

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 pig farms.

The current real-life example focus on a holding set in Brittany (France). This farm currently owns a herd of 44 places for maternity & 264 places for post-weaning, for which it needs around 78 215 kWh of energy supply per year in order to heat the buildings where the pigs are hosted.

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

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

PART II: FIELD APPLICATION CASE

- ▶ *N°/Nickname:* French Pig Farm
- ▶ *Location (Country/Region):* Brittany
- ▶ *Type of holding: Maternity & Post-Weaning farms*
- ▶ *Date:* Octobre 2020

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

- **Size of the surface/number of animals:** 44 places for maternity / 264 places for post-weaning
- **Water Use (heating/direct use):** Heating during the maternity (M) & post-weaning (PW) stages
 - **Frequency:** 1 month at high temperature + 1 month of post-weaning
 - **Timeframe:** all the time
 - **Quantity:** 729kWh (M) for each sow + 67kWh (PW) for each piglet
- **Version of FT STE system (ETF 1 / ETF2):** ETF 2 (with pressure)
- **Temperature needed (in °):** 30° (average between Maternity & Post-Weaning)
- **Standard fossil energy used:** Fioul
- **Price of fossil energy per kWh:** 0.0956 €
- **Energy consumption for the activity (in kWh/year):** 78 215 kWh/year
*cf. with energy waste and differentiated needs depending on the period of the year, the energy need accounts for:
729kWh/place/year (M) x 44 places/month (sow) + 67kWh/place/year (PW) x 264 places/month (piglet) = 78 275 kWh/year*
- **Expenditure of energy consumption (in EXCL TAX€/year):** 7 477.354 €/year
cf. 0.0956 EXCL.TAX€/kWh x 78 215 kWh/year = 7 477.354 EXCL. TAX €/year
- **Available subsidies for STE:** fond chaleur (between 20 and 40% of investment)
- **Amount of CO2 emission:** 57 097 kg CO2/year
cf. given that 1kWh produces about 0.73 kg CO2(eq), 0.73 kg CO2/kWh x 78 215 kWh/year = 57 096.95 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 = V9 Brest Study Case / V11 Lilles Irradiance & Cold Water

2 Simulation with a Feng Tech STE system:

- **Coverage Rate of the installation (Share of utilisation in %):** 50% (GOAL = at least 50%)
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:** 10 units
cf. potential energy savings = 39 457 kWh/year
- **Overall front surface of capture:** 40 m²
cf. 1 FT = 4m² ; 4m²/unit x 10 units = 40 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:** 3x30=90m²
- **Irradiance & Cold Water Measurements:**



valeurs d'irradiation (Calsol INES)	Brest	Albedo		0,8									
Unité (kWh / m ² / jour)	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Année
Irradiation Direct	0,97	1,1	2,22	2,49	2,63	2,4	2,44	2,16	1,66	1,89	1,14	0,77	1,82
Irradiation Diffus	0,56	0,87	1,37	1,91	2,29	2,49	2,4	2,08	1,56	1,05	0,65	0,47	1,48
Température eau froide °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/year):** 39 457 kWh/year
 - Yearly Basis: 10 FT STE units' full potential = **39 457 kWh/year** (relating to a specific simulation case)
cf. it corresponds to 25 647 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
 - Daily energy consumption saving : 39 457 kWh/year / 365 days = **108 kWh/day**
- **Savings on energy consumption (in €):** 3 772,1 € EXCL. TAX/year
cf. Given that, with energy waste, the energy saving accounts for 39 457 kWh/year x 0.0956 €/kWh = 3 772.0892 €/year
- **Remaining share of the standard energy used (per year):** 3 705 €/year (50 % ; 38 758 kWh/year)
 - In %: solar thermal energy represents 50% here so, remaining share of **50%**
 - In kWh: 78 215 - 39 457 = **38 758 kWh/year**
 - In €: 38 758 kWh/year x 0.0956 €/kWh = **3 705.2648 €/year**
- **Remaining emission of CO2:** 28 293 kg CO₂ (CO₂ reduction up to 28 804 kg CO₂)
cf. 38 758 kwh/year x 0.73 kg CO₂ = 28 293.34 kg CO₂

Hyp = No AIDS

- Provisionnal Cost (total - subsidies): 55 000 €**

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

- Cost of the equipment & installation: 50 000€**

Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 10 units x 5000 €/unit = 50 000 €

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

cf. in average if not done personally by the holder

- Aids and subsidies available: 0 €**

cf. grant = 0% *in the event of approval by regulating authorities*

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

- Financial Package : 5 860 €/year for 10 years (in average)**

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

- Provisionnal cost = financial loan = **55 000 €**

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

=> **55 000 € / 10 years = 5 500 €/year** ; taking into account the loan payment : **5 860 €/year** (in average)

- Return on investment (global expense / annual savings): 14 years & 7 months**

- Global expense = **55 000 €**

- Annual energy savings = **3 772 € per year** during 30 years so in total : 3 772 €/year x 30 years = **113 160 €**

- ROI = 55 000 € / 3 772 € = **14.6 years**

- ROIC = 3 772 € / 55 000 € = **6.9 %**

- Yearly Earnings (Annual savings and yearly loan payment): 207 €/year (for 10 years, then 5919 €/year)**

cf. good if savings > loan

- Annual savings = **3 772 €**

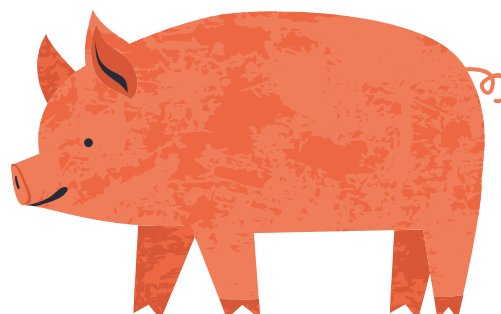
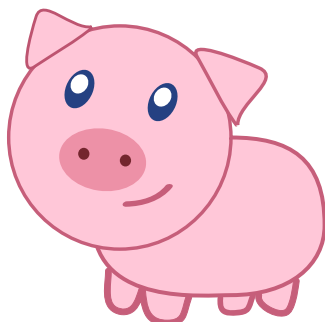
- Yearly loan payment = **5 860 €**

Difference = 3 772 - 5 860 = - 2 088 €/year of earnings during the 10 year-loan period / after = **3 772 €/year**

	Année	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Charge sans solaire	7477	8001	8561	9160	9801	10487	11222	12007	12848	13747	14709	15739	16841	18019	19281	20630	22074	23620	25273	27042
2	Remboursement emprunt	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	0	0	0	0	0	0	0	0	0	0
3	Gaz restant à acheter	3705	3965	4242	4539	4857	5197	5561	5950	6366	6812	7289	7799	8345	8929	9554	10223	10939	11705	12524	13400
4	Entretien du système	0	0	0	0	0	200	206	212	219	225	232	239	246	253	261	269	277	285	294	303
5	Charge avec solaire (2+3+4)	9565	9824	10102	10399	10717	11256	11626	12022	12445	12897	7521	8038	8591	9183	9815	10492	11216	11990	12818	13703
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Eco d'énergie (1-5) €HT/an	-2088	-1823	-1541	-1239	-915	-769	-405	-15	403	850	7188	7701	8249	8837	9465	10138	10859	11630	12456	13339
7	Eco d'énergie €HT /mois	-174	-152	-128	-103	-76	-64	-34	-1	34	71	599	642	687	736	789	845	905	969	1038	1112

- 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



WITH AIDS

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

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

- Cost of the equipment & installation: 50 000€**

Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 10 units x 5000 €/unit = 50 000 €

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

cf. in average if not done personally by the holder

- Aids and subsidies available: 15 000 €**

cf. average grant = 30% ; 50 000 x 0.30 = 15 000 € *in the event of approval by regulating authorities*

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

- Financial Package : 4 260 €/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: **4 260 €/year** (in average)

- Return on investment (global expense / annual savings): 10 years & 7 months**

- Global expense = **40 000 €**

- Annual energy savings = **3 772 € per year** during 30 years so in total : 5919 €/year x 30 years = **113 160 €**

- ROI = 40 000 € / 3 772 € = **10.6 years**

- ROIC = 3 772 € / 40 000 € = **9.4 %**

- Yearly Earnings (Annual savings and yearly loan payment): 681.4 €/year (for 10 years, then 2338.42 €/year)**

cf. good if savings > loan

- Annual savings = **3 772 €**

- Yearly loan payment = **4 260 €**

Difference = 3 772 - 4 260 = **- 488 €/year of earnings during the 10 year-loan period / after = 3 772 €/year**

	Année	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Charge sans solaire	7477	8001	8561	9160	9801	10487	11222	12007	12848	13747	14709	15739	16841	18019	19281	20630	22074	23620	25273	27042
2	Remboursement emprunt	4261	4261	4261	4261	4261	4261	4261	4261	4261	4261	0	0	0	0	0	0	0	0	0	0
3	Gaz restant à acheter	3705	3965	4242	4539	4857	5197	5561	5950	6366	6812	7289	7799	8345	8929	9554	10223	10939	11705	12524	13400
4	Entretien du système	0	0	0	0	0	200	206	212	219	225	232	239	246	253	261	269	277	285	294	303
5	Charge avec solaire (2+3+4)	7967	8226	8504	8801	9118	9658	10028	10424	10847	11299	7521	8038	8591	9183	9815	10492	11216	11990	12818	13703
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Eco d'énergie (1-5) €HT/an	-489	-225	57	359	683	829	1193	1583	2001	2448	7188	7701	8249	8837	9465	10138	10859	11630	12456	13339
7	Eco d'énergie €HT /mois	-41	-19	5	30	57	69	99	132	167	204	599	642	687	736	789	845	905	969	1038	1112

- 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

RELEVANT REMARKS & COMMENTS

NB 1: what about simulating another model where only the service of energy is sold, not the device?

NB 2: is Liquin a subcontractor of the installers or reverse?

NB 3: for each set of case study (academic + field application), making a review of conclusions (approximately 1p)