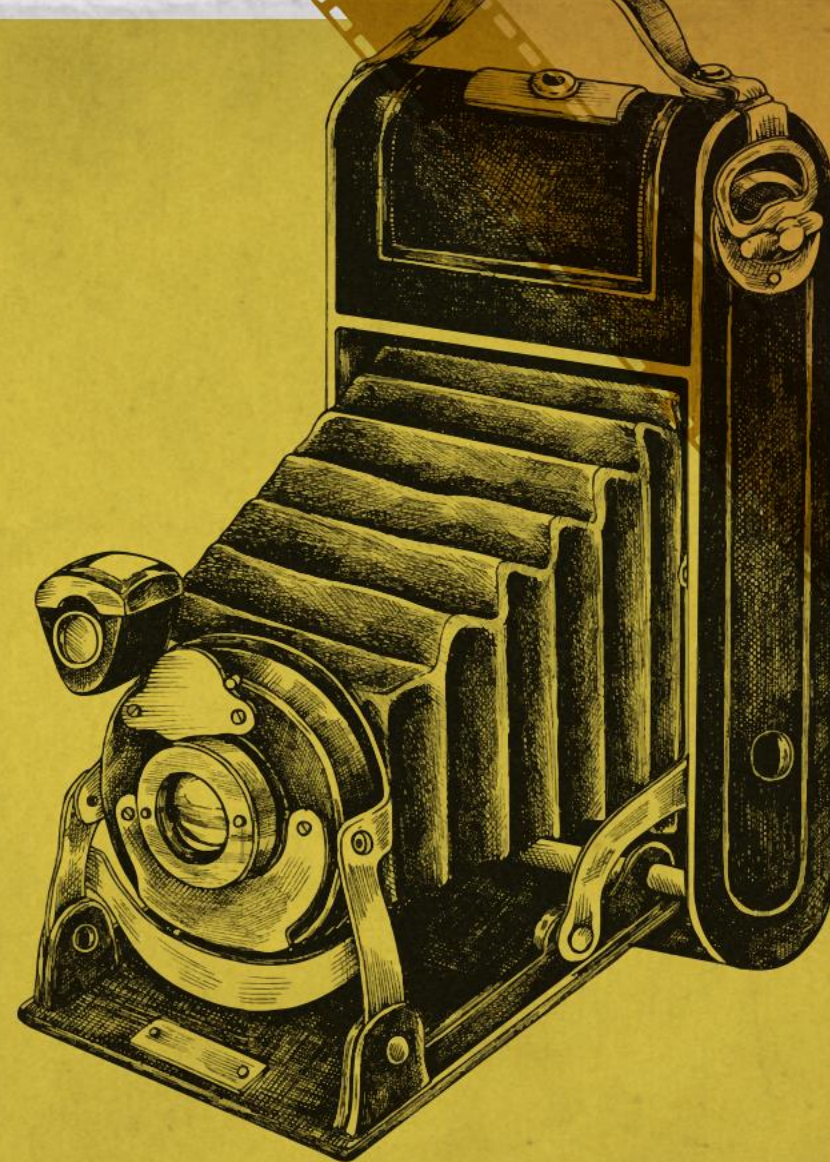
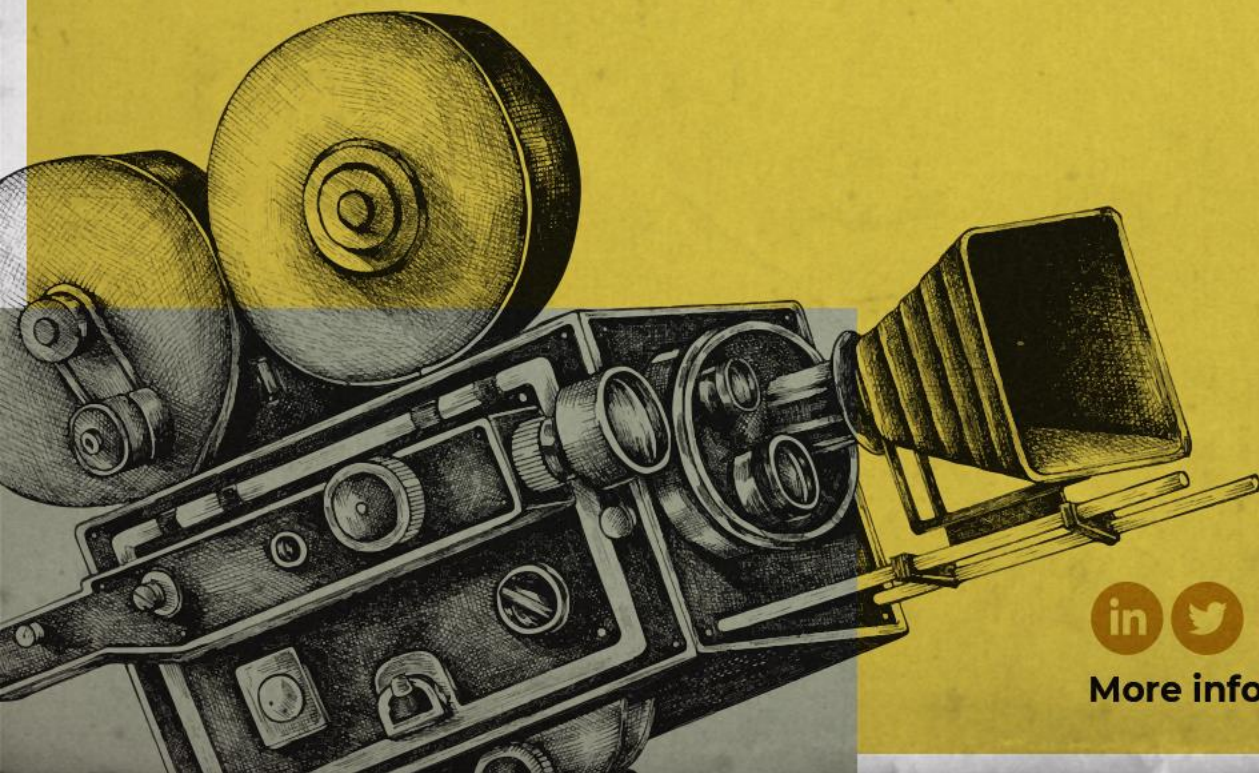


25TH MAY / 2022 ◊ VALENCIA, SPAIN

FINAL WORKSHOP

The NEMOSINE innovative
package for cultural
heritage preservation



More info at: nemosineproject.eu



NEMOSINE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760801.



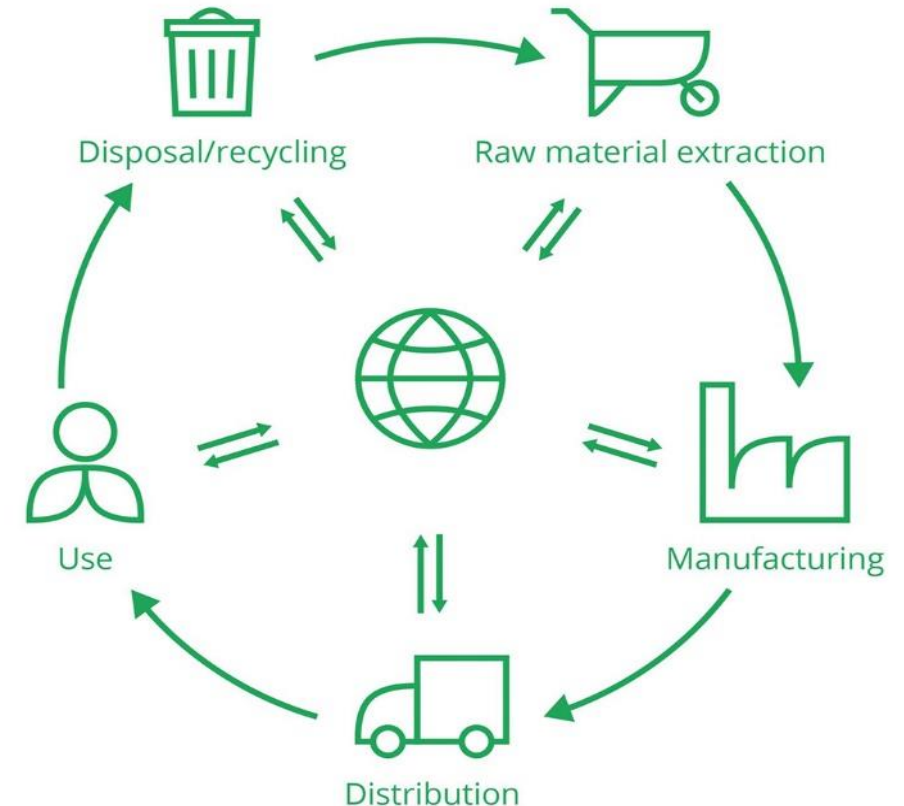
NEMOSINE socio-economic and environmental impact on the market

Luigi Ranza

Ciaotech - PNO

Environmental Impact Assessment

- ❑ Life Cycle Assessment, ISO 14040 and 14044
- ❑ All the activities from raw material extraction, through manufacturing, distribution, use, as well as final disposal or recycling
- ❑ 4 steps
 - Step 1 – The scope definition
 - Step 2 - The Life Cycle Inventory (LCI)
 - Step 3 - The Life Cycle Impact Assessment (LCIA)
 - Step 4 - The results interpretation





Environmental Impact Assessment

IMPACT CATEGORY	ENVIRONMENTAL INDICATORS	UNIT OF MEASURE
GREENHOUSE GAS EMISSIONS	CO2 equivalent emissions	kg CO2eq
RESOURCES DEPLETION	Raw materials used	kg
ENERGY	Energy consumption	kWh
WASTE GENERATION	Waste generated during package manufacturing	kg
	Raw materials end-of-life	kg

Reference scenario

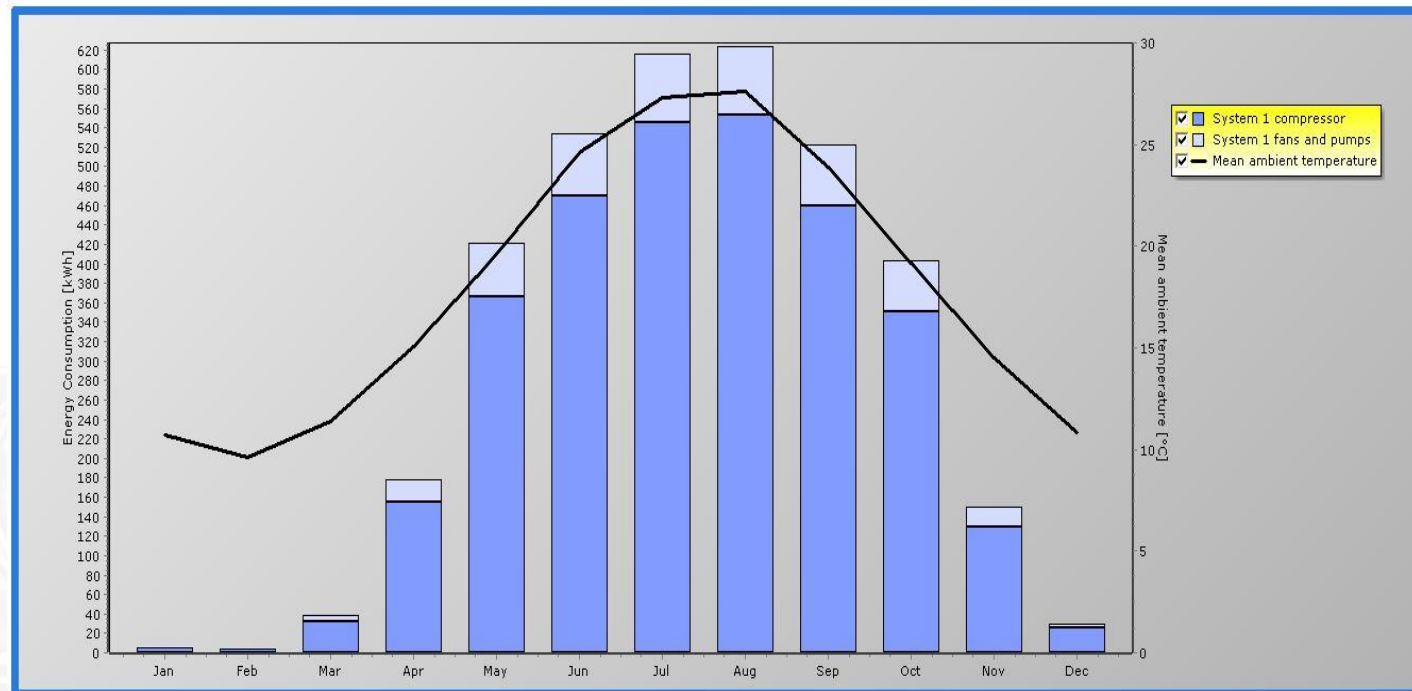
- ❑ refrigerated rooms (16°C) for storing CH (in conventional package)
- ❑ refrigerator and refrigerant manufacturing, use (air conditioning) and end-of-life

NEMOSINE scenario

- ❑ refrigerated rooms (25°C) + NEMOSINE packaging solution

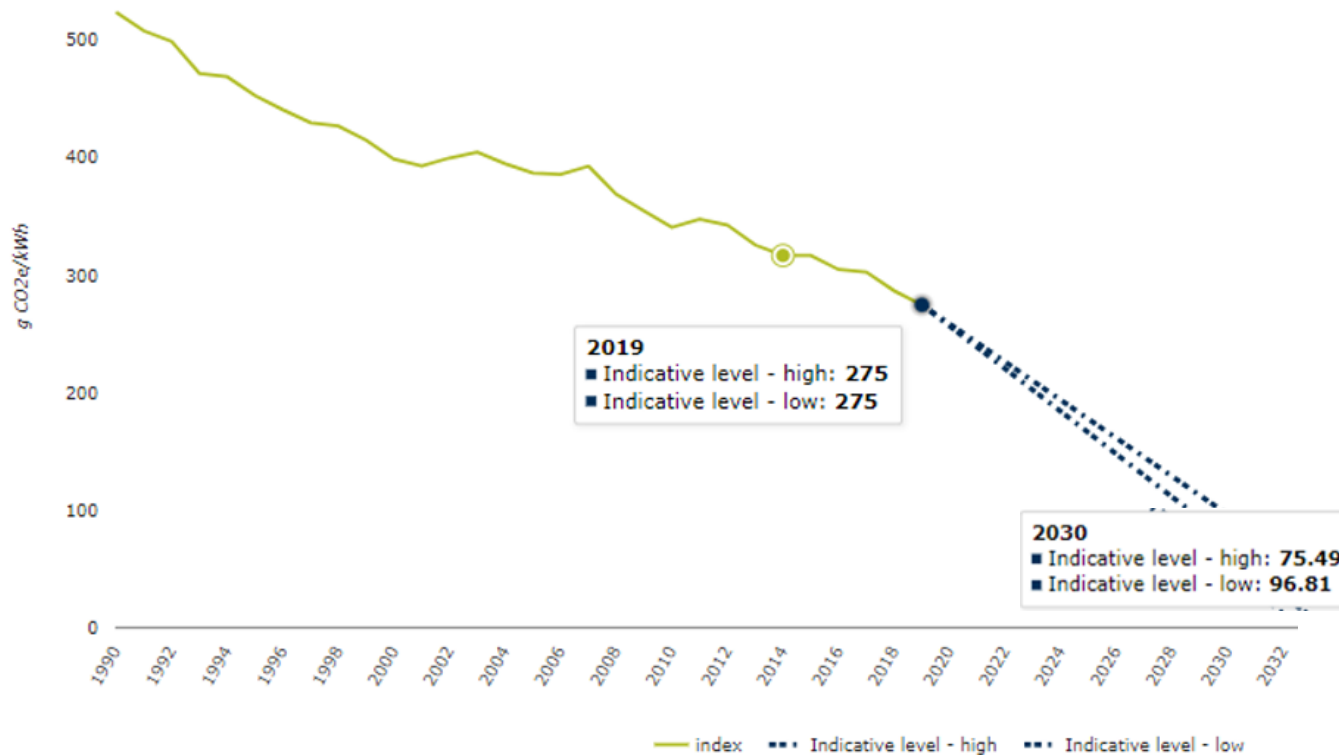
Environmental Impact Assessment

- functional unit: 1 package unit x 50 years
- estimated annual electricity consumption for refrigeration for different EU locations with different climate conditions (Athens, Valencia, Marseille, Milan, Paris, Prague, Birmingham)



Environmental Impact Assessment

- Greenhouse gas emission intensity of electricity generation – EEA 2019 and 2030

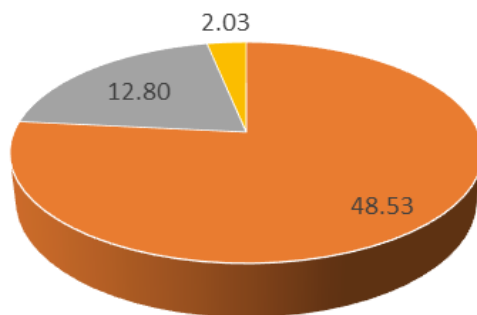


Hypothesis of the study

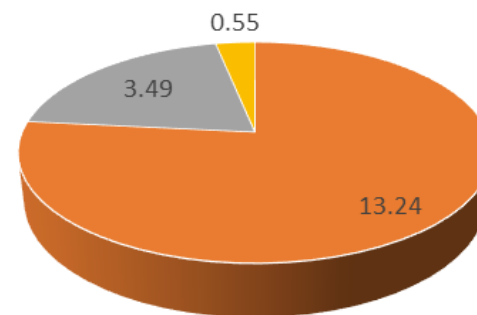
Reference scenario - refrigeration	16.00	°C
Nemosine scenario - refrigeration	25.00	°C
Package life span	50.00	years
MOF life span	5.00	years

Environmental Impact Assessment

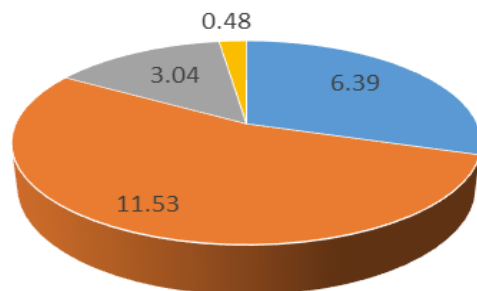
GWP [kg/CO₂eq] - Reference scenario



GWP - Reference scenario 2030

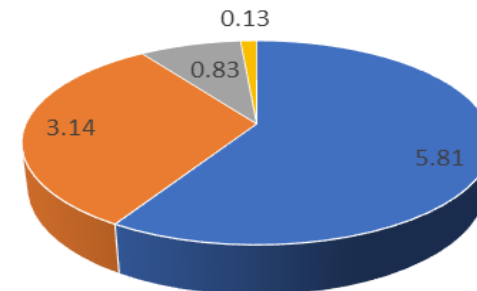


GWP [kg/CO₂eq] - Nemosine



- Nemosine package - raw materials + manufacturing + EOL
- Electricity - energy consumption
- Electricity - refrigerant leakages
- Electricity - raw materials + manufacturing + EOL

GWP - Nemosine 2030

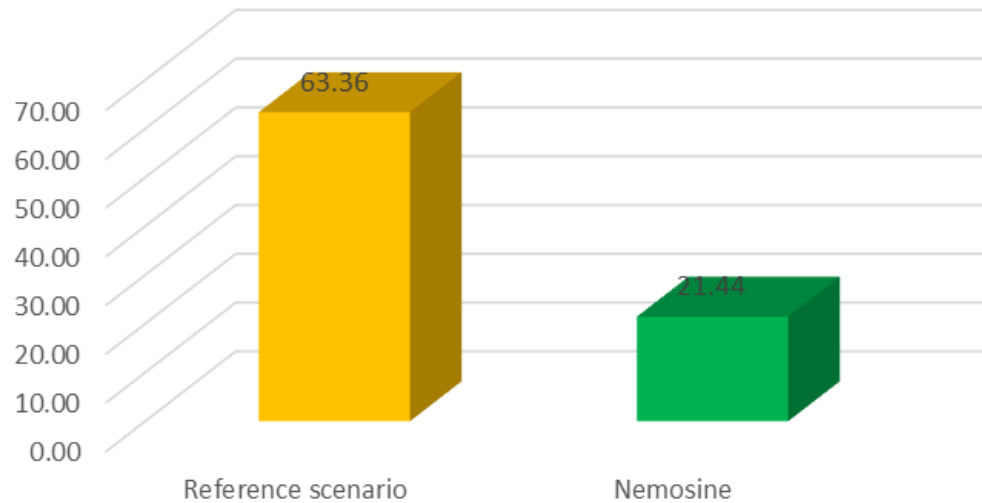


- Nemosine package - raw materials + manufacturing + EOL
- Electricity - energy consumption
- Electricity - refrigerant leakages
- Electricity - raw materials + manufacturing + EOL



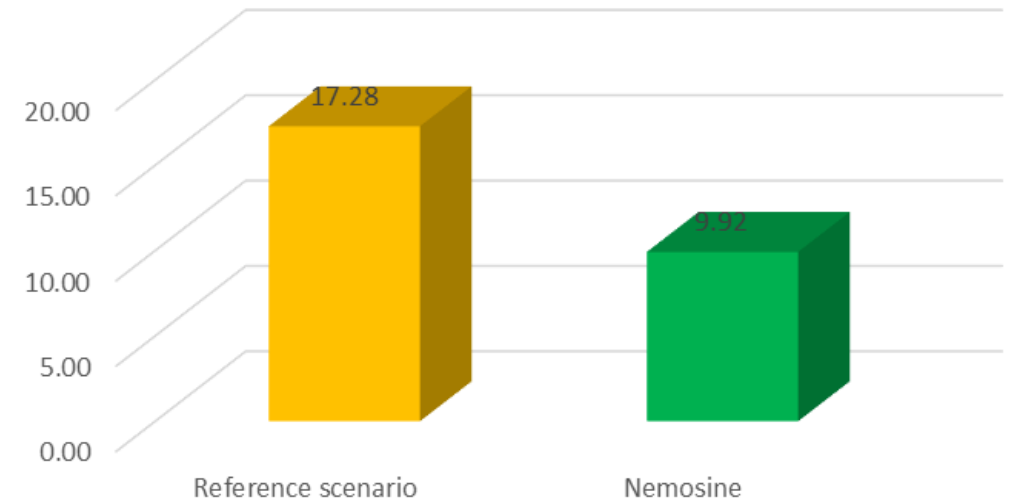
Environmental Impact Assessment

GWP [kg/CO₂eq] - Reference scenario VS
Nemosine



-60%

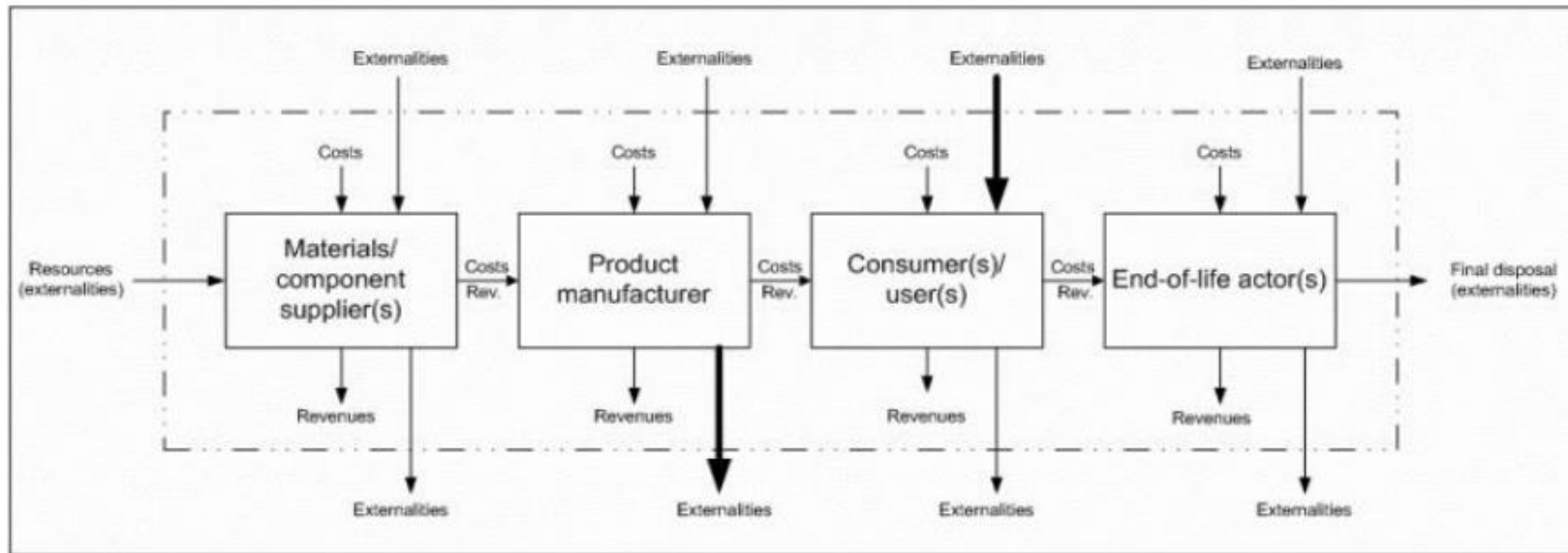
GWP [kg/CO₂eq] - Reference scenario VS
Nemosine 2030



-40%

Socio-economic Impact Assessment

Methodology: LCC (same approach as for LCA)



Source:
Rebitzer G.,
Hunkeler D.,
Life Cycle
Costing in
LCM:
Ambitions,
opportunities,
and
limitations,
Discussing a
framework

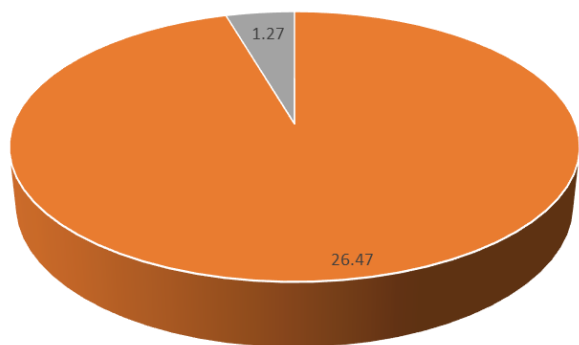
Current cost of electricity	0.15	€/kWh
Cost of electricity 2030	0.40	€/kWh
Current cost of externalities	20.00	€/ton CO ₂ eq
Cost of externalities 2030	28.00	€/ton CO ₂ eq

❑ BASIC VERSION

❑ PREMIUM VERSION (with sensors)

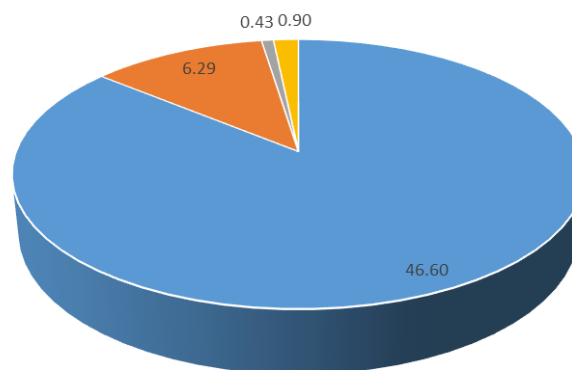
Socio-economic Impact Assessment

GWP [kg/CO₂eq] - Reference scenario



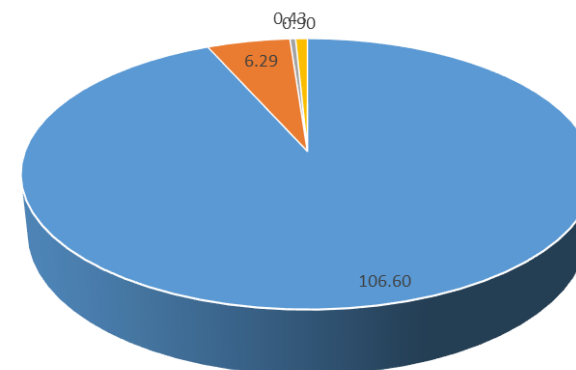
■ Cost of refrigeration ■ Cost of externalities

GWP [kg/CO₂eq] - Nemosine - basic



■ Cost of Nemosine package ■ Cost of refrigeration
■ Cost of externalities ■ End of life - recycling

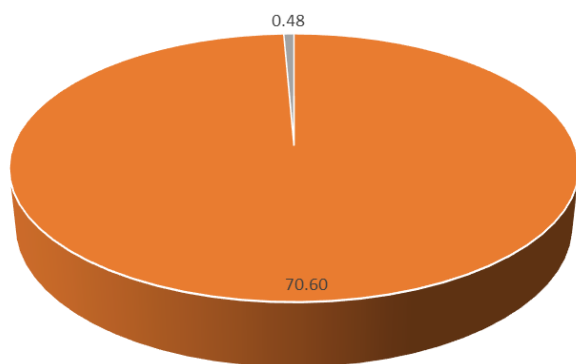
GWP [kg/CO₂eq] - Nemosine - premium



■ Cost of Nemosine package ■ Cost of refrigeration
■ Cost of externalities ■ End of life - recycling

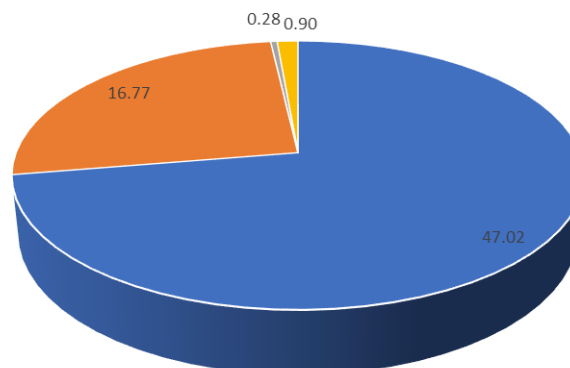
Socio-economic Impact Assessment

GWP [kg/CO₂eq] - Reference scenario 2030



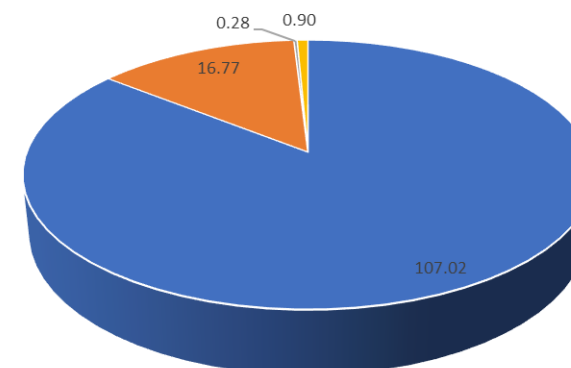
■ Cost of refrigeration ■ Cost of externalities

GWP [kg/CO₂eq] - Nemosine - basic 2030



■ Cost of Nemosine package ■ Cost of refrigeration
■ Cost of externalities ■ End of life - recycling

GWP [kg/CO₂eq] - Nemosine - premium 2030

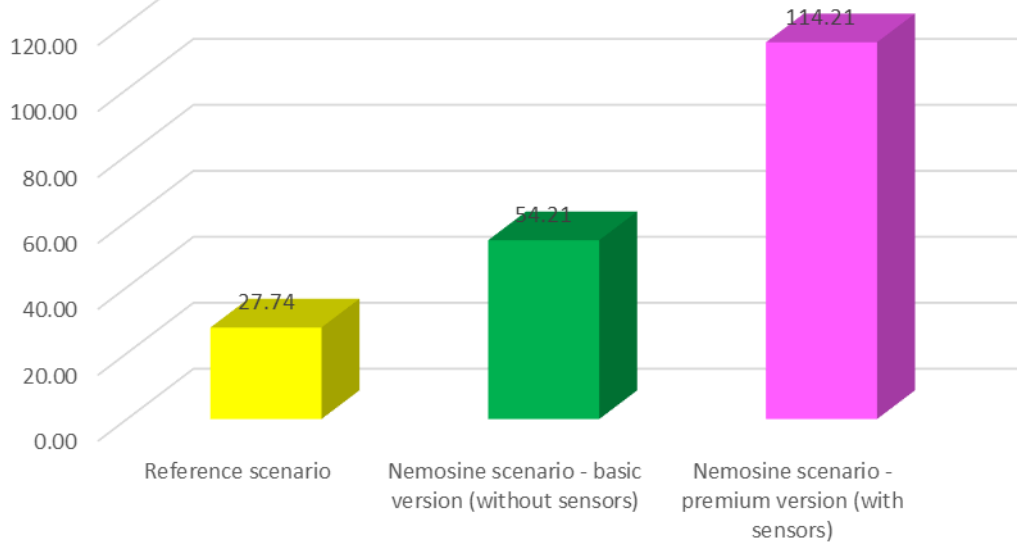


■ Cost of Nemosine package ■ Cost of refrigeration
■ Cost of externalities ■ End of life - recycling



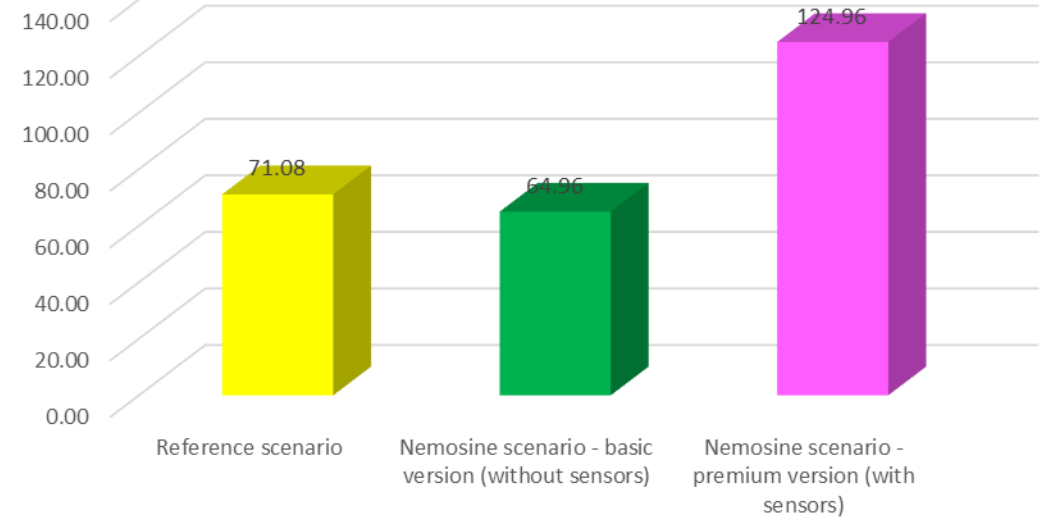
Socio-economic Impact Assessment

GWP [kg/CO₂eq] - Reference scenario VS Nemosine



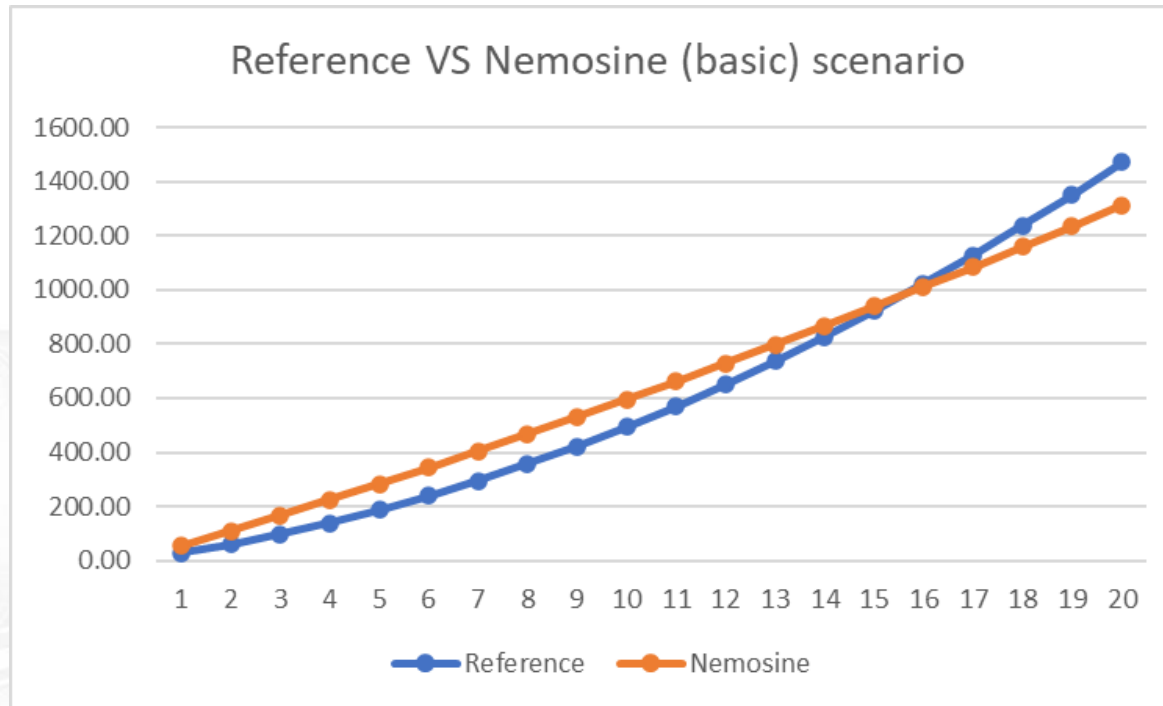
+90%/+300%

GWP [kg/CO₂eq] - Reference scenario VS Nemosine 2030



-10%/+70%

Socio-economic Impact Assessment



- CH is a capital of cultural, social, environmental and economic value
- CH helps deliver social cohesion in communities across Europe, providing a framework for participation and engagement as well as fostering integration
- CH is a significant creator of jobs across Europe

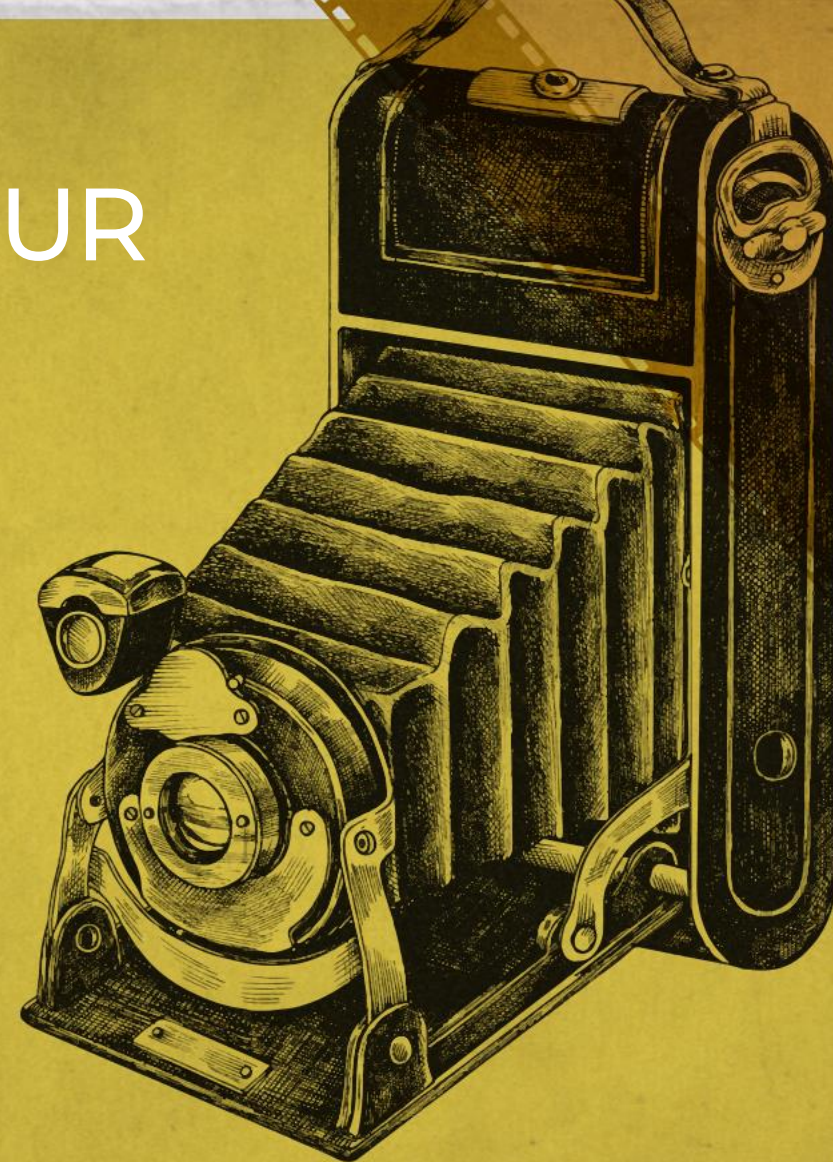
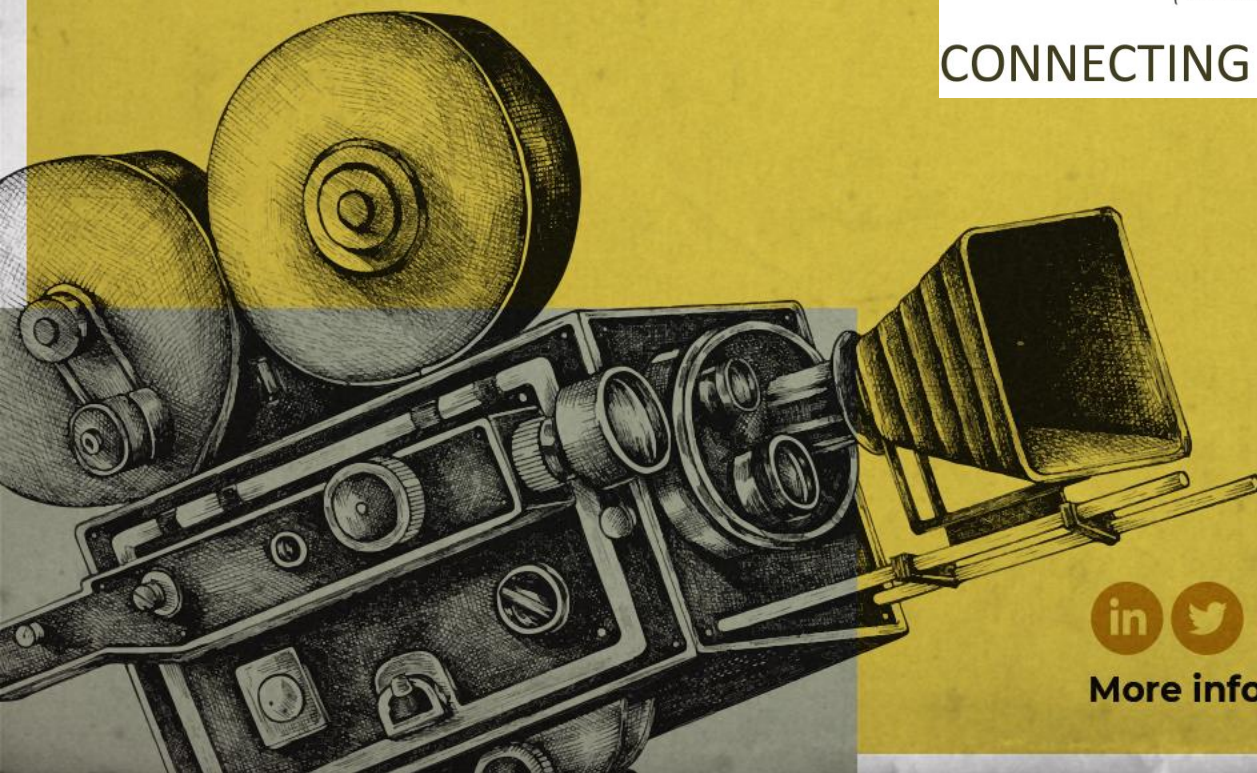


THANKS FOR YOUR ATTENTION

Luigi Ranza



CONNECTING AMBITIONS



More info at: nemosineproject.eu



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