### North-West Europe ICARE4FARMS

# 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 milk-fed calves breeding.

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 185 calves (1.8 batches/year) for which it needs around 48 469 kWh of energy supply per year in order to feed them.

After enumerating the main characteristics of this typical and fictional calves 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 Calves farms
- Location (Country/Region): France / Pays de la Loire

*Type of holding:* Milk-Fed Calves Breeding

• Date: 22th July 2021

1 <u>Initial characteristics of the installation:</u> (Use Market Analysis + Technology Assessment)

- Number of cows: 370 calves/year (2 lots of 185 places per year)
- Water Use (heating/direct consumption): Feeding of Calves with heated milk
  - Frequency: 2 times a day
  - Timeframe: morning and evening
  - Quantity: 1300 L/day
- Version of FT STE system: ETF1 (version without pressure)
- Temperature needed (in °): 80°C
- Standard fossil energy used: Propane
- Price per kWh: 0.12 EXCL. TAX/€/kWh
- Energy consumption for the activity (in kWh): 48 469 *kWh/year* cf.with energy waste, the energy need accounts for 370 calfs x 131 kWh/calf = 48 469 kWh/year
- Expenditure of energy consumption (in €/kWh): 5 816 € EXCL. TAX/year cf. 0.12 EXCL.TAX/€/kWh x 48 469 kWh/year = 5 816.4 EXCL. TAX €/year
- Available subsidies for STE: between 20 and 40% of the equipment cost (Fonds Chaleur)
- Amount of CO2 emission: 13 184 kg CO2/year cf. given that 1kWh with propane produces about 0.272 kg CO2(eq), 0.272 kg CO2/kWh x 48 469 kWh/year = 13 183, 568 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 Lille Study Case

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

- Coverage Rate of the installation (Share of utilisation in %): 56% (GOAL = at least 50%)
- Number of STE units to reach the energy needs: 7 units cf. potential energy savings = 27 088 kWh/year
- Overall front surface of capture: 28 m2 cf.1 FT = 4m2; 4m2/unit x 7 units = 28 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: 3x21 = 63m2cf. Length of concrete slab = size of panels (2x2,5m) + space between panels (0.5m x t panels) / Width = 3 m

• Irradiance & Cold Water Measurements:

Lille 45°	Albedo	0,8										
January	February	March	April	May	June	July	August	September	October	November	Décember	Year
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
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
6,2	6,5	8,1	9,5	11	13	14	14	13	10	8,1	6,7	10
	January 0,57	January         February           0,57         0,96           0,45         0,79	January         February         March           0,57         0,96         1,61           0,45         0,79         1,29	January         February         March         April           0,57         0,96         1,61         2,11           0,45         0,79         1,29         1,87	January         February         March         April         May           0,57         0,96         1,61         2,11         2,21           0,45         0,79         1,29         1,87         2,29	January         February         March         April         May         June           0,57         0,96         1,61         2,11         2,21         2,36           0,45         0,79         1,29         1,87         2,29         2,49	January         February         March         April         May         June         July           0,57         0,96         1,61         2,11         2,21         2,36         2,13           0,45         0,79         1,29         1,87         2,29         2,49         2,44	January         February         March         April         May         June         July         August           0,57         0,96         1,61         2,11         2,21         2,36         2,13         2,11           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05	January         February         March         April         May         June         July         August         September           0,57         0,96         1,61         2,11         2,21         2,36         2,13         2,11         2,05           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05         1,53	January         February         March         April         May         June         July         August         September         October           0,57         0,96         1,61         2,11         2,22         2,36         2,13         2,11         2,05         1,43           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05         1,53         0,97           1         <	January         February         March         April         May         June         July         August         September         October         November           0,57         0,96         1,61         2,11         2,22         2,36         2,13         2,11         2,05         1,43         0,72           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05         1,53         0,97         0,54           0,45         0,79         1,29         1,87         2,99         2,49         2,40         2,05         1,53         0,97         0,54	January         February         March         April         May         June         July         August         September         October         November         Décember           0,57         0,96         1,61         2,11         2,22         2,36         2,13         2,11         2,05         1,43         0,72         0,45           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05         1,53         0,97         0,54         0,36           0,45         0,79         1,29         1,87         2,29         2,49         2,4         2,05         1,53         0,97         0,54         0,36

3m

21 m

#### • Solar energy contribution (in kWh): 27 088 kWh/year

Yearly Basis: 7 FT STE units' full potential = 27 088 kWh/year (relating to a specific simulation case) cf. it corresponds to 17 065 kWh/year useful solar energy (depends on distance, insulation etc. / simulation from an average case)
 Daily energy consumption saving: 27 088 kWh/year / 365 days = 74.2 kWh/day

• Savings on energy consumption (in €): 3 250.56 € EXCL. TAX/year

cf. Given that, with energy waste, the energy saving accounts for 27 088 kWh/year x 0.12 €/kWh = 3 250.56 €/year

- Remaining share of the standard energy used (per year): 2 566 €/year (44%; 21 381 kWh/year)
  - $\circ$  In %: solar thermal energy represents 56% here so, remaining share of 44%
  - In kWh: 48 469 27 088 = **21 381 kWh/year**
  - ∘ In €: 21 381 kWh/year x 0.12 €/kWh = 2 565.72 €/year
- Remaining emission of CO2: 5816 kg CO2 (CO2 reduction up to 7 368 kg CO2) cf. 21 381 kwh/year x 0.272 kg CO2 = 5815.632 kg CO2/year

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•	Financial Pa	ckag	<b>e</b> :4	261	€/ve	ar foi	r 10	vears	s (in a	avera	ige)										
	cf. Total - subsidies										0,										
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	=> 40 000 € /	10 ye	ars =	4 000	€/yea	ar;ta	king i	nto a	ccoun	t the l	oan pa	ayment	: 4 261	€/yea	<b>r</b> (in a	verage	per yea	r for 10	) years	)	
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•	<ul> <li>ROI = 40 000 €</li> <li>ROIC = 3 250.5</li> <li>Yearly Earnings</li> <li>Annual savings</li> <li>Yearly loan page</li> </ul>	y savir € / 3 2 56 € / n <b>gs (</b> > loan gs = <b>3</b> 2 aymen	ngs = 3 50.56 40000 <b>Ann</b> 250.56 t = 4 2	3 250. € = 12 ) € = 8 ual s 5 € 261 €	2.3 ye 3.13 % avir	ars ngs a	nd y	/ear	ly loa	an pa	ayme	ent): -	1010	€/ye	ar (fi	rst yea	ar)				
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- MAES Ets / Lacta Services / 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





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Previsionna cf. cost of equipr		-	al - si	ubsidi	es). 2		~ ~											
cf. cost of equipr	nent & in				C3). 2	29 50	0€											
		stallatio	on + site	prepara	tion - p	otentia	al aids =	= previsi	ional co	ost								
• Cost of	he ea	uinm	nent 8	linst:	allati	on. :	35000	€										
<u>Notes:</u> 3829	-	-							unit	/ 7 u	nits x 50	00€/ur	nit = 35	5000€				
• Cost of																		
<b>cf.</b> in averag																		
<ul> <li>Aids and</li> </ul>	l subs	idies	avail	able:	10 50	0€												
<b>cf.</b> grant = 3 <u>OPTIONAL</u>																		
Financial Pa	-		-	-	-		(in av	verag	e)									
<ul><li>cf. Total - subsidie</li><li>Previsionnal</li></ul>				-		inuity)												
• Duration: 10				n rate =		(with	yearly	/ increa	ase)	1	STE Du	ırabili	ty = +:	30 yeai	rs			
=> 29 500 €	-															ar for 1	0 years	5)
					nonci	e / ai	nnua	il savi	ingsi	1: 9 VA	ears &	1 m	onth					
Return on i	nvesti	ment	: (glot	bai exp	helise				0-,	<b>,</b> , , , , ,								
<ul> <li>Global expension</li> </ul>	nse = <b>29</b>	500€		-					•									
<ul><li>Global expension</li><li>Annual energy</li></ul>	nse = <b>29</b> gy savin	<b>500 €</b> gs = <b>3</b>	250.56	€ per y					•		0.56 €/ງ			ars = <b>9</b>	7 516.8	€		
<ul> <li>Global expension</li> <li>Annual ener</li> <li>ROI = 29 500</li> </ul>	nse = <b>29</b> gy savin € / 3 25	<b>500 €</b> gs = <b>3</b> 50.56 €	250.56 : = 9,07	€ per y years					•		0.56 €/ງ			ears = <b>9</b>	7 516.8	€		
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<ul> <li>Global experi-</li> <li>Annual ener</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li>ROIC = 29 500</li> <li><b>Yearly Earn</b></li> <li><b>cf.</b> good if saving</li> <li>Annual saving</li> <li>Yearly loan p</li> </ul>	nse = 29 gy savin € / 3 25 0 € / 3 25 ings ( $I$ s > loan gs = 3 2 bayment	500 € gs = 3 50.56 € 250.56 Annu 50.56€ : = 3 14	250.56 := 9,07 € = 119 al sav £ 40 €	€ per y years % vings a	ear du and y	uring 3 <b>/earl</b>	80 yea I <b>y loa</b>	rs so in In pay	ymei	: 3 250 nt): 1	10.56	year x 5 €/ye	30 уе 2 <i>ar</i> (f	irst ye	ear)		3250.56	5€/ve
<ul> <li>Global experi-</li> <li>Annual ener</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li><b>Yearly Earn</b></li> <li><b>cf.</b> good if saving</li> <li>Annual savir</li> </ul>	se = 29 gy savin € / 3 25 0 € / 3 2 ings ( <i>i</i> s > loan gs = 3 2 bayment 3250.56	500 € gs = 3 50.56 € 250.56 Annu 50.56€ : = 3 14	250.56 := 9,07 € = 119 al sav £ 40 €	€ per y years % vings a	ear du	uring 3 <b>/earl</b>	80 yea I <b>y loa</b>	rs so in In pay	ymei	: 3 250 nt): 1	10.56	year x 5 <i>€/y€</i> e 10 y	30 ye 2 <i>ar</i> (f	irst ye	ear)		3250.56 18	5 €/ye
<ul> <li>Global experi- Annual ener</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li>ROIC = 29 500</li> <li>Yearly Earn of. good if saving</li> <li>Annual saving</li> <li>Yearly loan p</li> <li>Difference =</li> </ul>	se = 29 gy savin € / 3 25 0 € / 3 2 ings ( <i>i</i> s > loan gs = 3 2 bayment 3250.56 r 1	<b>500 €</b> gs = <b>3</b> 50.56 € 250.56 <b>Annu</b> 50.56€ 5 - 314 2	250.56 Ξ = 9,07 € = 119 al sav al sav δ 10 € 0 = 110 3	€ per y years % vings a .56 €/ye	ear du	uring 3 /earl	30 yean y loa ngs du	rs so in In pay	ymei the fir	: 3 250 nt): 1	10.56 r of th	year x 5 <i>€/y€</i> e 10 y	. 30 ye ear (f year-li	irst ye oan pe	ear) riod / a	fter = 3	18	-
<ul> <li>Global experies</li> <li>Annual enere</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li>ROIC = 29 500</li> <li>Yearly Earn</li> <li>Good if saving</li> <li>Annual savir</li> <li>Yearly loan p</li> <li>Difference =</li> </ul>	se = 29 gy savin € / 3 25 0 € / 3 25 ings (A s > loan gs = 3 2 bayment 3250.56 r 1 \$5816	<b>500 €</b> gs = <b>3</b> 50.56 € 250.56 <b>Annu</b> <b>50.56</b> <b>50.56</b> <b>50.56</b> <b>50.56</b> <b>4</b> <b>50.56</b> <b>6</b> <b>314</b> <b>2</b> <b>6</b> <b>223</b>	250.56 Ξ = 9,07 € = 119 al sav Ξ 40 € 0 = 110 3 6659 71	€ per y years % vings a .56 €/ye	ear du	vearl earni	30 year y loa ngs du	rs so in In pay uring t	ymei the fir	: 3 250 nt): 1	10.56 r of th	year x 5 €/ye e 10 y 13	. 30 ye ear (f year-li	irst ye oan pe	ear) riod / a	fter = 3	18	19
<ul> <li>Global experies</li> <li>Annual enere</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li>Yearly Earn</li> <li>Good if saving</li> <li>Annual saving</li> <li>Annual saving</li> <li>Difference =</li> <li>Yearly loan p</li> <li>Difference saving</li> <li>Costs without ST</li> <li>Loan repayment</li> <li>Gas remaining to but</li> </ul>	se = <b>29</b> gy savin € / 3 25 0 € / 3 25 <b>ings</b> ( <i>I</i> s > loan gs = <b>3 2</b> ayment 3250.56 r 1 E 5816 t 3143 y 2566	500 € gs = 3 50.56 € 250.56 Annu 50.56 = 3 14 5 - 314 2 6223 3143 2745	250.56 = 9,07 € = 119 al sav E 0 = 110 3 6659 71 3143 31 2938 31	€ per y years % vings a .56 €/yu 4 5 .25 7624 .43 3143 .43 3363	ear of 8158 3143 3599	earni 7 8729 3143 3851	30 year y loa ngs du 9340 3143 4120	rs so in In pay uring t 9 9994 1 3143 4409	total ymei 10 10693 3143 4717	: 3 250 nt): 1 rst yea 11 11442 0 5047	10.56 r of th 12 12243 0 5401	year x 5 €/y€ e 10 y 13 13100 0 5779	30 ye ear (f 14 14016 0 6183	irst ye oan pe 15 14998 0 6616	ear) riod / a 16 16047 0 7079	fter = 3	18 18373 0 8105	19 19659 0 8672
<ul> <li>Global experies</li> <li>Annual enere</li> <li>ROI = 29 500</li> <li>ROIC = 29 500</li> <li>Yearly Earn</li> <li>cf. good if saving</li> <li>Annual savir</li> <li>Yearly loan p</li> <li>Difference =</li> <li>Yearly Costs without ST</li> <li>Loan repayment</li> </ul>	se = <b>29</b> gy savin € / 3 25 0 € / 3 25 <b>ings</b> ( <i>I</i> s > loan gs = <b>3 2</b> ayment 3250.56 r 1 E 5816 t 3143 y 2566	500 € gs = 3 50.56 € 250.56 Annu 50.56 5 - 314 2 5 - 314 2 5 - 314 2 5 - 314	250.56 = 9,07 € = 119 al sav £ 40 € 0 = 110 3 3 3 3 3 3 3 3 3 3 3 3 3	€ per y years % vings a .56 €/ye 4 5 125 7624 143 3143	ear of 8158 3143 3599	uring 3       /earl       earni       7       8729       3143	30 year y loa ngs du 8 9340 3143	rs so in In pay uring t 9 9994 1 3143	ymei total total	: 3 250 nt): 1 rst yea 11 11442 0	10.56 r of th 12 12243 0	year x 5 €/y€ e 10 y 13 13100 0	30 ye ear (f 14 14016	irst ye oan pe 15 14998 0	ear) riod / a 16 16047	fter = 3	18 18373 0	19 19659 0
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