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 Farming.
The current academic example focuses on a holding without on-farm processing and located in Roscommon. The assumptions are that it owns a herd of 90 cows for which it needs around 34 970 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

- *N°/Nickname:* N°1 / Irish Dairy Farm
- *Type of holding: Dairy Farm (without on-farm processing)*
- *Location (Country/Region): Roscommon, Ireland (Lat/Lon: 53372 ; -8033)*
- *Date: 13/10/21*

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

- **Size of the surface/number of animals:** 90 cows
- **Water Use (heating/direct use):** Cleaning of the Milking Parlours & Storage
  - **Frequency:** twice
  - **Timeframe:** once in the morning and once in the evening
  - **Quantity:** 900L per day for the whole herd (assuming 10L of water per cow)
- **Version of FT STE system (***ETF 1 / ETF2): ETF 2 (with pressure)*
- **Temperature needed (in °):** 80°
- **Standard fossil energy used:** Electric Boiler
- **Price of fossil energy per €/kWh:** 0.21€/kWh (shift between day and night)
- **Energy consumption for the activity (in kWh/year):** 34 970 kWh/year
  cf.with energy waste and differentiated needs depending on the period of the year, the energy need accounts for 34994 kWh/year (see calculation tool)
- **Expenditure of energy consumption (in EXCL TAX€/year):** 7 344€
  cf. 0.21 EXCL.TAX/€/kWh x 34970 kWh/year = 7 343.7 EXCL. TAX €/year
- **Available subsidies for STE:** no subsidy / possibly grant from SEAI (to be asserted)
- **Amount of CO2 emission:** 15 946 kg *CO2/year*
  cf. given that 1kWh produces about 0.456 kg CO2(eq), 0.456 kg CO2/kWh x 34970 kWh/year = 15 946.32 kg CO2/year

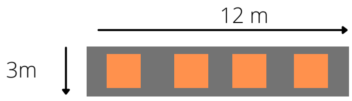
Prerequisites of installation:

- 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

❷ Simulation with a Feng Tech STE system:

- **Coverage Rate of the installation (Share of utilisation in %):** 50% (dimensioning for at least 50%)
- **Number of STE units to reach the energy needs:** 4 units
  cf. potential useful STE = 11 054 kWh/year
- **Overall front surface of capture:** 16 m2
  cf.1 FT = 4m2 ; 4m2/unit x 4 units = 16 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:**



- **Irradiance & Cold Water Measurements:**

Solar irradiance value (Calsol INES)	Roscommon	Albedo	0,8										
Unit (kWh / m² / day)	Jan.	Feb	Mar.	Apl.	May	Juin	Luly	Aug	Sep	Oct.	Nov.	Dec.	Year
Direct irradiance	0,45	1,03	1,63	2,60	3,18	1,18	1,34	1,34	1,15	0,97	0,49	0,34	1,31
Diffus irradiance	0,88	1,43	2,00	2,40	2,60	2,51	2,72	2,49	2,14	1,58	0,94	0,76	1,87
Cold water temperature (°C)	6,5	5,6	6,5	10,2	13	13,9	14,3	15,8	13,2	9,8	8,5	5	10

- **Solar energy contribution (Energy savings in kWh/year)**: 17 546 kWh/year
  - Yearly Basis: 5 FT STE units' full potential = **17 546 kWh/year** *(relating to a specific simulation case)*
    cf. it corresponds to 11 054 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
  - Daily energy consumption saving: 17 546 kWh/year / 365 days = **48.1 kWh/day**
- **Savings on energy consumption (in €)**: 3 685 € *EXCL. TAX/year*
  cf. Given that, with energy waste and to heat 900 L of water, the energy saving accounts for 17 546 kWh/year x 0.21 €/kWh = 3 684.66 €/year
- **Remaining share of the standard energy used (per year):** 3 659€*/year* (50% ; 17 424 kWh/year)
  - In %: solar thermal energy represents 50% here so, remaining share of **50%**
  - In kWh: 34 970 - 17 546 = **17 424 kWh/year**
  - In €: 17 424 kWh/year x 0.21 €/kWh = **3 659.04 €/year**
- **Remaining emission of CO2:** 7 945 *kg CO2 (CO2 reduction up to 8 001 kg CO2)*
  cf. 17 424 kwh/year x 0.456 kg CO2 = 7 945, 344 kg CO2

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Hyp = No AIDS

- **Previsionnal Cost (total - subsidies):** 25 000€

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

  - **Cost of the equipment & installation:** 20 000€

    <u>Notes:</u> 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 4 units x 5000€/unit = 20 000 €
  - **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 € <u>*in the event of approval by regulating authorities*</u>

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

- **Financial Package :** 3313 *€ / year for 10 years* (in average)

  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **25 000€**
  - Duration: **10 years** / Loan rate = **6.6%** (with yearly increase) / STE Durability = **+30 years**

  => 25 000€ / 10 years = 2500 €/year ; taking into account the loan payment: **3313 €/year** (in average)

- **Return on investment (global expense / annual savings):** 6 *years & 9 months*
  - Global expense = **25 000€**
  - Annual energy savings = **3 685 € per year** during 30 years so in total : **3 685** €/year x 30 years = **110 550 €**
  - ROI = 25 000 € / 3 685 € = **6.78 years**
  - ROIC = 3 685 € / 25 000 € = **14.74%**

- **Yearly Earnings (Annual savings and yearly loan payment):** 372 *€/year* (for 10 years, then 3 685 €/year)

  cf. good if savings > loan
  - Annual savings = **3 685 €**
  - Yearly loan payment = **3 313 €**
  - Difference = 3 685 - 3 313 = **372 €/year of earnings during the 10 year-loan period / after = 3 685 €/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	7344	7858	8408	8996	9626	10300	11021	11793	12618	13501	14446	15458	16540	17697	18936	20262	21680	23198	24822	26559
2	Loan repayment	3316	3316	3316	3316	3316	3316	3316	3316	3316	3316	0	0	0	0	0	0	0	0	0	0
3	Gas remaining to buy	3659	3915	4189	4483	4796	5132	5491	5876	6287	6727	7198	7702	8241	8818	9435	10096	10802	11558	12368	13233
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	6975	7231	7505	7798	8112	8648	9013	9403	9821	10268	7430	7941	8487	9071	9696	10364	11079	11844	12661	13536
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Enegy saving (1-5) €HT/Y	369	627	903	1198	1514	1652	2008	2389	2797	3233	7016	7517	8053	8626	9240	9897	10601	11354	12160	13023
7	Energy saving €HT/m	31	52	75	100	126	138	167	199	233	269	585	626	671	719	770	825	883	946	1013	1085

- **Network of (potential) installers**: EnerGlaze, Glenergy, Clean Energy Ireland, Alternative Energy Ireland, Comet Renewable Ireland, Home & Agri

- **Legislation for installation/Procedures and precautions:** since late 2022, planning permission on plants under 300mÂ² not necessary (an exemption certificate will be required), except in locations within 5Km of airports or helipads

RELEVANT REMARKS & COMMENTS

Hyp = 30% AIDS

- **Previsionnal Cost (total - subsidies):** 19 000€
  cf. cost of equipment & installation + site preparation - potential aids = previsional cost
  - **Cost of the equipment & installation:** 20 000€
    Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 4 units x 5000€/unit = 20000 €
  - **Cost of the site preparation:** 5 000€
    cf. *in average if not done personally by the holder*
  - **Aids and subsidies available:** *6 000 €*
    cf. average grant = 30% ; 0.3 x 20 000 = 6 000 € *in the event of approval by regulating authorities*
    OPTIONAL COST: *monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)*

- **Financial Package :** 2 520 € */ year for 10 years* (in average)
  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **19 000€**
  - Duration: **10 years** / Loan rate = **6.6%** (with yearly increase) / STE Durability = **+30 years**
    => 19 000€ / 10 years = 1 900 €/year ; taking into account the loan payment: **2 520 €/year** (in average)

- **Return on investment (global expense / annual savings):** 5 *years & 1,5 month*
  - Global expense = **19 000 €**
  - Annual energy savings = **3 685 € per year** during 30 years so in total : **3 685** €/year x 30 years = **110 550 €**
  - ROI = 19 000 € / 3 685 € = **5.16 years**
  - ROIC = 3 685 € / 19 000 € = **19.4 %**

- **Yearly Earnings (Annual savings and yearly loan payment):** 1 165 *€/year* (for 10 years, then 3685 €/year)
  cf. good if savings > loan
  - Annual savings = **3 685 €**
  - Yearly loan payment = **2 520 €**
  - Difference = 3 685 - 2 520 = **1 165 €/year of earnings during the 10 year-loan period / after = 3 685 €/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	7344	7858	8408	8996	9626	10300	11021	11793	12618	13501	14446	15458	16540	17697	18936	20262	21680	23198	24822	26559
2	Loan repayment	2520	2520	2520	2520	2520	2520	2520	2520	2520	2520	0	0	0	0	0	0	0	0	0	0
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5	Costs with STE	6179	6435	6709	7002	7316	7852	8217	8608	9025	9472	7430	7941	8487	9071	9696	10364	11079	11844	12661	13536
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Enegy saving (1-5) €HT/Y	1165	1423	1699	1994	2310	2448	2804	3185	3593	4029	7016	7517	8053	8626	9240	9897	10601	11354	12160	13023
7	Energy saving €HT/m	97	119	142	166	193	204	234	265	299	336	585	626	671	719	770	825	883	946	1013	1085

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