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 Pig Farm.
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 190 sows giving birth to 4370 piglets/year for which it needs around 30 156 kWh of energy supply per year in order to heat the maternity and post-weaning buildings. After enumerating the main characteristics of this typical and fictional pig 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:* French Pig Farm
- *Location (Country/Region):* Pays de la Loire
- *Type of holding: Maternity farms*
- *Date: 14/10/2021*

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

- **Size of the surface/number of animals:** 190 sows for 4370 piglets (in average per year; 23 babies/1 sow) cf. 276 places/month with the assumption that 4370 piglets / 12 months
- **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 °):** 35° (M) / 24° (PW)
- **Standard fossil energy used:** Electric Boiler
- **Price of fossil energy per kWh:** 0.16 €
- **Energy consumption for the activity (in kWh/year):** 30 156 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 16 places/month (sow) + 67kWh/place/year (PW) x 276 places/month (piglet) = 30 156 kWh/year
- **Expenditure of energy consumption (in EXCL TAX€/year):** 4 825 €/year
  cf. 0.16 EXCL.TAX/€/kWh x 30 156 kWh/year = 4 824.96 EXCL. TAX €/year
- **Available subsidies for STE:** fond chaleur (between 20 and 40% of investment) / average = 35%
- **Amount of CO2 emission:** 3016 kg *CO2/year*
  cf. given that 1kWh produces about 0.1 kg CO2(eq), 0.1 kg CO2/kWh x 30 156 kWh/year = 3016 kg CO2/year

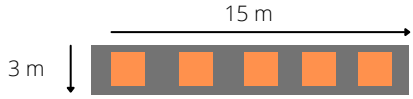
Prerequisites of installation:

- 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 %):** 55% (GOAL = at least 50%)
- **Number of STE units to reach the energy needs:** 5 units
  cf. potential energy savings = 16 703 kWh/year
- **Overall front surface of capture:** 20 m2
  cf.1 FT = 4m2 ; 4m2/unit x 5 units = 20 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:** 3x15 = 30m2



- **Irradiance & Cold Water Measurements:**

valeurs d'irradiation (Calsol INES)	Brest 45°	Albedo	0,8										
Unité (kWh / m² / 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)**: 16 703 kWh/year
  - Yearly Basis: 5 FT STE units' full potential = **16 703 kWh/year** *(relating to a specific simulation case)*
    cf. it corresponds to 10 857 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
  - Daily energy consumption saving: 16 703 kWh/year / 365 days = **45.76 kWh/day**
- **Savings on energy consumption (in €)**: 2 672.48*€ EXCL. TAX/year*
  cf. Given that, with energy waste, the energy saving accounts for 16 703 kWh/year x 0.16 €/kWh = 2 672.48 €/year
- **Remaining share of the standard energy used (per year):** 2 152.48 *€/year* (45 % ; 13 453 kWh/year)
  - In %: solar thermal energy represents 55% here so, remaining share of **45%**
  - In kWh: 30 156 - 16 703 = **13 453 kWh/year**
  - In €: 13 453 kWh/year x 0.16 €/kWh = **2 152.48 €/year**
- **Remaining emission of CO2:** 1345 *kg CO2 (CO2 reduction up to 1671 kg CO2)*
  cf. 13 453 kwh/year x 0.1 kg CO2 = 1345 kg CO2

CASE STUDY

I4F-WP1-Task 3

Hyp = No AIDS

- **Previsionnal Cost (total - subsidies):** 30 000 €
  cf. cost of equipment & installation + site preparation - potential aids = previsional cost
  - **Cost of the equipment & installation:** 25 000€
    Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 5 units x 5000€/unit = 25 000 €
  - **Cost of the site preparation:** 5000€
    cf. *in average if not done personally by the holder*
  - **Aids and subsidies available:** *0 €*
    cf. grant = 0% %
    OPTIONAL COST: *monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)*

- **Financial Package :** 3 196 *€/year for 10 years* (in average)
  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **30 000 €**
  - Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**
    => 30 000 € / 10 years = 3 000 €/year ; taking into account the loan payment: **3 196 €/year** (in average)

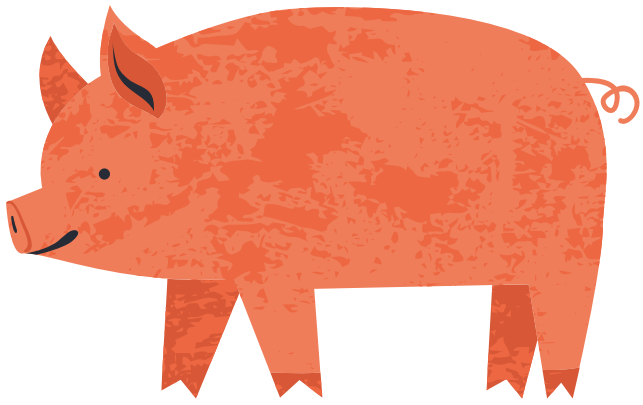
- **Return on investment (global expense / annual savings):** 11 *years & 2 months*
  - Global expense = **30 000 €**
  - Annual energy savings = **2 672.48 € per year** during 30 years so in total : 2 672.48 €/year x 30 years = **80 174.4 €**
  - ROI = 30 000 € / 2 672.48 € = **11,23 years**
  - ROIC = 2 672.48 € / 30 000 € = **9%**

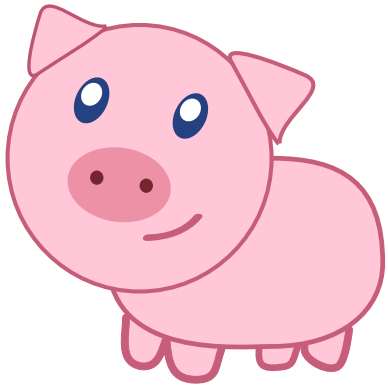
- **Yearly Earnings (Annual savings and yearly loan payment):** -523.52*€/year* (for 10 years, then 2672.48 €/year)
  cf. good if savings > loan
  - Annual savings = **2 672.48 €**
  - Yearly loan payment = **3 196 €**
  - Difference = 2 672.48 - 3 196 = **- 523.52 €/year of earnings during the 10 year-loan period / after = 2 672.48 €/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	4825	5163	5524	5911	6325	6767	7241	7748	8290	8870	9491	10156	10867	11627	12441	13312	14244	15241	16308	17450
2	Remboursement emprunt	3196	3196	3196	3196	3196	3196	3196	3196	3196	3196	0	0	0	0	0	0	0	0	0	0
3	Gaz restant à acheter	2153	2303	2464	2637	2822	3019	3230	3456	3698	3957	4234	4531	4848	5187	5550	5939	6355	6799	7275	7785
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)	5349	5499	5661	5833	6018	6415	6632	6865	7113	7379	4466	4770	5094	5441	5811	6208	6631	7085	7569	8087
		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	-524	-337	-136	78	307	352	608	883	1177	1492	5025	5386	5773	6187	6630	7105	7613	8157	8739	9362
7	Eco d'énergie €HT /mois	-44	-28	-11	6	26	29	51	74	98	124	419	449	481	516	552	592	634	680	728	780

- **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):** 21 000 €
  - **Cost of the equipment & installation:** 25 000€
    Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 5 units x 5000 €/unit = 25 000 €
  - **Cost of the site preparation:** 5 000€
    cf. *in average if not done personally by the holder*
  - **Aids and subsidies available:** *9 000 €*
    cf. average grant = 30% % ; 30 000 x 0.30 = 9 000 € *in the event of approval by regulating authorities*
    OPTIONAL COST: *monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)*

- **Financial Package : 2 237***€/year for 10 years* (in average)
  cf. Total - subsidies ; cash + financial loan (= duration + annuity)
  - Previsionnal cost = financial loan = **21 000€**
  - Duration: **10 years** / Loan rate = **1.27%** (with yearly increase) / STE Durability = **+30 years**
    => 21 000 € / 10 years = 2 100 €/year ; taking into account the loan payment: **2 237 €/year** (in average)

- **Return on investment (global expense / annual savings):** 7 *years & 10 Months*
  - Global expense = **21 000€**
  - Annual energy savings = **2 672.48 € per year** during 30 years so in total : **2 672.48** €/year x 30 years = **80 174.4 €**
  - ROI = 21 000 € / 2 672.48 € = **7.85 years**
  - ROIC = 2 672.48 € / 21 000 € = **12.7%**

- **Yearly Earnings (Annual savings and yearly loan payment):** 435.48 *€/year* for 10 years, then 2 672.48 €/year)
  cf. good if savings > loan
  - Annual savings = **2 672.48 €**
  - Yearly loan payment = **2 237 €**
  - Difference = 2 672.48 - 2 237 = **435.48 €/year of earnings during the 10 year-loan period / after = 2 672.48 €/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	4825	5163	5524	5911	6325	6767	7241	7748	8290	8870	9491	10156	10867	11627	12441	13312	14244	15241	16308	17450
2	Remboursement emprunt	2237	2237	2237	2237	2237	2237	2237	2237	2237	2237	0	0	0	0	0	0	0	0	0	0
3	Gaz restant à acheter	2153	2303	2464	2637	2822	3019	3230	3456	3698	3957	4234	4531	4848	5187	5550	5939	6355	6799	7275	7785
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)	4390	4540	4702	4874	5059	5456	5674	5906	6154	6420	4466	4770	5094	5441	5811	6208	6631	7085	7569	8087
		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	435	622	822	1037	1266	1311	1567	1842	2136	2451	5025	5386	5773	6187	6630	7105	7613	8157	8739	9362
7	Eco d'énergie €HT /mois	36	52	69	86	105	109	131	153	178	204	419	449	481	516	552	592	634	680	728	780

- **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

RELEVANT REMARKS & COMMENTS