Application Centre for Renewable Resources
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Initiative of Wageningen University & Research

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A glass of milk

140 Wh
food energy

20 W
brain at rest

≈ 7 h
energy equivalent



200 g whole milk

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A glass of milk

140 Wh
food energy

20 W
brain at rest

≈ 7 h
energy equivalent

~500 Wh
production energy



200 g whole milk



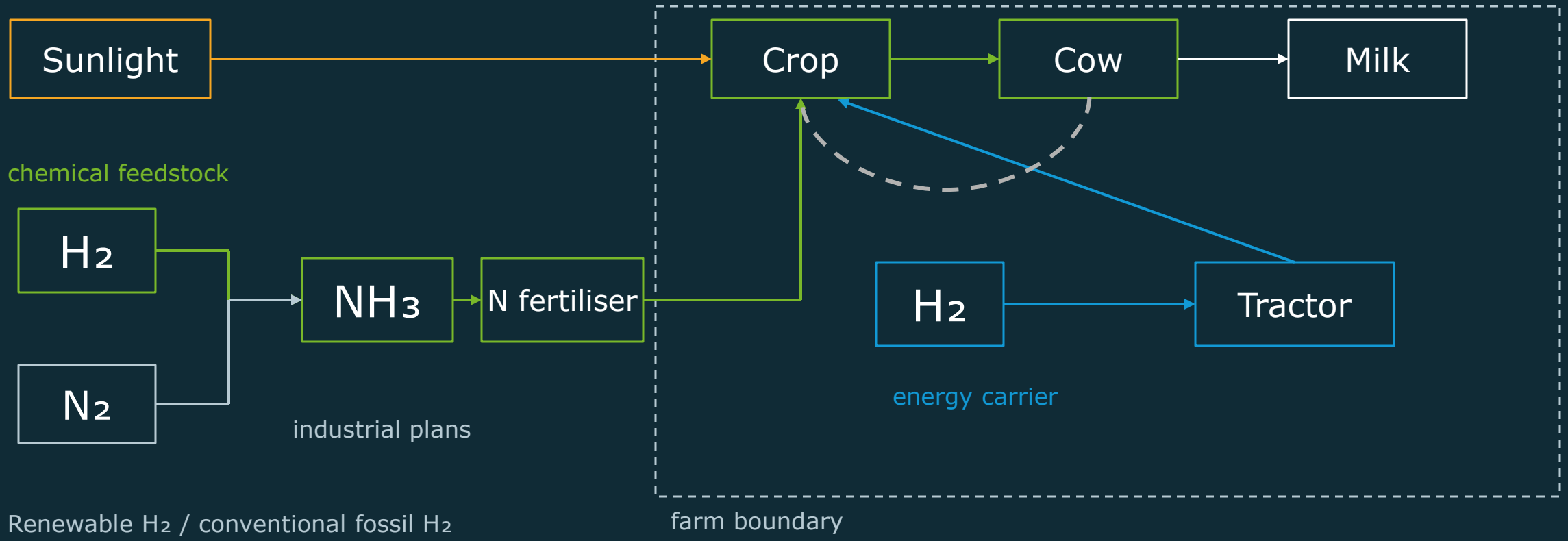
The Farm as an Energy System

Where does hydrogen fit?

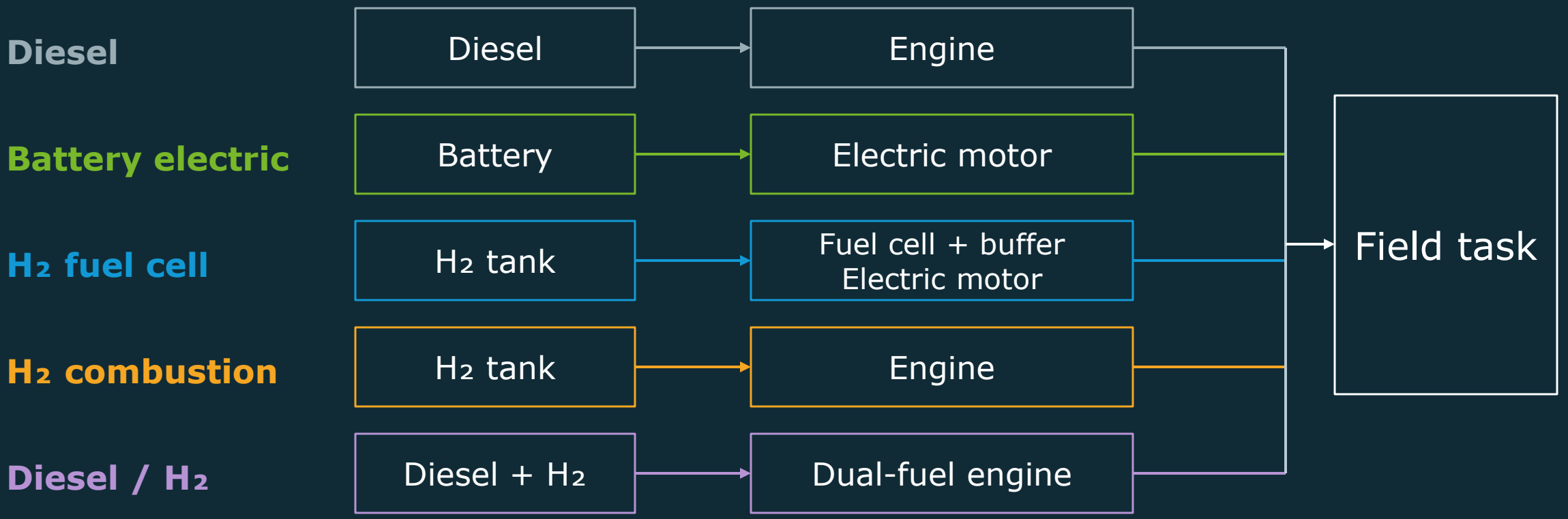
4TU Energy PhD Course

3 November 2026

What powers this glass?

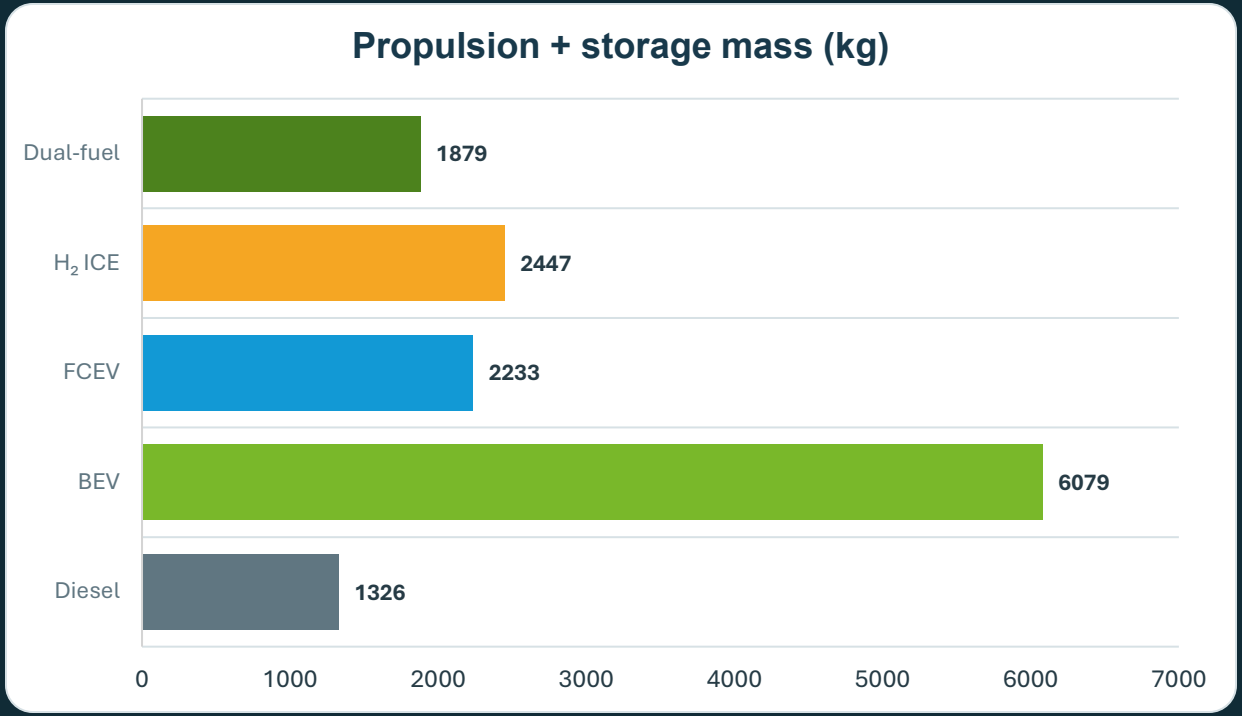


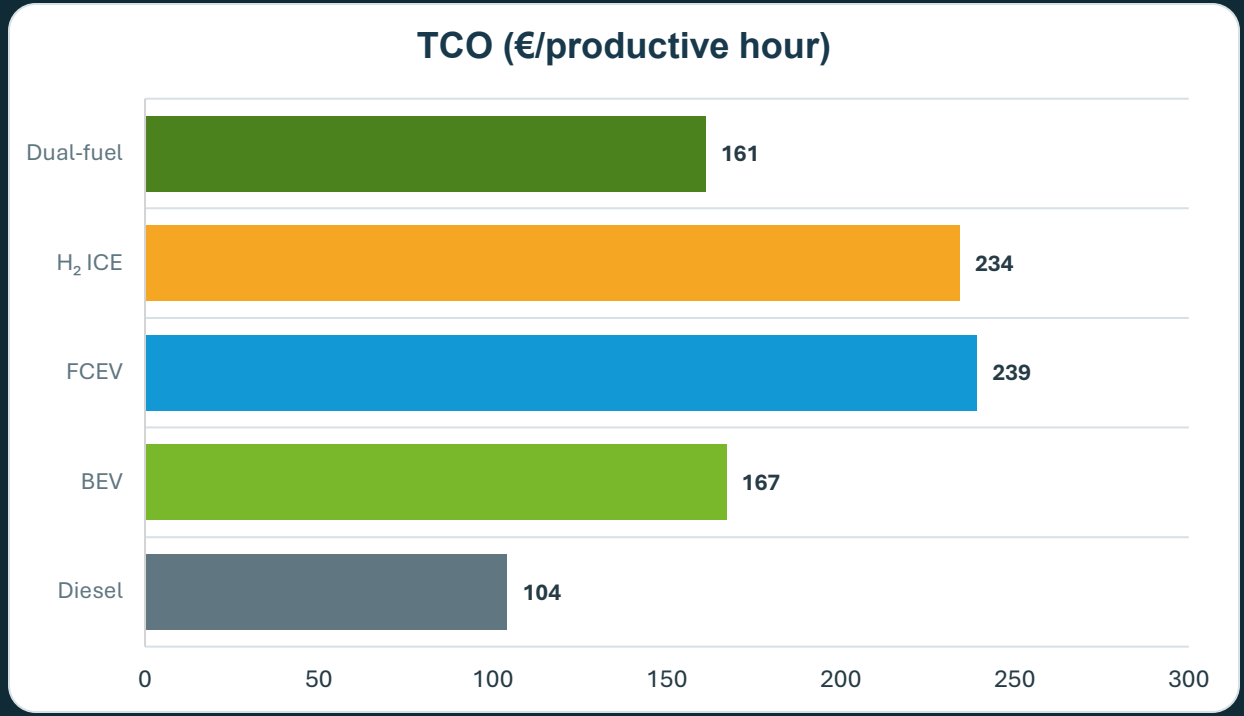
Five powertrain routes



On-board storage for the same field task

Scenario: 150 kW rated • 80 kW average • 8 h autonomy • 300 kW charger • €14/kg H_2 • €1.72/L diesel • 5 machines share infrastructure



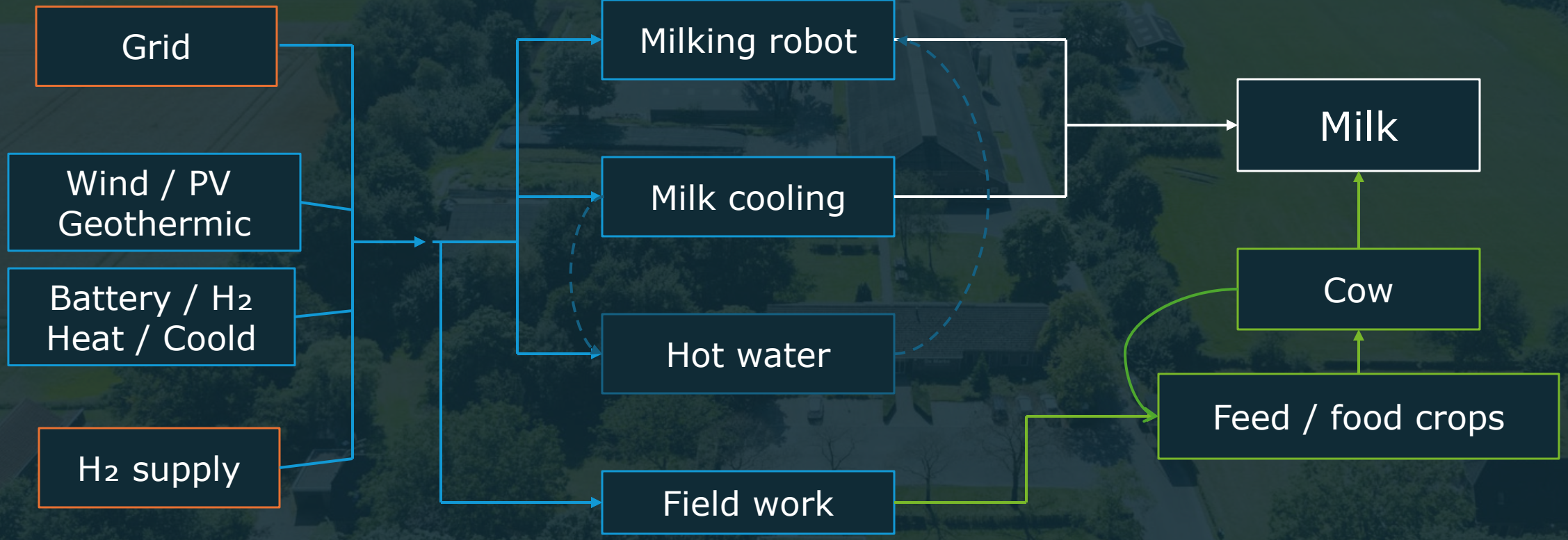


Duty cycle, not the fuel label determines the best fit

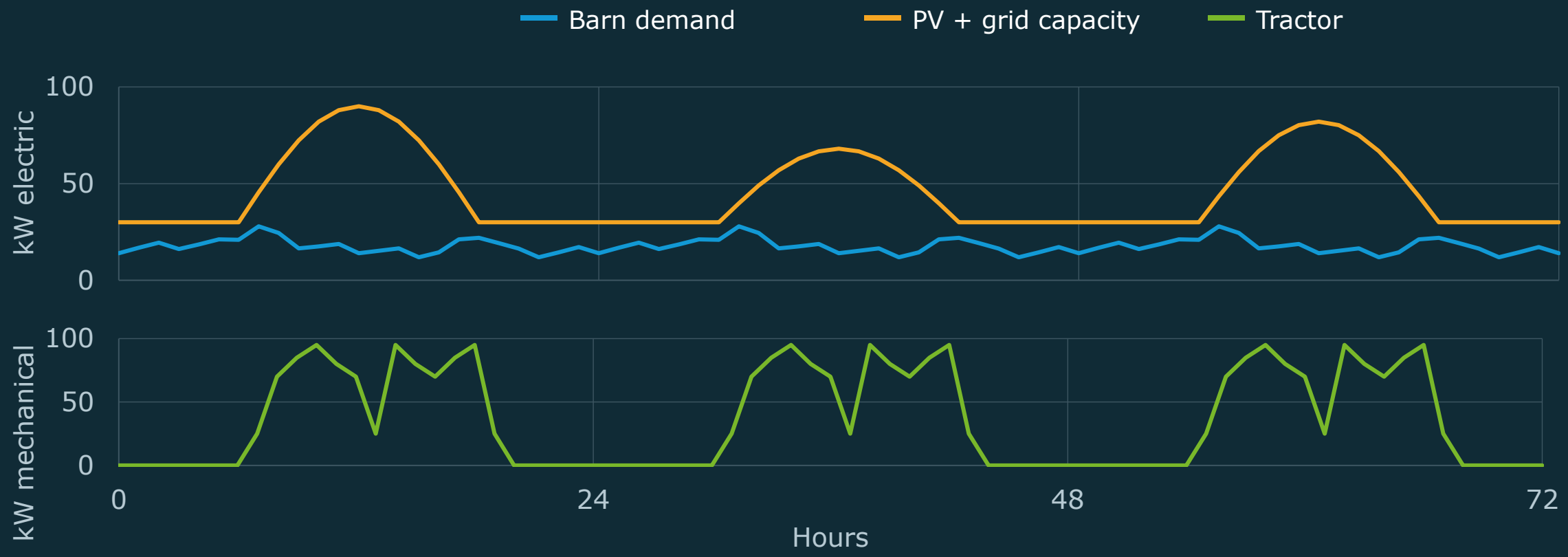
Route	Yard / indoor	Mixed farm	Long field / PTO	Peak season	Main trade-off
Diesel	●●●	●●●	●●●	●●●	Mature baseline; highest climate burden
Battery EV	●●●	●●○	●○○	●○○	Highest efficiency; autonomy adds mass and charge time
H_2 fuel cell	●●○	●●●	●●●	●●○	Zero tailpipe; expensive H_2 chain
H_2 combustion	●○○	●●●	●●●	●●●	Robust transient response; NO_x + lower efficiency
Diesel–H_2	●●○	●●●	●●○	●●●	Low-risk bridge; residual diesel emissions
Hybrid architecture	●●●	●●●	●●●	●●●	Buffer battery can downsize FC/engine; more complexity

DIRECT ELECTRICITY FIRST — H_2 WHERE POWER × AUTONOMY MAKES BATTERIES IMPRACTICAL

The dairy farm energy system

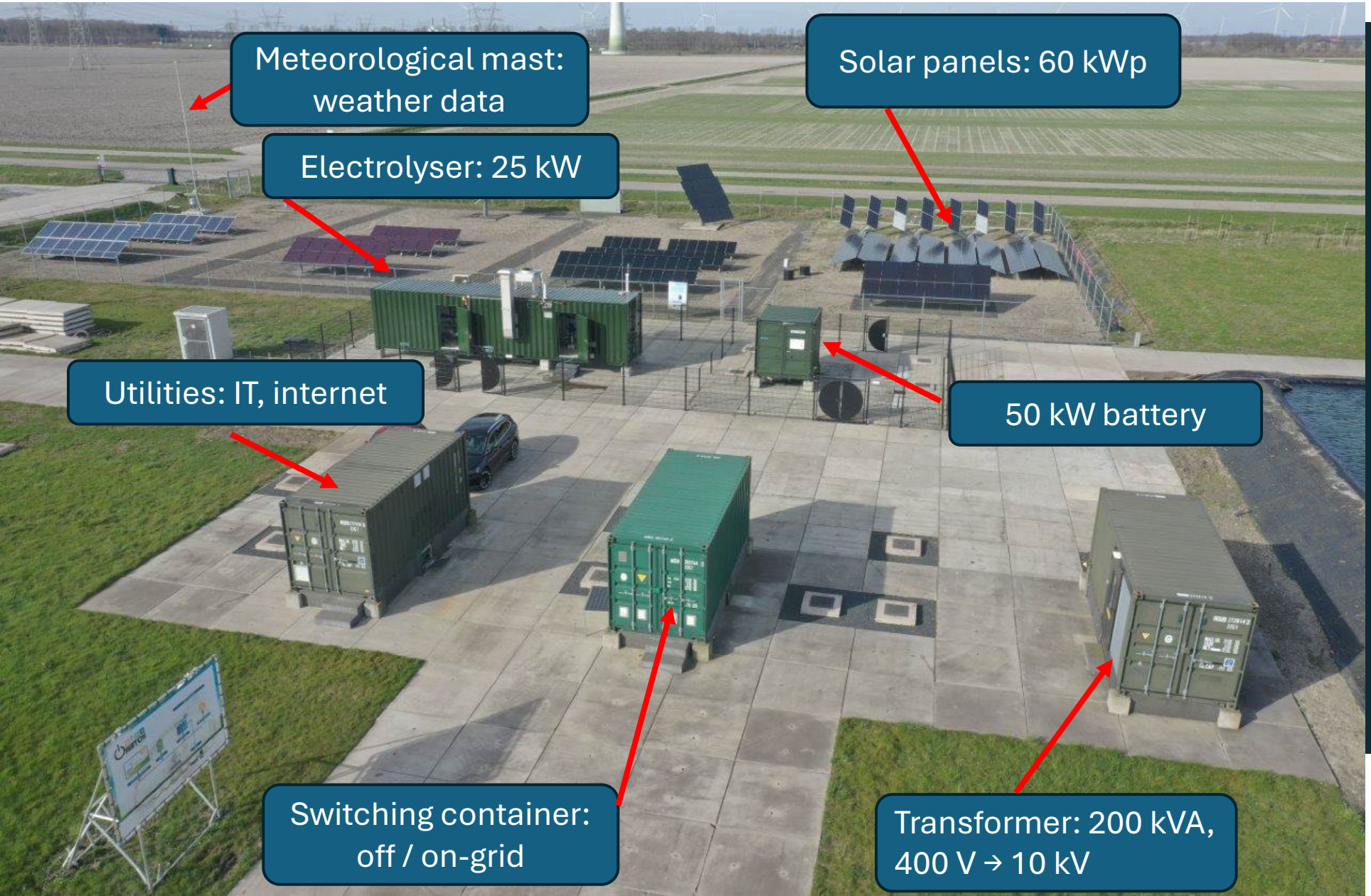


Daily demand and the spring work window



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SWITCH Fieldlab Testing the farm energy system

H_2

±0.5 kg H_2 production per hour at full load

±10–12 kg H_2 per day at continuous operation

The energy behind this glass

On the farm

H_2 as energy carrier for field work options

Before the farm

H_2 as option for N fertilizer

Let's try to feed our brain less fossil energy.



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