating authorities*  
**OPTIONAL COST:** monitoring = 1200€ (equipment) + 1200€ (installation) + 38 €/year (RESOL subscription)
- **Financial Package : 1 711 €/year for 10 years (in average)**  
cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **15 500 €**
  - Duration: **10 years** / Loan rate = **2%** (with yearly increase) / STE Durability = **+30 years**  
=> **15 500 € / 10 years = 1 550 €/year** ; taking into account the loan payment: **1 711 €/year** (in average)
- **Return on investment (global expense / annual savings): 7 years & 7 months**
  - Global expense = **15 500 €**
  - Annual energy savings = **2 045.26 € per year** during 30 years so in total :  $2\ 045.26\ €/year \times 30\ years = 61\ 350\ €$
  - ROI =  $15\ 500\ € / 2\ 045.26\ € = 7.6\ years$
  - ROIC =  $2\ 045.26\ € / 15\ 500\ € = 13.2\ %$
- **Yearly Earnings (Annual savings and yearly loan payment): 334.26€/year (for 10 years, then 2045.26€/year)**  
cf. good if savings > loan
  - Annual savings = **2 045.26 €**
  - Yearly loan payment = **1 711 €**
  - Difference =  $2\ 045.26 - 1\ 711 = 334.26\ €/year$  of earnings during the 10 year-loan period / after = **2 045.26 €/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         | 3447 | 3689 | 3947 | 4223 | 4519 | 4835 | 5173 | 5536 | 5923 | 6338 | 6781 | 7256 | 7764 | 8307 | 8889 | 9511 | 10177 | 10889 | 11651 | 12467 |
| 2    | Loan repayment            | 1711 | 1711 | 1711 | 1711 | 1711 | 1711 | 1711 | 1711 | 1711 | 1711 | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     |
| 3    | Gas remaining to buy      | 1402 | 1500 | 1605 | 1717 | 1838 | 1966 | 2104 | 2251 | 2409 | 2577 | 2758 | 2951 | 3157 | 3379 | 3615 | 3868 | 4139  | 4429  | 4739  | 5070  |
| 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            | 3113 | 3212 | 3317 | 3429 | 3549 | 3878 | 4021 | 4175 | 4339 | 4514 | 2990 | 3190 | 3403 | 3632 | 3876 | 4137 | 4416  | 4714  | 5032  | 5373  |
| 6    | Energy saving (1-5) CHT/Y | 334  | 477  | 630  | 794  | 970  | 957  | 1152 | 1361 | 1584 | 1824 | 3792 | 4066 | 4360 | 4675 | 5013 | 5374 | 5761  | 6176  | 6619  | 7094  |
| 7    | Energy saving CHT/m       | 28   | 40   | 53   | 66   | 81   | 80   | 96   | 113  | 132  | 152  | 316  | 339  | 363  | 390  | 418  | 448  | 480   | 515   | 552   | 591   |

- **Network of installers:** Rexel, Cebeo, Remeha, Buderus, Vaillant, Viessmann, Desco, STG, Vanoirschot, ESTG, Van Marcke Pro, Aosmith International, Leenaerts Agrotechniek, Verbeke Machines, Schippers, ATTB, Belsolar, the Belgian federation of STE systems suppliers (<https://www.infozonneboiler.be/nl/>)
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## RELEVANT REMARKS & COMMENTS

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