ENOUGH

EUROPEAN FOOD CHAIN SUPPLY TO REDUCE GHG EMISSIONS BY 2050

Demonstrating ENOUGH calculation tool

WP4

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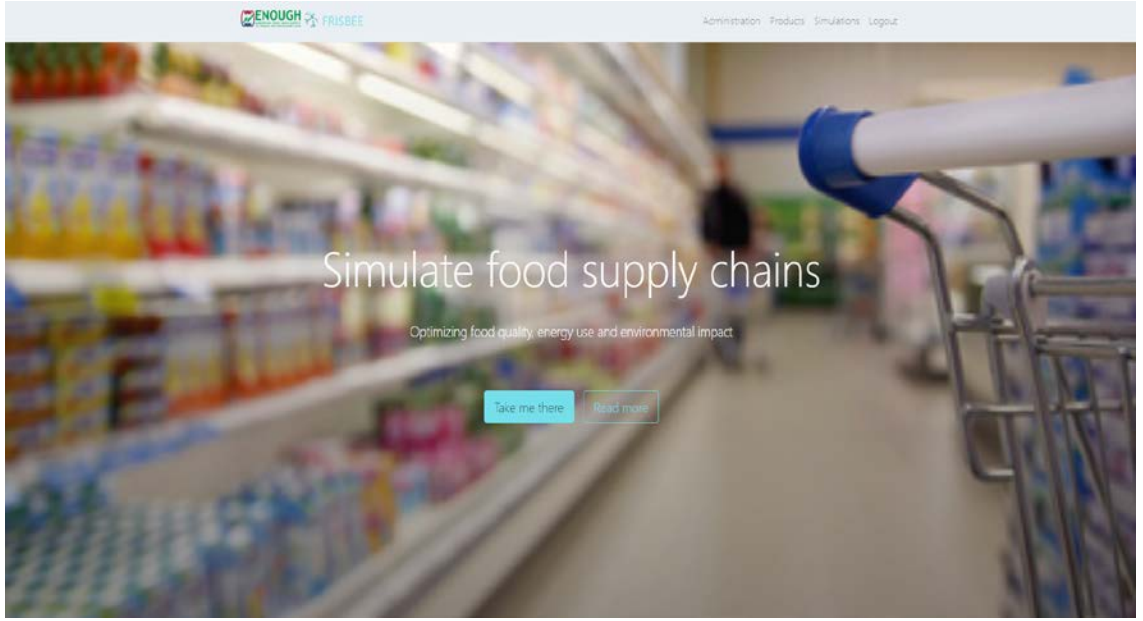
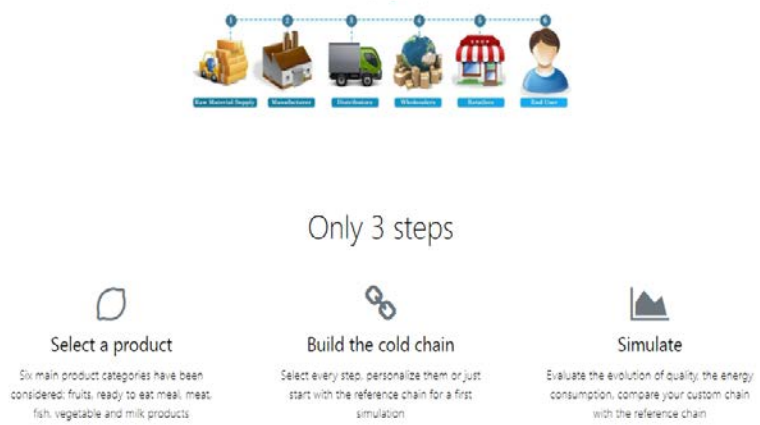
Enough decision support tool

Purpose of this tool:

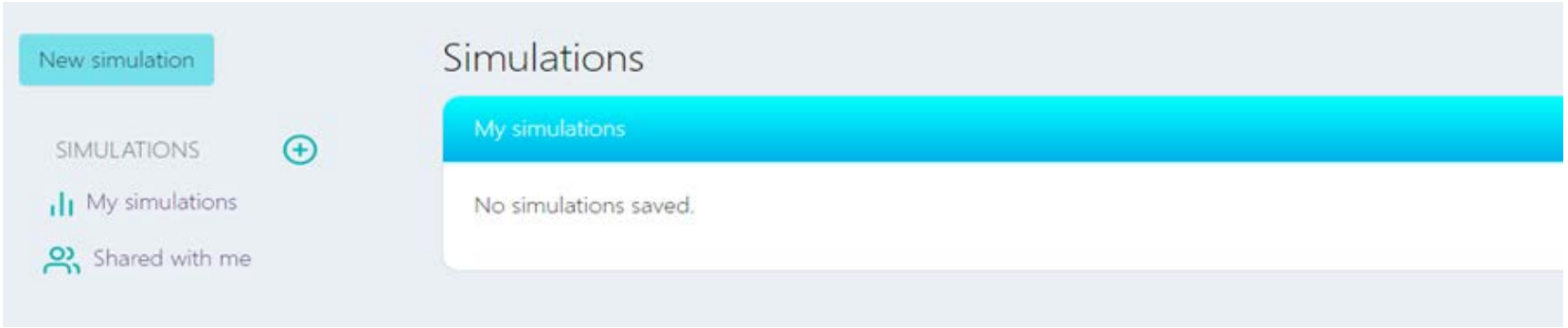
To simulate and assess food supply chains on multiple criteria

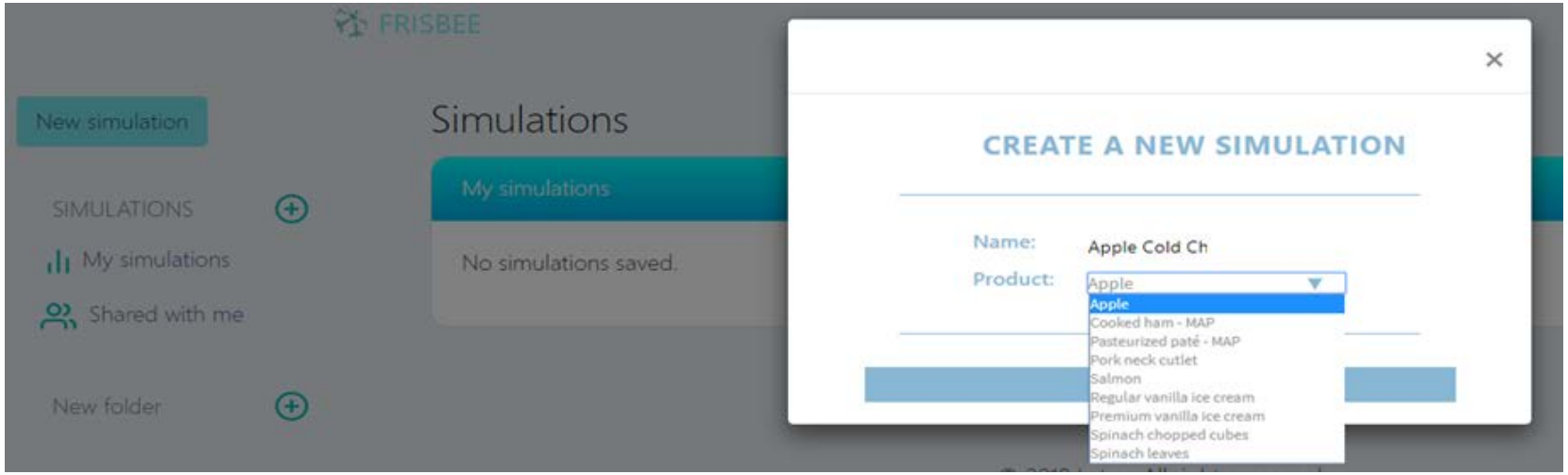
- Product quality and safety
- Energy consumption
- **CO2 emission**



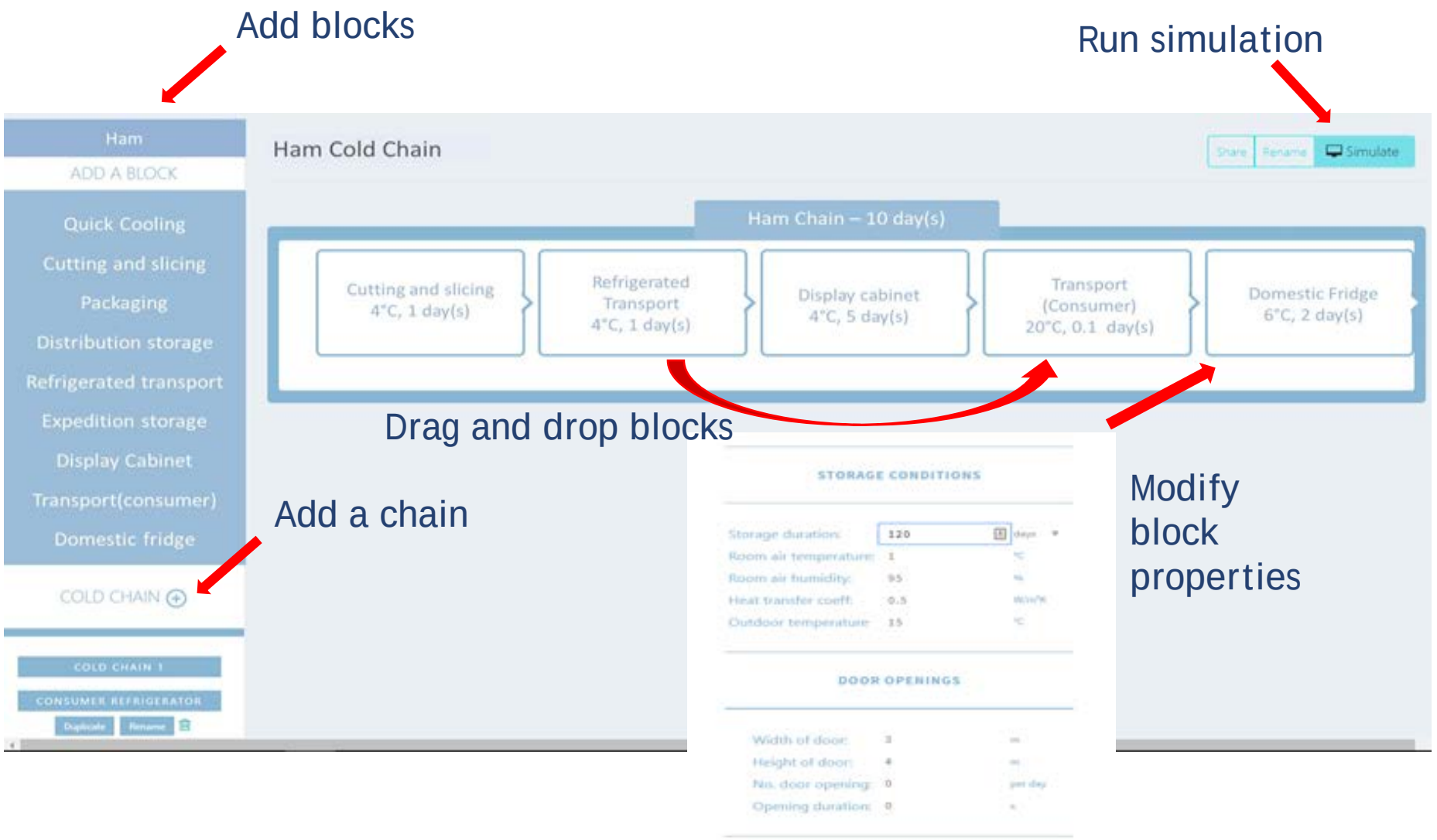


Create a simulation



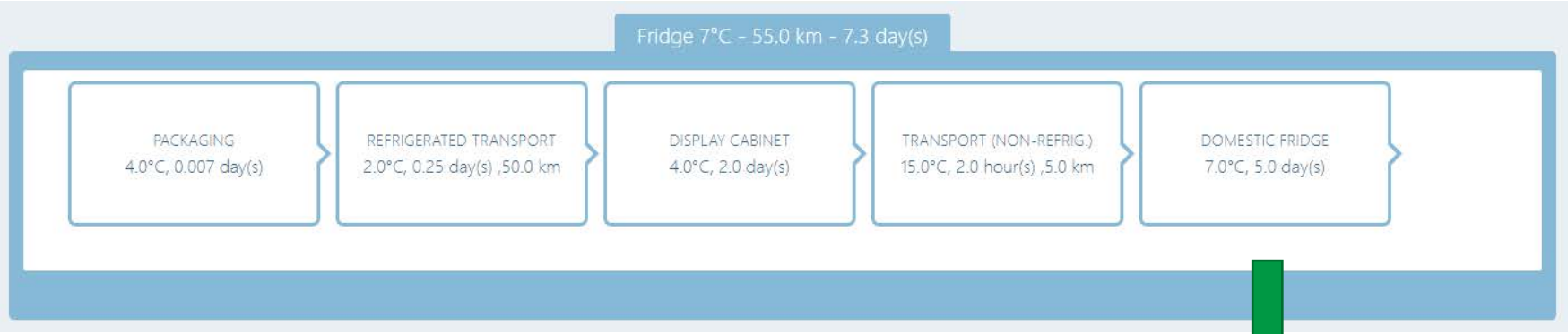


Building the chain

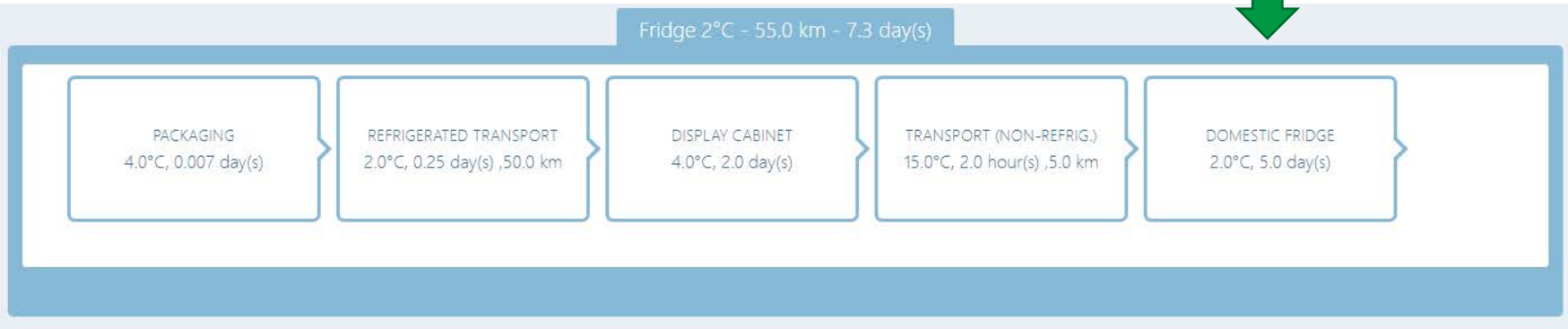


Simulation example: cooked ham

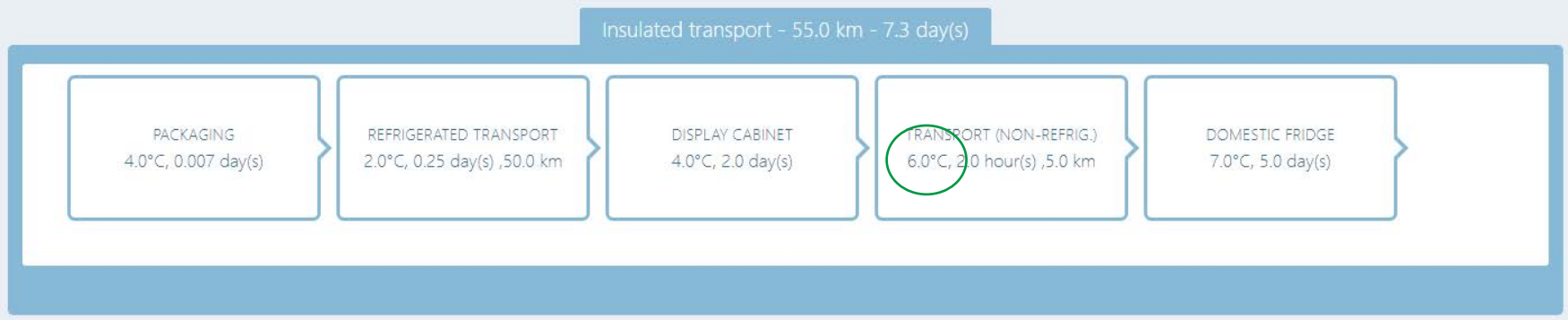
Fridge 7°C



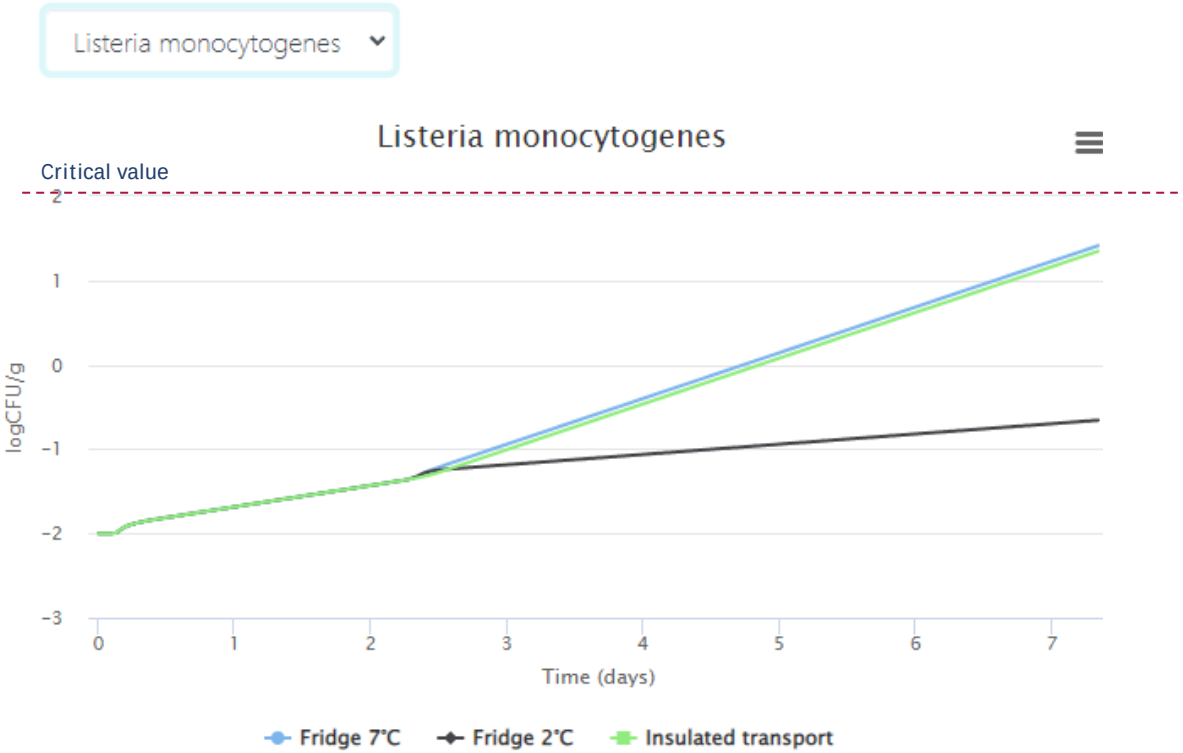
Fridge 2°C



Insulated consumer transport



Results



Chains ranking

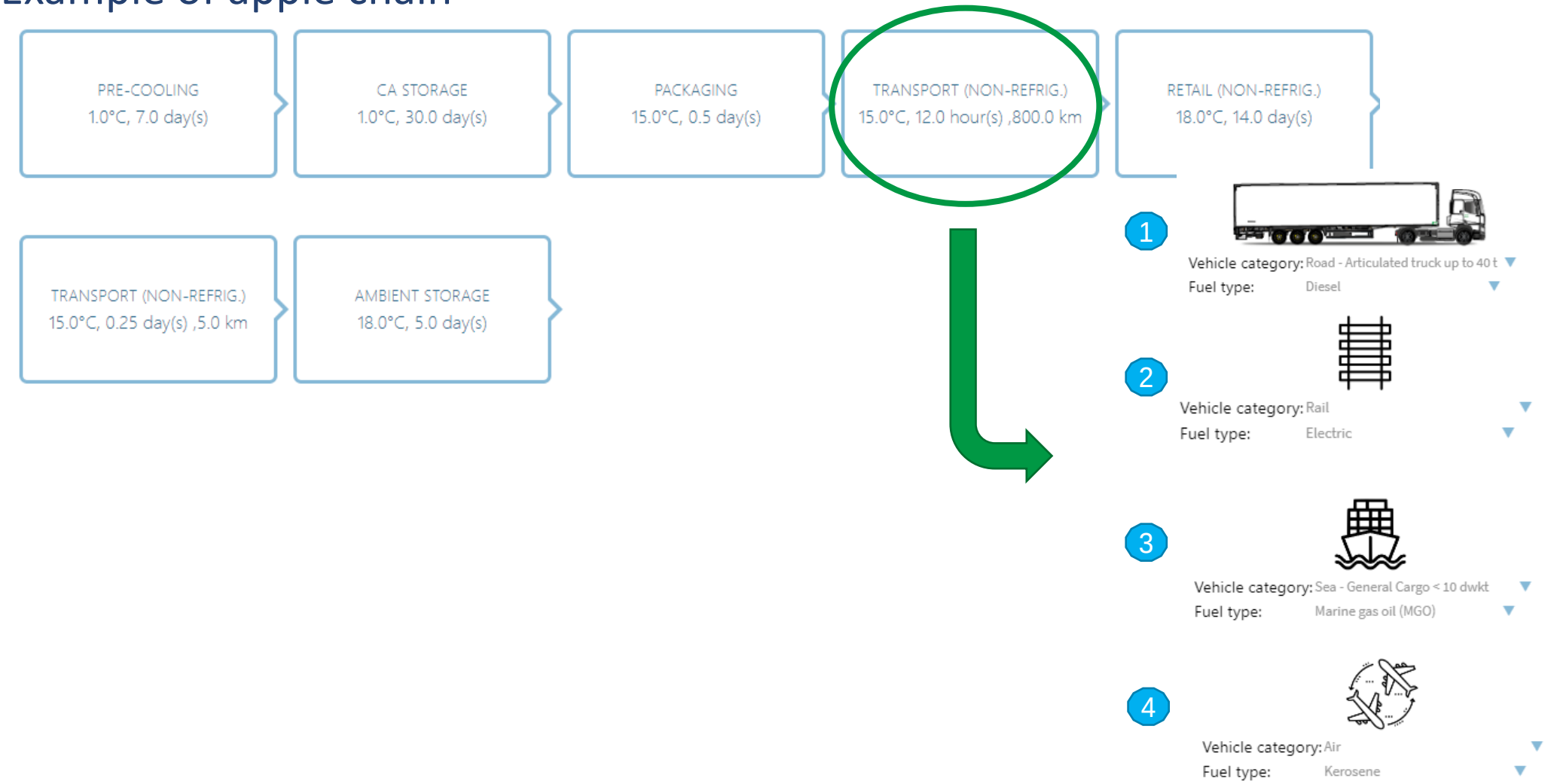
Multiple Criteria Decision Analysis (MCDA)

Rank	Chain name	Score	Distance	Listeria monocytogenes	Lactic acid bacteria	lactic acid bacteria	Water activity	Energy consumption	CO2 emission
			km	*logCFU/g*	*logCFU/g*	*logCFU/g*	-	*kWh/kg*	*kg CO2/kg*
1	Fridge 2°C	2.0	55.0	-0.66	3.20	4.38	-0.66	0.533	0.206
2	Insulated transport	-0.76	55.0	1.35	6.29	8.08	1.35	0.516	0.199
3	Fridge 7°C	-1.24	55.0	1.41	6.39	8.19	1.41	0.516	0.199

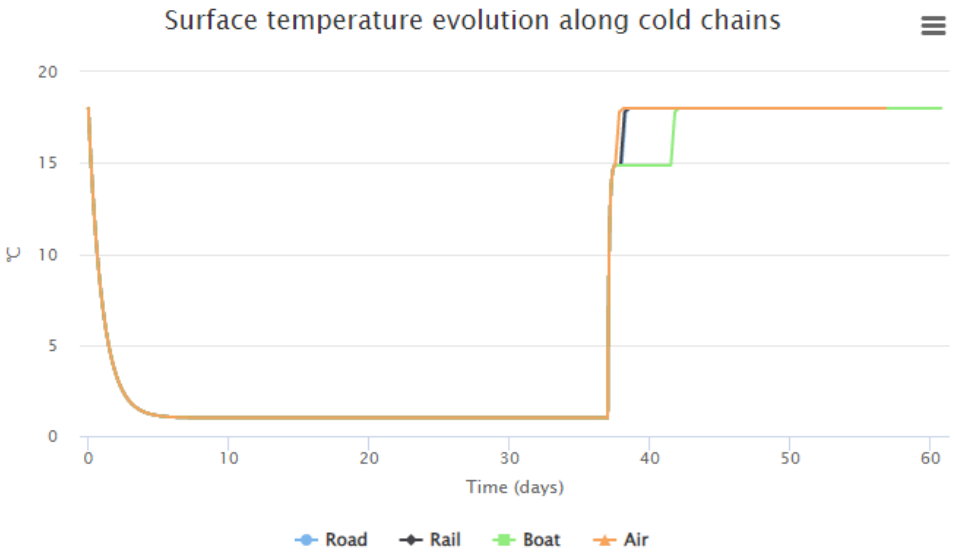
High impact of fridge temperature on product quality

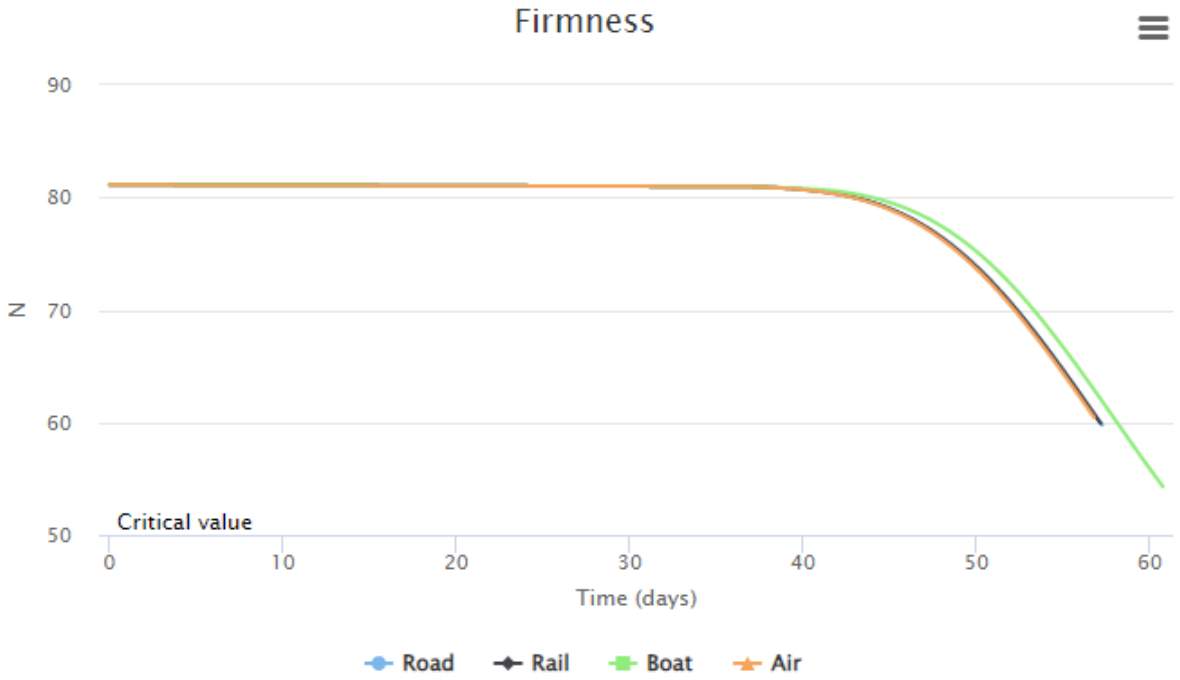
Other example: impact of transportation mode on GHG emissions

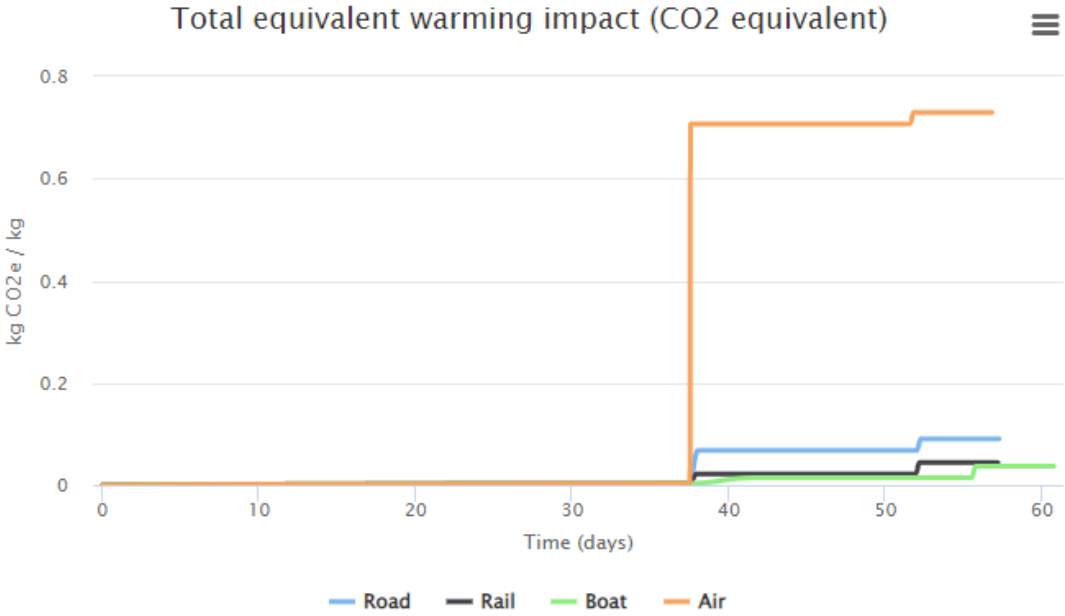
Example of apple chain



Results







Rank	Chain name	Score	Distance	Firmness	Colour	Relative volatile	Weight loss	Energy consumption	CO2 emission
			km	*N*	*a**	*None*	*%*	*kWh/kg*	*kg CO2/kg*
1	Rail	1.49	805.0	59.91	9.19	561.36	3.05	0.159	0.044
2	Boat	1.1	805.0	54.30	9.81	550.30	3.46	0.133	0.037
3	Road	0.19	805.0	59.77	9.22	561.22	3.06	0.328	0.09
4	Air	-2.78	805.0	60.44	9.10	561.85	3.01	2.737	0.729

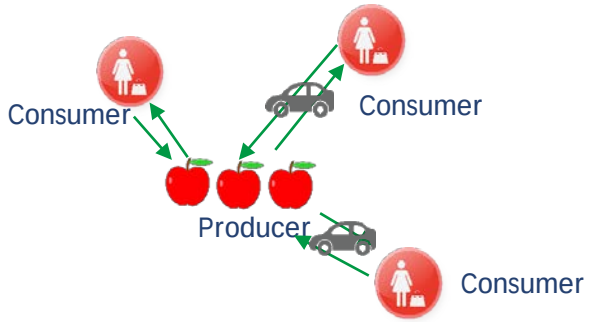
Much higher GHG emissions for air transport

Other example: local or long distance

- Long distance chain

- Local chain

0 to 1 intermediary between producers and consumers



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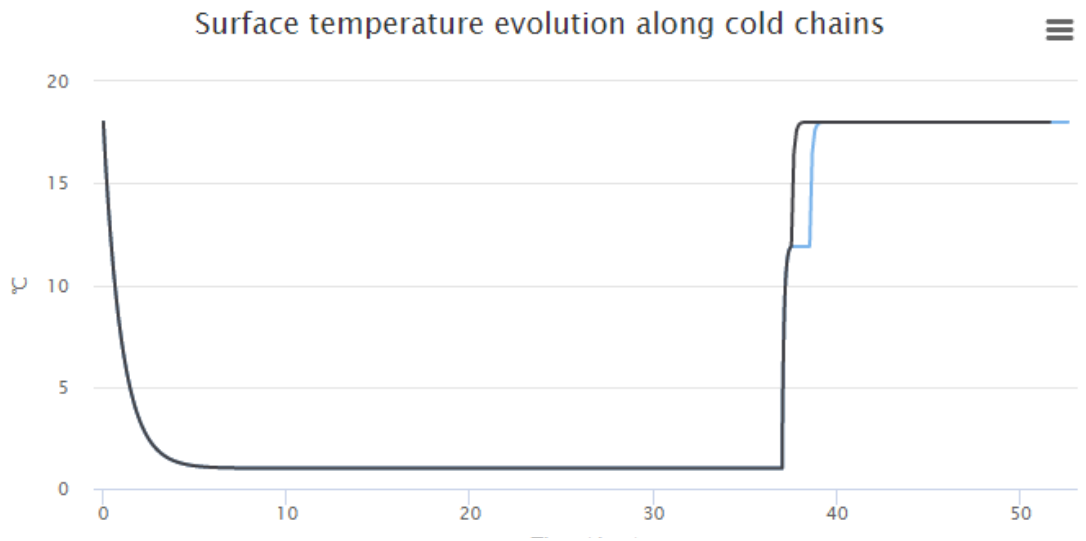

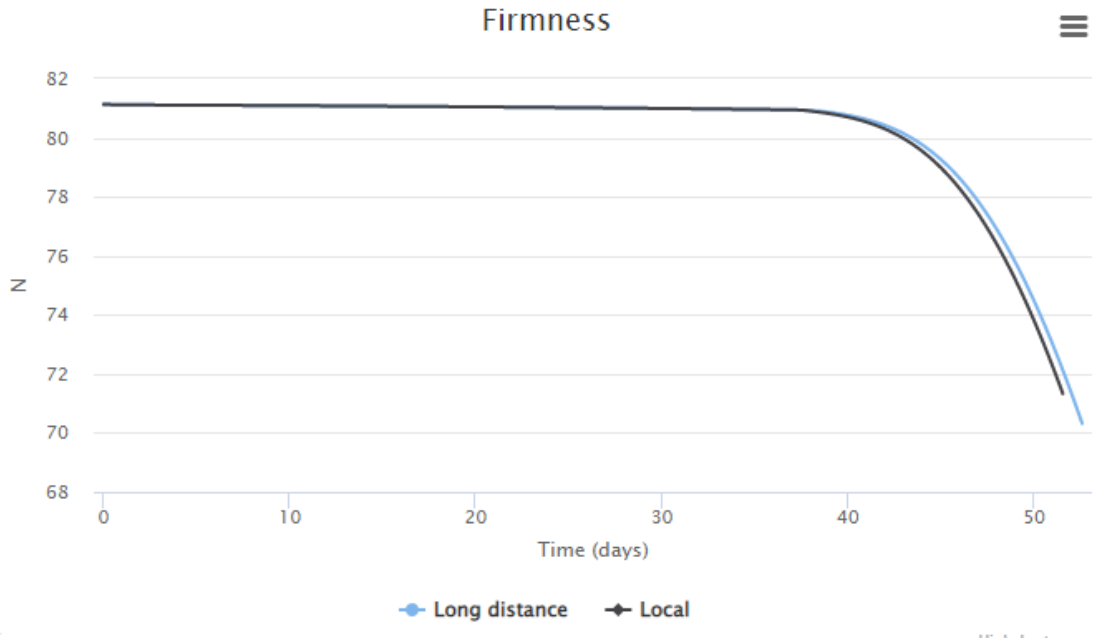

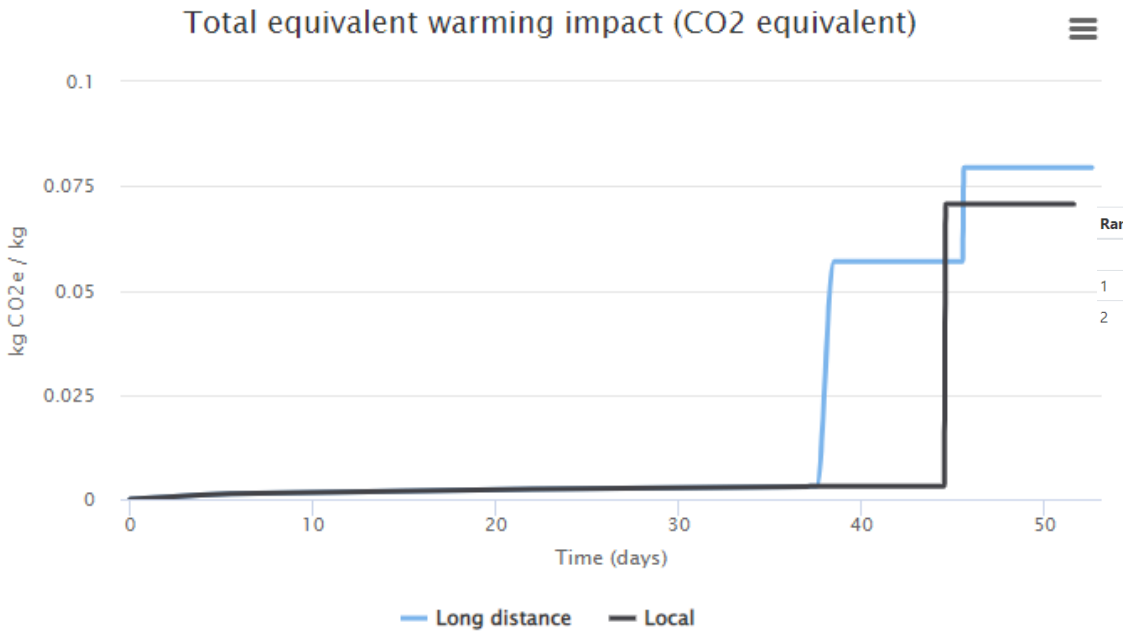

Rank	Chain name	Score	Distance	Firmness	Colour	Relative volatile	Weight loss	Energy consumption	CO2 emission
			km	*N*	*a**	*None*	*%*	*kWh/kg*	*kg CO2/kg*
1	Local	0.57	15.0	71.26	4.74	532.26	2.28	0.255	0.071
2	Long distance	-0.57	705.0	70.32	5.30	535.75	2.38	0.287	0.079

Shorter duration for local chain
Not much difference in terms of CO2 emissions due to small quantities transported by consumers

Other examples of simulations / assessments

Impact of refrigeration

Example: Pasteurised milk / UHT milk

Pasteurized milk requires **refrigeration** all along the food supply chain

Sterilization requires more energy consumption, but **no refrigeration** after

Impact of temperature for frozen products

Example: **-18°C to -12°C**, what would be the difference, especially on GHG emissions?

New technologies to reduce emissions

Renewable energy sources, heating recovery for food processes, energy storage, active packaging, « green » delivery, next generation refrigerator …

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101036588

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Thank you for your attention

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