### North-West Europe ICARE4FARMS

## CASE STUDY



I4F-WP1-Task 3

### Context/Intro:

!!!!invent for academic/anonymise for field application case!!!!!

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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 Calf Farms.

The current academic example focus on a holding set in Flanders. The assumptions are that it owns a herd of 600 calves for which it needs 246 461 kWh of energy supply per year in order to prepare the food for the calves.

After enumerating the main characteristics of this typical and fictional calf 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: Flemish Calf Farm
- Location (Country/Region): Flanders, Belgium
- Type of holding: Calf farm
- Date: 26/10/2021

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

- Size of the surface/number of animals: 900 calves
- Water Use (heating/direct use): preparation of the food
  - Frequency: twice a day
  - Timeframe: morning + evening
  - Quantity: 6000 liters/day
- Version of FT STE system (ETF 1 / ETF2) ETF 2 (with pressure)
- Temperature needed (in °): 80°C
- Standard fossil energy used: Propane
- Price of fossil energy per kWh: 0.08 euro/kWh
- Energy consumption for the activity (in kWh/year): 246 461 kWh/year cf. with energy waste and differentiated needs depending on the period of the year, the energy need accounts for 246 461 kWh/year
- Expenditure of energy consumption (in EXCL TAX€/year): 19 717 € cf. 0.08 EXCL.TAX/€/kWh x 246 461 kWh/year = 19 716.88 EXCL. TAX €/year
- Available subsidies for STE: only for STE systems that have been approved/certificated in Flanders no subsidy then for FT
- Amount of CO2 emission: 67 777 CO2/year cf. given that 1kWh produces about 0.275 kg CO2(eq), 0.275 kg CO2/kWh x 246 461 kWh/year = 67 776.775 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 = V10 Lille Study Case

#### 2 <u>Simulation with a Feng Tech STE system:</u>

- Coverage Rate of the installation (Share of utilisation in %): 51% (GOAL = at least 50%)
- Number of STE units to reach the energy needs: 25 units cf. potential useful solar thermal energy = 78 839 kWh/year
- Overall front surface of capture: 100 m2 cf.1 FT = 4m2; 4m2/unit x 25 units = 100 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: 5x39 = 195m2
- Irradiance & Cold Water Measurements:

Solar irradiance value (Calsol INES)	GEEL	Albedo	0,8										
Unit (kWh / m² / day)	Jan.	Feb	Mar.	Apl.	May	Juin	Luly	Aug	Sep	Oct.	Nov.	Dec.	Year
Direct irradiance	0,41	0,62	2,56	4,31	4,16	2,68	2,31	2,4	2,69	0,44	0,97	0,31	1,99
Diffus irradiance	0,95	1,39	1,85	2,12	2,24	2,58	2,61	2,5	2,11	1,46	1,24	0,83	1,82
Cold water temperature (°C)	6,2			12,4	14,6	17,8			16,5	11,9			12

• Solar energy contribution (Energy Savings in kWh/year): 125 142 kWh

• Yearly Basis: 24 FT STE units' full potential = **125 142 kWh/year** (relating to a specific simulation case) **cf.** it corresponds to 78 839 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)

• Daily energy consuption saving: 125 142 kWh/year / 365 days = **342.9 kWh/day** 

- Savings on energy consumption (in €): 10 011 € EXCL. TAX/year cf. the energy saving accounts for 125 142 kWh/year x 0.08 €/kWh = 10 011.36 €/year
- Remaining share of the standard energy used (per year): 9 705.52 €/year (49 % ; 121 319 kWh/year)
  - $\,\circ\,$  In %: solar thermal energy represents 51% here so, remaining share of 49%
  - In kWh: 246 461 125 142 = **121 319 kWh/year**
  - In €: 121 319 kWh/year x 0.08 €/kWh = **9 705.52 €/year**
- Remaining emission of CO2: 33 363 kg CO2 (CO2 reduction up to 34 414 kg CO2) cf. 121 319 kwh/year x 0.275 kg CO2 = 33 362.725 kg CO2

Costs with STE

6 Enegy saving (1-5) €HT/Y 7 Energy saving €HT/m

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Hyp = No AIDS	
• Previsionnal Cost (total - subsidies): 130 000 €	
<b>cf.</b> cost of equipment & installation + site preparation - potential aids = previsional cost	
<ul> <li>Cost of the equipment &amp; installation: 125 000 € Notes: 3829€ for one stainless steel unit + installation expenses = 5000€/unit / 25 units x 5000€/unit = 125 000 €</li> <li>Cost of the site preparation: 5000€ cf. in average if not done personally by the holder</li> <li>Aids and subsidies available: 0 € cf. average grant = XXX % ; X1 × X2 = XXX € in the event of approval by regulating authorities oPTIONAL COST: monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)</li> <li>Financial Package : 14 354 €/year for 10 years (in average) cf. Total - subsidies ; cash + financial loan (= duration + annuity) o Previsionnal cost = financial loan = 130 000 €</li> </ul>	
<ul> <li>Duration: 10 years / Loan rate = 2% (with yearly increase) / STE Durability = +30 years =&gt; 130 000 € / 10 years = 13 000 €/year ; taking into account the loan payment: 14 354 €/year (in average)</li> <li>Return on investment (global expense / annual savings): 13 years</li> </ul>	
<ul> <li>Global expense = 130 000 €</li> </ul>	
o Annual energy savings = 10 011 € per year during 30 years so in total : 10 011 €/year x 30 years = 300 330 €	
<ul> <li>ROI = 130 000 € / 10 011 € = 13 years</li> </ul>	
o ROIC = 10 011 € / 130 000 € = 7.7 %	
<ul> <li>Yearly Earnings (Annual savings and yearly loan payment): -4 343 €/year (10 years, then 10 011 €/ye cf. good if savings &gt; loan</li> <li>Annual savings = 10 011 €</li> <li>Yearly loan payment = 14 354 €</li> <li>Difference = 10 011 - 14 354 = -4 343 €/year of earnings during the 10 year-loan period / after = 10 011 €/year</li> </ul>	ar)
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 19717 21097 22574 24154 25845 27654 29590 31661 33877 36249 38786 41501 44406 47515 50841 54399 58207 62282 666	42 71307
2 Loan repayment 14354 14354 14354 14354 14354 14354 14354 14354 14354 14354 0 0 0 0 0 0 0 0 0 0	0 0
3         Gas remaining to buy         9706         10385         11112         11890         12722         13613         14565         15585         16676         17843         19092         20429         21859         23389         25026         26778         28652         30658         328           4         System maintenance         0         0         0         0         200         206         212         219         225         232         239         246         253         261         260         2777         285         2	M 35100

- Network of installers: Rexel, Cebeo, Remeha, Buderus, Vaillant, Viessmann, Desco, STG, Vanoirschot, ESTG, Van Marcke Pro, Aosmith International, Leenaerts Agrotechniek, Verbeke Machines, Schippers, ATTB, Belsolar, the Belgian federation of STE systems suppliers (https://www.infozonneboiler.be/nl/)
- Legislation for installation/Procedures and precautions: In Flanders, installation on a flat roof is exempt from permit if the installation is no higher than 1m above the roof edge. On a sloping roof, the installation of solar panels is exempt if they are integrated into the sloping roof surface: on the roof covering or replacing it. The installation must not conflict with the requirements of a special plan of action (BPA), municipal spatial implementation plan (RUP) or subdivision permit.





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Hyp = 30% AIDS
• Previsionnal Cost (total - subsidies): 92 500 €
<b>cf.</b> cost of equipment & installation + site preparation - potential aids = previsional cost
<ul> <li>Cost of the equipment &amp; installation: 125 000 €</li> </ul>
Notes: 3829€ for one stainless steel unit & 3480€ for one basic unit + installation expenses = 5000€/unit / 28 units x 5000€/unit = 112 000 €
<ul> <li>Cost of the site preparation: 5000€</li> </ul>
<b>cf.</b> in average if not done personally by the holder
<ul> <li>Aids and subsidies available: 37 500 €</li> </ul>
cf. average grant = 30%; 0.3 x &125 000 = 37 500 € in the event of approval by regulating authorities OPTIONAL COST: monitoring = 1200€ (equipment) + 1200€ (installation)+ 38 €/year (RESOL subscription)
<ul> <li>Financial Package : 10 213 €/year for 10 years (in average)</li> </ul>
<b>cf.</b> Total - subsidies ; cash + financial loan (= duration + annuity)
<ul> <li>Previsionnal cost = financial loan = 92 500 €</li> </ul>
• Duration: <b>10 years</b> / Loan rate = <b>2%</b> (with yearly increase) / STE Durability = <b>+30 years</b>
=> 92 500 € / 10 years = 9 250 €/year ; taking into account the loan payment: 10 213 €/year (in average)
<ul> <li>Global expense = 92 500 €</li> <li>Annual energy savings = 10 011 € per year during 30 years so in total : 10 011 €/year x 30 years = 300 330 €</li> <li>ROI = 92 500 € / 10 011 € = 9.2 years</li> <li>ROIC = 10 011 € / 92 500 € = 10.8%</li> <li>Yearly Earnings (Annual savings and yearly loan payment): -202 €/year (10 years, then 10 011 €/year) cf. good if savings &gt; loan</li> <li>Annual savings = 10 011 €</li> <li>Yearly loan payment = 10 213 €</li> <li>Difference = 10 011 - 10 213 = -202 €/year of earnings during the 10 year-loan period / after = 10 011 €/year</li> </ul>
Year         1         2         3         4         5         6         7         8         9         10         11         12         13         14         15         16         17         18         19
1 Costs without STE 19717 21097 22574 24154 25845 27654 29590 31661 33877 36249 38786 41501 44406 47515 50841 54399 58207 62282 66642 71
2         Loan repayment         10213         10213         10213         10213         10213         10213         10213         10213         0<
4 System maintenance 0 0 0 0 0 0 0 200 206 212 219 225 232 239 246 253 261 269 277 285 294
5 Costs with STE 19919 20598 21325 22103 22935 24026 24985 26011 27108 28282 19324 20668 22105 23642 25287 27047 28929 30943 33098 33
6 Energy saving [1-5] CHT/V -202 499 1249 2051 2909 3628 4605 5650 6769 7967 19462 20834 22302 23872 25554 27353 29278 31339 33544 35
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### RELEVANT REMARKS & COMMENTS