CASE STUDY

I4F-WP1-Task 3

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 Pays de la Loire. The assumptions are that it owns a herd of 100 cows for which it needs 23 780 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.

PART I: ACADEMIC CASE

- *N°/Nickname:* French Dairy Case
- *Type of holding:* Dairy Farm (without on-farm processing)
- *Location (Country/Region):* France / Pays de la Loire
- *Date:* 26th June 2021

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

- **Number of cows:** 100 cows
- **Water Use (heating/direct use):** Cleaning of Milking Parlours & Milk tanks
  - **Frequency***:* 2 times a day
  - **Timeframe:** morning and evening
  - **Quantity:** 600-700L at 70°C per day
- **Version of FT STE system**: ETF 2 (version with pressure)
- **Temperature needed (in °):** 70°C
- **Standard fossil energy used:** Electric Boiler (2 units of 3kW and 300L)
- **Price per kWh:** *0.16 €/kWh EXCL. TAX*
- **Energy consumption for the activity (in kWh):** *23 780 kWh/year*
  cf.with energy waste and to heat 600L of water, the energy need accounts for 100 cows x 120 kWh/year/cow = 23 780 kWh/year
- **Expenditure of energy consumption (in €/kWh):** *3 804.8 € EXCL. TAX/year*
  cf. 0.16€HT/kWh x 23 780 kWh/year = 3 804.8 € EXCL. TAX/year
- **Available subsidies for STE:** between 20 and 40% of the equipment cost (*Fonds Chaleur*) / 35% in average
- **Amount of CO2 emission:** *2378 kg CO2/year*
  cf. given that 1kWh produces about 0.1kg CO2(eq), 0.1kg CO2/kWh x 23780 kWh/year = 2378 kg CO2/year

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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 Lilles 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:** 3 units
  cf. potential energy savings = 13 282 kWh/year

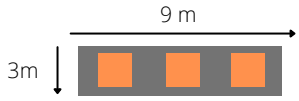
- **Overall front surface of capture:** 12 m2
  cf.1 FT = 4m2 ; 4m2/unit x 3 units = 12 m2

- **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:** 3x9 **=** 27m2



- **Irradiance & Cold Water Measurements:**

Solar irradiance value (Calsol INES)	Lille 45°	Albedo	0,8										
Unit (kWh / m² / 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 (Energy Savings in kWh)**: *13 282 kWh/year*

  - Yearly Basis: 3 FT STE units' full potential = **13 282 kWh/year** *(relating to a specific simulation case)*
    cf. it corresponds to 8368 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
  - Daily energy consumption saving: 13 282kWh / 365 days = **36.39 kWh/day**

- **Savings on energy consumption (in €)**: 2 125.12 *€ EXCL. TAX/year*
  cf. Given that, with energy waste and to heat 600L of water, the energy saving accounts for 13 282 kWh/year x 0.16€ = 2 125.12 €/year

- **Remaining share of the standard energy used (per year):** 1 680 *€/year* (44% ; 10 498 kWh/year)

  - In %: solar thermal energy represents 56% here so, remaining share of **44%**
  - In kWh: 23780 - 13282 = **10 498 kWh/year**
  - In €: 10 498 kWh/year x 0.16 €/kWh = **1 679.68 €/year**

- **Remaining emission of CO2:** 1050 *kg CO2 (CO2 reduction up to 1328 kg CO2)*
  cf. 10 498 kwh/year x 0.1kg CO2 = 1049.8 kg CO2

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Hyp = No AIDS

- **Previsionnal Cost (total - subsidies):** *17 000 €*

  cf. cost of equipment & installation + site preparation - potential aids = previsional 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:** *2000€*

    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 :** *1 811 €/year for 10 years* (in average)

  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **17 000€**
  - Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**

    => 17000 € / 10 years = 1700 €/year ; taking into account the loan payment: **1811 €/year** (in average)

- **Return on investment (global expense / annual savings):** 8 *years*
  - Global expense = **17 000€**
  - Annual energy savings = **2 125.12€ per year** during 30 years so in total : 2 125.12 €/year x 30 years = **63 753.6 €**
  - ROI = 17000 € / 2 125.12 € = **8 years**
  - ROIC = 2 125.12 € / 17000 € = **12.5%**

- **Yearly Earnings (Annual savings and yearly loan payment):** *+314 €/year* (for 10 years, then 2125 €/year)

  cf. good if savings > loan
  - Annual savings = **2 125.12€**
  - Yearly loan payment = **1 811 €**
  - Difference = 2 125.12 - 1 811 = **314.12 €/year of earnings on the 10 year-loan period / after = 2 125.12 €/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	3805	4071	4356	4661	4987	5337	5710	6110	6537	6995	7485	8009	8569	9169	9811	10498	11233	12019	12860	13760
2	Loan repayment	1811	1811	1811	1811	1811	1811	1811	1811	1811	1811	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	1680	1797	1923	2058	2202	2356	2521	2697	2886	3088	3304	3536	3783	4048	4331	4634	4959	5306	5677	6075
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	3491	3608	3734	3869	4013	4367	4538	4721	4916	5124	3536	3774	4029	4301	4592	4903	5236	5591	5971	6377
		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	314	463	622	792	975	969	1172	1389	1622	1871	3949	4234	4540	4868	5219	5595	5997	6428	6889	7383
7	Energy saving €HT/m	26	39	52	66	81	81	98	116	135	156	329	353	378	406	435	466	500	536	574	615

- **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

- **Legislation for installation/Procedures and precautions:** rural environnment 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):** *12 500 €*
  cf. cost of equipment & installation + site preparation - potential aids = previsional 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:** *2000 €*
    cf. *in average if not done personally by the holder*
  - **Aids and subsidies available:** *4 500 €*
    cf. grant = 30% ; 15000 x 0.30 = 4 500 € *in the event of approval by regulating authorities*
    OPTIONAL COST: *monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)*

- **Financial Package :** *1 332 €/year for 10 years* (in average)
  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **12 500€**
  - Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**
    => 12 500 € / 10 years = 1 250 €/year ; taking into account the loan rate: **1 332 €/year** (in average)

- **Return on investment (global expense / annual savings):** 5 *years & 11 months*
  - Global expense = **12 500€**
  - Annual energy savings = **2 125.12 € per year** during 30 years so in total : 2 125.12 €/year x 30 years = **63 753.6€**
  - ROI = 12 500 € / 2 125.12 € = **5.88 years**
  - ROIC = 2 125.12 € / 12 500 € = **17%**

- **Yearly Earnings (Annual savings and yearly loan payment):** *+793 €/year* (for 10 years, then 2125 €/year)
  cf. good if savings > loan
  - Annual savings = **2 125.12€**
  - Yearly loan payment = **1 332 €**
  - Difference = 2 125.12 - 1 332 = **793.12 €/year of earnings on the 10 year-loan period / after = 2 125.12 €/year**

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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RELEVANT REMARKS & COMMENTS