

Context/Intro:

In the framework of the ICaRE4Farms project, this document aims at reviewing the real-life potential of Feng Tech STE system within the agricultural sector of milk-fed calf farms.

The current real-life example focus on a holding set in Brittany (France). This farm currently hosts around 1 600 calves a year (i.e. 1.8 lots of 800 places), for which it needs around 184 375 kWh of energy supply per year in order to feed th calves with heated milk (powder + hot water).

After enumerating the main characteristics of this field application farm before installing STE plants, a review of fonctionning with the Feng Tech system illustrating expected results will be tackled.

This file complements previous work on case studies and offer a more localised illustration.

FIELD APPLICATION CASE

- ▶ *N°/Nickname:* Bretagne Veaux
- ▶ *Location (Country/Region):* Brittany
- ▶ *Type of holding:* Milk-Fed Calf Farm
- ▶ *Date:* 07/04/2022

1 Initial characteristics of the installation: (Use Market Analysis + Technology Assessment)

- **Size of the surface/number of animals:** ≈ 1600 calves/year (1.8 batch/year with **800** places)
- **Water Use (heating/direct use):** Feeding (5600 L/day)
 - **Frequency:** 2 times per day
 - **Timeframe:** morning & evening
 - **Quantity:** from 1.5 to 4.5 L per feeding/calf (twice a day so 3 to 9 L/calf)
- **Version of FT STE system (ETF 1 / ETF2):** ETF 1
- **Temperature needed (in °):** 80°
- **Standard fossil energy used:** Propane
- **Price of fossil energy per kWh:** 0,0825 €/kwh (special pricing; otherwise 0.16/kWh)
- **Energy consumption for the activity (in kWh/year):** 184 375 kWh/year
cf. with energy waste and differentiated needs depending on the period of the year, the energy need accounts for 184 375 kWh/year
 $\Rightarrow 12.8 \text{ kWh} \times 14\,400 \text{ t/an} = 184\,375 \text{ kWh/an}$
- **Expenditure of energy consumption (in EXCL TAX€/year):** 15 211 €/year
cf. $0.0825 \text{ EXCL. TAX€/kWh} \times 184\,375 \text{ kWh/year} = 15\,210,9 \text{ EXCL. TAX €/year}$
- **Available subsidies for STE:** 0 €
- **Amount of CO2 emission:** 47 384 kgCO2/year
cf. given that 1kWh of propane in France produces about 0.257 kg CO2(eq), $0,257 \text{ kg CO2/kWh} \times 185\,561 \text{ kWh/year} = 47\,689 \text{ kg CO2/year}$



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 = V11 Lille Study Case

2 Simulation with a Feng Tech STE system:

- **Coverage Rate of the installation (Share of utilisation in %):** 54%

cf. precisising when the farmer wanted willingly a restricted share of power supply + Depending on location and weather + the value is imposed as it is the hypothetical reference we want to check after with the field application case

- **Number of STE units to reach the energy needs:** 24

cf. potential energy savings = 62 374 kWh/year

- **Overall front surface of capture:** 96 m²

cf. 1 FT = 4m² ; 4m²/unit x 24 units = 96 m²

- **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:**

Possibility for 2 thermometers + 2 flowmeters BUT not expressively mandatory

- **Surface requirement for the equipment:** 5x36= 180 m²



- **Irradiance & Cold Water Measurements:**

valeurs d'irradiation (Calsol INES)	Brest 45°	Albedo	0,8											
Unité (kWh / m ² / jour)	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Année	
Irradiation Direct	1,09	1,25	2,43	3,09	2,43	2,43	2,87	2,66	2,3	2,1	1,3	0,78	2,06	
Irradiation Diffus	0,58	0,9	1,38	1,87	2,31	2,48	2,36	2,07	1,59	1,07	0,68	0,48	1,48	
Température eau froide °C	7,5	7,8	9,4	11	12	14	15	15	14	11	9,3	7,8	11	

- **Solar energy contribution (Energy Savings in kWh/year):** 97 566 kWh/year

- Yearly Basis: 24 FT STE units' full potential = **97 566 kWh/year** (relating to a specific simulation case)
cf. it corresponds to 62 374 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
- Daily energy consumption saving: 97 566 kWh/year / 365 days = **267 kWh/day**

- **Savings on energy consumption (in €):** 8 049 € EXCL. TAX/year

cf. the energy saving accounts for 97 566 kWh/year x 0,0825 €/kWh = 8 045 €/year

- **Remaining share of the standard energy used (per year):** 7259 €/year (47% ; 87 995 kWh/year)

- In %: solar thermal energy represents 53% here so, remaining share of **47%**
- In kWh: 185 561 - 97 566 = **87 995 kWh/year**
- In €: 87 995 kWh/year x 0,0825 €/kWh = **7259 €/year**

- **Remaining emission of CO₂:** 22 614 kg CO₂ (CO₂ reduction up to 25 075 kg CO₂)

cf. 87 995 kwh/year x 0,257 kg CO₂ = 22 614 kg CO₂

Hyp = No AIDS

- Previsionnal Cost (total - subsidies): 125 000 €**

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

- Cost of the equipment & installation: 120 000 € (cas exemplaire / geste commercial)**

Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 24 units x 5000€/unit = 120 000 €

- 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 % ; $X1 \times X2 = XXX \text{ €}$ *in the event of approval by regulating authorities*

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

- Financial Package : 13 469 €/year for 10 years (in average)**

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

- Previsionnal cost = financial loan = 125 000 €

- Duration: **10 years** / Loan rate = **1,50%** (with yearly increase) / STE Durability = **+30 years**

=> **125 000 € / 10 years = 12 500 €/year** ; taking into account the loan rate: **13 469 €/year** (in average)

- Return on investment (global expense / annual savings): 8,7 years**

- Global expense = **125 000 €**

- Annual energy savings = **8 168 € per year** during 30 years so in total : 8 168 €/year x 30 years = **245 040 €**

- ROI = 70 700 € / 8 168 € = **8.65 years**

- ROIC = 8 168 € / 70 700 € = **11.5 %**

- Yearly Earnings (Annual savings and yearly loan payment): 545 €/year (for 10 years, then 8 163 €/year)**

cf. good if savings > loan

- Annual savings = **8 049 €**

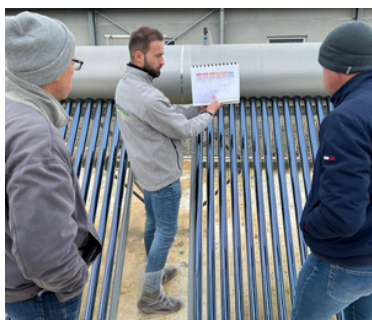
- Yearly loan payment = **13 469 €**

- Difference = 8 049 - 13 469 = **- 5 420 €/year of earnings during the 10 year-loan period / after = 8 049 €/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	15309	16074	16878	17722	18608	19538	20515	21541	22618	23749	24936	26183	27492	28867	30310	31826	33417	35088	36842	38685
2	Loan repayment	13469	13469	13469	13469	13469	13469	13469	13469	13469	13469	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	7260	7623	8004	8404	8824	9265	9729	10215	10726	11262	11825	12416	13037	13689	14373	15092	15847	16639	17471	18345
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	20728	21091	21472	21873	22293	22934	23403	23896	24413	24956	12057	12655	13283	13942	14634	15361	16124	16924	17765	18647
6	Energy saving (1-5) €HT/Y	-5420	-5017	-4594	-4151	-3685	-3196	-2688	-2155	-1595	-1207	12879	13528	14209	14925	15676	16465	17294	18164	19078	20037
7	Energy saving €HT/m	-452	-418	-383	-346	-307	-263	-214	-166	-119	-101	1073	1127	1184	1244	1306	1372	1441	1514	1590	1670

Network of installers: Ets LEFORT / Solair3Tech / Elevance (groupe Agriale) / Pineau Thermic System / MAES Ets / Lacta Services / INOVIA (Ancien du Groupe Terrena) / SARL TESSIER / Comptoir machine à traire (CMT) / CES Tardy - EMERAUDE ELEVAGE EQUIPEMENT / Energies libres / M ENERGIES Thermiques / Boissinot Elevage / Animat53 / Sarl Evident / AB Energies / MODEMA Agri / ALDS Duval Services / Méheust / Bretagne Sud Elevage (BSE) / Roudaut-Foricher / Sotec

- Legislation for installation/Procedures and precautions:** rural environment so few restrictions ; when roof, request for work to municipality / when on the floor, nothing needed as long as within property



Hyp = 30% AIDS

• Previsionnal Cost (total - subsidies): 87 500 €

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

◦ Cost of the equipment & installation: 68 000 €

Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 24 units x 5000€/units = 120 000 €

◦ Cost of the site preparation: 5 000 €

cf. in average if not done personally by the holder

◦ Aids and subsidies available: 37 500 €

cf. average grant = 30% ; $X1 \times X2 = 68\,000 \times 0.30 = 20\,400$ € in the event of approval by regulating authorities

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

• Financial Package : 9 428 €/year for 10 years (in average)

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

◦ Previsionnal cost = financial loan = 87 500 €

◦ Duration: **10 years** / Loan rate = **1,5%** (with yearly increase) / STE Durability = **+30 years**

=> **87 500 € / 10 years = 8 750 €/year** ; taking into account the loan rate: **9 428 €/year** (in average)

• Return on investment (global expense / annual savings): 6.2 years

◦ Global expense = 87 500 €

◦ Annual energy savings = **8 163 € per year** during 30 years so in total : 8 163 €/year x 30 years = **245 040 €**

◦ ROI = $X1 \text{ €} / X2 \text{ €} = 50\,300 / 8\,163 = 6.16 \text{ years}$

◦ ROIC = $X2 \text{ €} / X1 = 8\,163 / 50\,300 \text{ €} = 0.16.2\%$

• Yearly Earnings (Annual savings and yearly loan payment): 2 743 €/year (for 10 years, then 8163 €/year)

cf. good if savings > loan

◦ Annual savings = **8 049 €**

◦ Yearly loan payment = 9 428 €

◦ Difference = $X1 - X2 = 8\,049 - 9\,428 = -1\,379$ €/year of earnings during the 10 year-loan period / after = 8 049 €/year

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Costs without STE	15309	16074	16878	17722	18608	19538	20515	21541	22618	23749	24936	26183	27492	28867	30310	31826	33417	35088	36842	38685
Loan repayment	9428	9428	9428	9428	9428	9428	9428	9428	9428	9428	0	0	0	0	0	0	0	0	0	0
Gas remaining to buy	7260	7623	8004	8404	8824	9265	9729	10215	10726	11262	11825	12416	13037	13689	14373	15092	15847	16639	17471	18345
System maintenance	0	0	0	0	0	200	206	212	219	225	232	239	246	253	261	269	277	285	294	303
Costs with STE	16688	17051	17432	17832	18252	18893	19563	19855	20372	20915	12057	12655	13283	13942	14634	15361	16124	16924	17765	18647
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy saving (1-5) €HT/Y	-1379	-976	-554	-110	356	645	1153	1686	2246	2834	12879	13528	14209	14925	15676	16465	17294	18164	19078	20037
Energy saving €HT/m	-115	-81	-46	-9	30	54	96	140	187	236	1073	1127	1184	1244	1306	1372	1441	1514	1590	1670

- **Network of installers:** Ets LEFORT / Solair3Tech / Elevance (groupe Agriale) / Pineau Thermic System / MAES Ets / Lacta Services / INOVIA (Ancien du Groupe Terrena) / SARL TESSIER / Comptoir machine à traire (CMT) / CES Tardy - EMERAUDE ELEVAGE EQUIPEMENT / Energies libres / M ENERGIES Thermiques / Boissinot Elevage / Animat53 / Sarl Evident / AB Energies / MODEMA Agri / ALDS Duval Services / Méheust / Bretagne Sud Elevage (BSE) / Roudaut-Foricher / Sotec

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RELEVANT REMARKS & COMMENTS

#1 : lissage proportionnel à croissance des veaux de la consommation d'eau (1.5 à 4.5 l par repas)

#2 : quel valeur entre 10 à 12kg/veau/an pour 800 veaux ≠ 14.400 t/an ? **choix de 14 400 kg**

#3 : question du geste commercial ammenant à près de 30k€ de différence pour un même dimensionnement entre l'époque et aujourd'hui

#4 : prix propane = 0.16€/kWh MAIS éleveur annonce 880 €HT/t soit avec 20% TVA 1056€/t
=> 1 kg propane = 12.8 kWh => 1000 kg = 12 800 kWh => 1056€ / 12 800 ≈ **0.825€ (BON ???)**