

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 milk-fed calves breeding.

The current academic example focus on a holding without on-farm processing and set in Pays de la Loire. The assumptions are that it owns a herd of 185 calves (1.8 batches/year) for which it needs around 48 469 kWh of energy supply per year in order to feed them.

After enumerating the main characteristics of this typical and fictional calves 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.

PART I: ACADEMIC CASE

- | | |
|---|--|
| ▶ <i>N°/Nickname:</i> French Calves farms | ▶ <i>Location (Country/Region):</i>
France / Pays de la Loire |
| ▶ <i>Type of holding:</i>
Milk-Fed Calves Breeding | ▶ <i>Date:</i> 22th July 2021 |

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

- **Number of cows:** 370 calves/year (2 lots of **185** places per year)
- **Water Use (heating/direct consumption):** Feeding of Calves with heated milk
 - **Frequency:** 2 times a day
 - **Timeframe:** morning and evening
 - **Quantity:** 1300 L/day
- **Version of FT STE system:** ETF1 (version without pressure)
- **Temperature needed (in °):** 80°C
- **Standard fossil energy used:** Propane
- **Price per kWh:** 0.12 EXCL. TAX/€/kWh
- **Energy consumption for the activity (in kWh):** 48 469 kWh/year
cf. with energy waste, the energy need accounts for 370 calfs x 131 kWh/calf = 48 469 kWh/year
- **Expenditure of energy consumption (in €/kWh):** 5 816 € EXCL. TAX/year
cf. 0.12 EXCL.TAX/€/kWh x 48 469 kWh/year = 5 816.4 EXCL. TAX €/year
- **Available subsidies for STE:** between 20 and 40% of the equipment cost (*Fonds Chaleur*)
- **Amount of CO2 emission:** 13 184 kg CO2/year
cf. given that 1kWh with propane produces about 0.272 kg CO2(eq), 0.272 kg CO2/kWh x 48 469 kWh/year = 13 183, 568 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

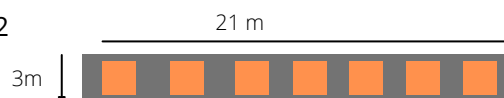
Employed Version of the matrix = V11 Lille Study Case

2 Simulation with a Feng Tech STE system:

- **Coverage Rate of the installation (Share of utilisation in %):** 56% (GOAL = at least 50%)
- **Number of STE units to reach the energy needs:** 7 units
cf. potential energy savings = 27 088 kWh/year
- **Overall front surface of capture:** 28 m²
cf. 1 FT = 4m² ; 4m²/unit x 7 units = 28 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:**
Commercial scope = 2 thermometers + 2 flowmeters

- **Surface requirement for the equipment:** 3x21 = 63m²

cf. Length of concrete slab = size of panels (2x2,5m) + space between panels (0,5m x t panels) / Width = 3 m



- **Irradiance & Cold Water Measurements:**

Solar irradiance value (Calsol INES)	Lille 45°	Albedo	0,8											
Unit (kWh / m ² / day)	January	February	March	April	May	June	July	August	September	October	November	Décember	Year	
Direct irradiance	0,57	0,96	1,61	2,11	2,21	2,36	2,13	2,11	2,05	1,43	0,72	0,45	1,56	
Diffus irradiance	0,45	0,79	1,29	1,87	2,29	2,49	2,4	2,05	1,53	0,97	0,54	0,36	1,42	
Cold water temperature (°C)	6,2	6,5	8,1	9,5	11	13	14	14	13	10	8,1	6,7	10	

- **Solar energy contribution (in kWh):** 27 088 kWh/year
 - Yearly Basis: 7 FT STE units' full potential = **27 088 kWh/year** (relating to a specific simulation case)
cf. it corresponds to **17 065 kWh/year useful solar energy** (depends on distance, insulation etc. / simulation from an average case)
 - Daily energy consumption saving: 27 088 kWh/year / 365 days = **74.2 kWh/day**
- **Savings on energy consumption (in €):** 3 250.56 € EXCL. TAX/year
cf. Given that, with energy waste, the energy saving accounts for 27 088 kWh/year x 0.12 €/kWh = 3 250.56 €/year
- **Remaining share of the standard energy used (per year):** 2 566 €/year (44% ; 21 381 kWh/year)
 - In %: solar thermal energy represents 56% here so, remaining share of **44%**
 - In kWh: 48 469 - 27 088 = **21 381 kWh/year**
 - In €: 21 381 kWh/year x 0.12 €/kWh = **2 565.72 €/year**
- **Remaining emission of CO₂:** 5816 kg CO₂ (CO₂ reduction up to 7 368 kg CO₂)
cf. 21 381 kWh/year x 0.272 kg CO₂ = 5815.632 kg CO₂/year

Hyp = No AIDS

- Previsionnal Cost (total - subsidies): 40 000 €**

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

- Cost of the equipment & installation: 35000€**

Notes: 3829€ for one stainless steel unit & 3480€ for one basic unit + installation expenses = 4000€/unit / 7 units x 5000€/unit = 32000€

- Cost of the site preparation: 5000€**

cf. in average if not done personally by the holder

- Aids and subsidies available: 0€**

cf. average grant = 0%

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

- Financial Package : 4 261 €/year for 10 years (in average)**

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

- Previsionnal cost = financial loan = **40 000 €**

- Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**

=> **40 000 € / 10 years = 4 000 €/year** ; taking into account the loan payment: **4 261 €/year** (in average per year for 10 years)

- Return on investment (global expense / annual savings): 12 years & 4 months**

- Global expense = **40 000 €**

- Annual energy savings = **3 250.56 € per year** during 30 years so in total : 3 250.56 €/year x 30 years = **97 516.8 €**

- ROI = 40 000 € / 3 250.56 € = **12.3 years**

- ROIC = 3 250.56 € / 40000 € = **8.13 %**

- Yearly Earnings (Annual savings and yearly loan payment): - 1010€/year (first year)**

cf. good if savings > loan

- Annual savings = **3 250.56 €**

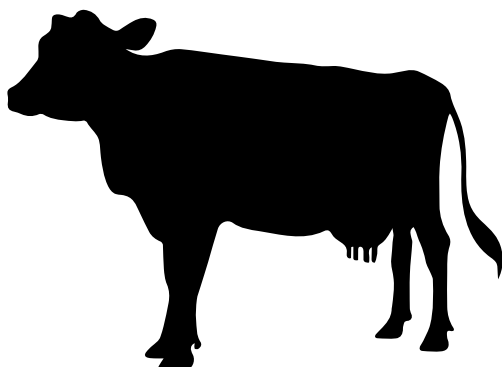
- Yearly loan payment = **4 261 €**

- Difference = 3 250.56 - 4261 = **-1010 €/year of earnings during the first year of the 10 year-loan period / after = 3 250.56 €/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	5816	6223	6659	7125	7624	8158	8729	9340	9994	10693	11442	12243	13100	14016	14998	16047	17171	18373	19659	21035
2	Loan repayment	4261	4261	4261	4261	4261	4261	4261	4261	4261	4261	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	2566	2745	2938	3143	3363	3599	3851	4120	4409	4717	5047	5401	5779	6183	6616	7079	7575	8105	8672	9279
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	6827	7007	7199	7405	7625	8060	8318	8594	8889	9204	5279	5639	6025	6437	6877	7348	7851	8390	8966	9582
		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	-1011	-783	-540	-279	-1	98	411	746	1105	1489	6162	6603	7075	7580	8121	8700	9319	9983	10693	11453
7	Energy saving €HT/m	-84	-65	-45	-23	0	8	34	62	92	124	514	550	590	632	677	725	777	832	891	954

- Network of installers:** Ets LEFORT / Solair3Tech / Elevance (groupe Agriale) / Pineau Thermic System / MAES Ets / Lacta Services / SARL TESSIER / Comptoir machine à traire (CMT) / CES Tardy - EMERAUDE ELEVAGE EQUIPEMENT / Energies libres

- 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): 29 500 €**

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

- Cost of the equipment & installation: 35000€**

Notes: 3829€ for one stainless steel unit + installation expenses = 4000€/unit / 7 units x 5000€/unit = 35000€

- Cost of the site preparation: 5000€**

cf. in average if not done personally by the holder

- Aids and subsidies available: 10 500€**

cf. grant = 30% ; 35000 x 0.30 = 10 500€ in the event of approval by regulating authorities

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

- Financial Package : 3 140€/year for 10 years (in average)**

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

- Previsionnal cost = financial loan = **29 500 €**

- Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**

=> **29 500 € / 10 years = 2 950 €/year** ; taking into account the loan payment: **3 140 €/year** (in average per year for 10 years)

- Return on investment (global expense / annual savings): 9 years & 1 month**

- Global expense = **29 500 €**

- Annual energy savings = **3 250.56 € per year** during 30 years so in total : 3 250.56 €/year x 30 years = **97 516.8 €**

- ROI = 29 500 € / 3 250.56 € = **9,07 years**

- ROIC = 29 500 € / 3 250.56 € = **11%**

- Yearly Earnings (Annual savings and yearly loan payment): 110.56 €/year (first year)**

cf. good if savings > loan

- Annual savings = **3 250.56€**

- Yearly loan payment = **3 140 €**

- Difference = 3250.56 - 3140 = **110.56 €/year of earnings during the first year of the 10 year-loan period / after = 3250.56 €/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	5816	6223	6659	7125	7624	8158	8729	9340	9994	10693	11442	12243	13100	14016	14998	16047	17171	18373	19659	21035
2	Loan repayment	3143	3143	3143	3143	3143	3143	3143	3143	3143	3143	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	2566	2745	2938	3143	3363	3599	3851	4120	4409	4717	5047	5401	5779	6183	6616	7079	7575	8105	8672	9279
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	5709	5888	6080	6286	6506	6942	7199	7475	7770	8085	5279	5639	6025	6437	6877	7348	7851	8390	8966	9582
		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	108	335	579	839	1118	1216	1529	1865	2224	2608	6162	6603	7075	7580	8121	8700	9319	9983	10693	11453
7	Energy saving €HT/m	9	28	48	70	93	101	127	155	185	217	514	550	590	632	677	725	777	832	891	954

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RELEVANT REMARKS & COMMENTS
