

SOLUTION SET 1



- Mechanical ventilation through a decentralized ventilation system
- Space heating and cooling through a centralized heat pump with water storage
- Air movement through ceiling fan

LOW-RISE BUILDING

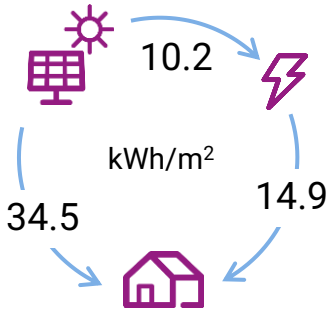
3 floors, 7 dwellings of 80-110m² each



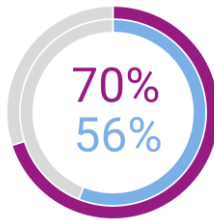
MEDITERRANEAN GEO-CLUSTER



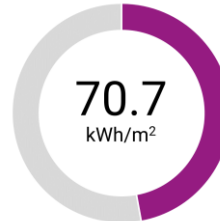
ENERGY, LOAD MATCHING AND GRID INTERACTION



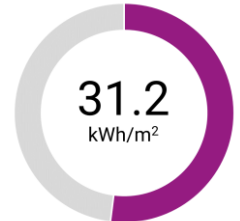
Self-generation
Self-consumption



Primary energy

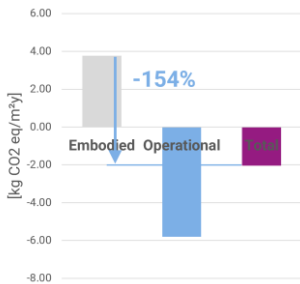


Final energy

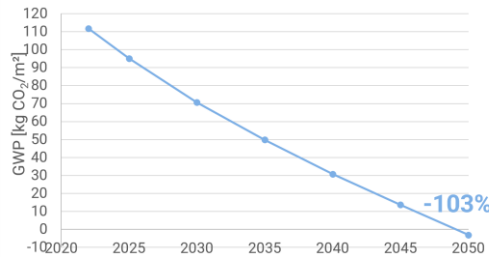


LIFE CYCLE ASSESSMENT

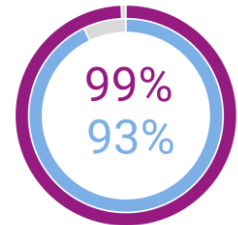
Global Warming Potential (GWP)



Dynamic GWP

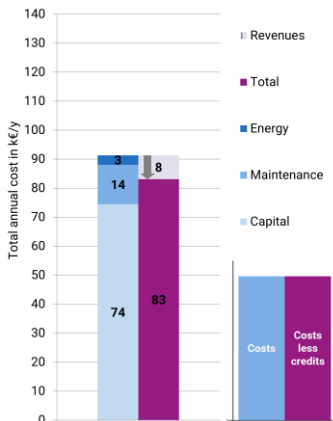


Thermal comfort Relative Humidity comfort

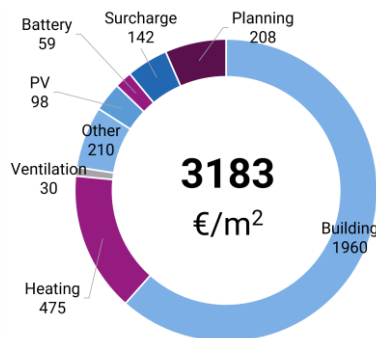


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Ventilating and being in contact with the outdoor space



RESPONSE

Opening windows. Very little use of the ventilation system



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- Air movement through ceiling fan

HIGH-RISE BUILDING

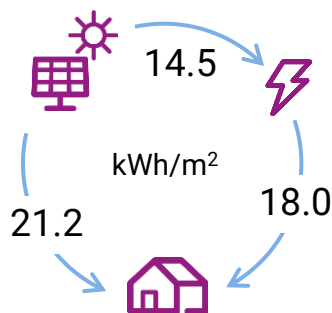
8 floors, 20 dwellings of 50-75m² each



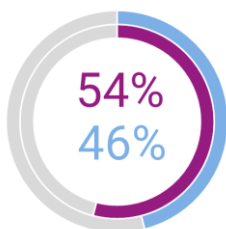
MEDITERRANEAN GEO-CLUSTER



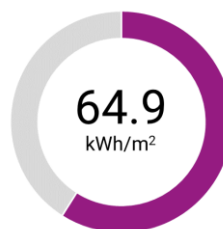
ENERGY, LOAD MATCHING AND GRID INTERACTION



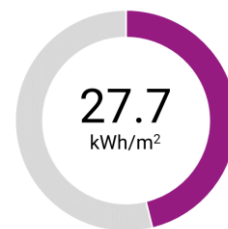
Self-generation
Self-consumption



Primary energy

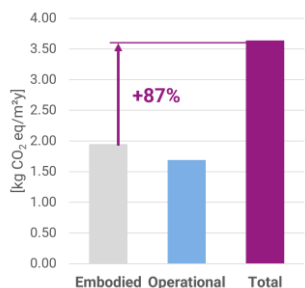


Final energy

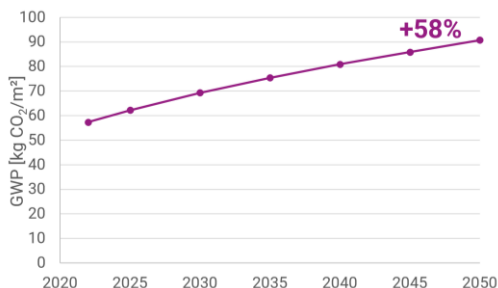


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

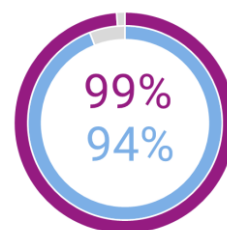


Dynamic GWP



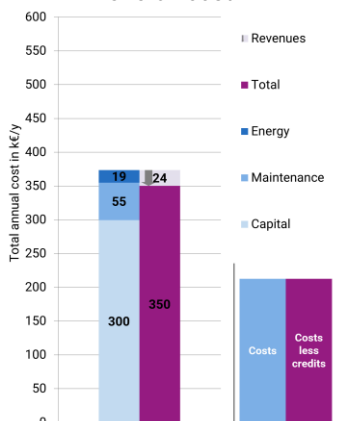
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

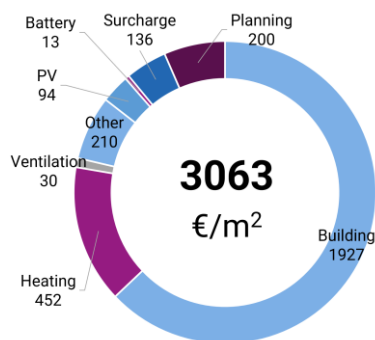


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Sleeping comfortably with an adequate temperature



RESPONSE

Turning off the heating system and opening windows



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LOW-RISE BUILDING

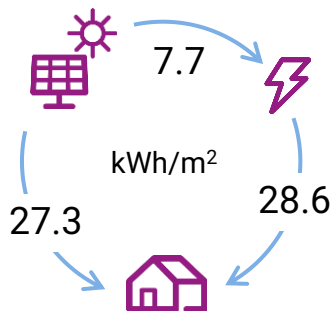
3 floors, 7 dwellings of 80-110m² each



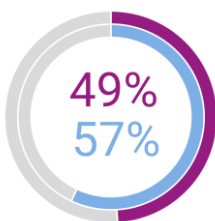
CONTINENTAL GEO-CLUSTER



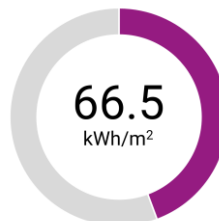
ENERGY, LOAD MATCHING AND GRID INTERACTION



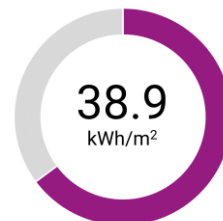
Self-generation
Self-consumption



Primary energy

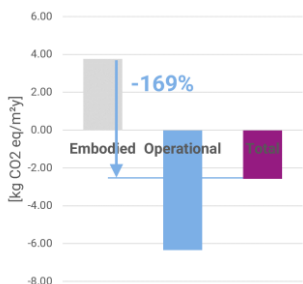


Final energy

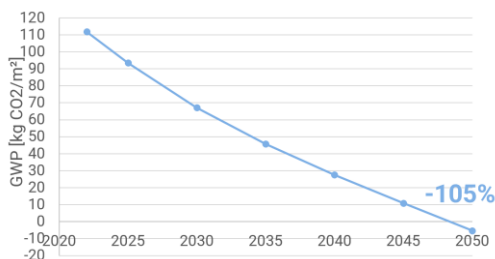


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

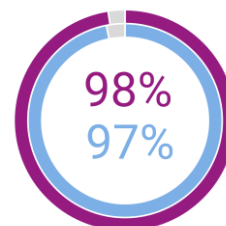


Dynamic GWP



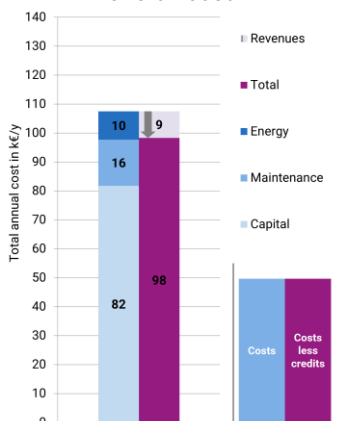
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

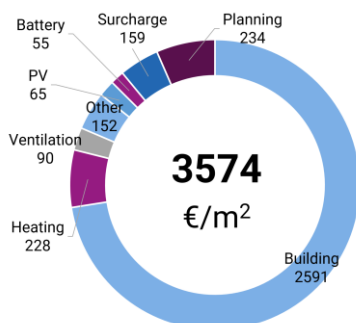


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Relaxing in the outdoor balcony (all year round) and being in contact with outdoor space



RESPONSE

Using an electric heater on the balcony



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SOLUTION SET 1



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- Air movement through ceiling fan

HIGH-RISE BUILDING

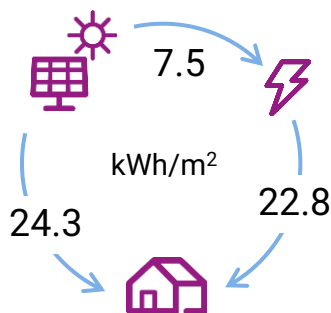
8 floors, 20 dwellings of 50-75m² each



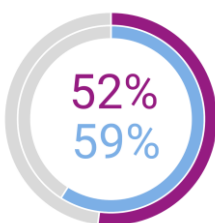
CONTINENTAL GEO-CLUSTER



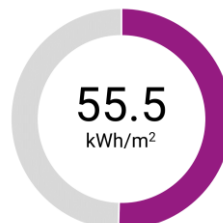
ENERGY, LOAD MATCHING AND GRID INTERACTION



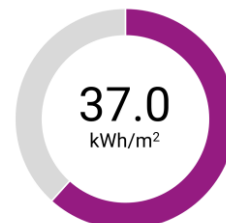
Self-generation
Self-consumption



Primary energy

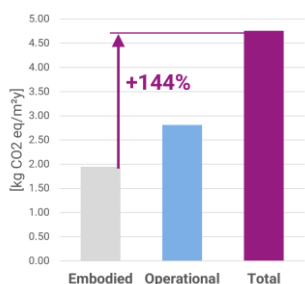


Final energy

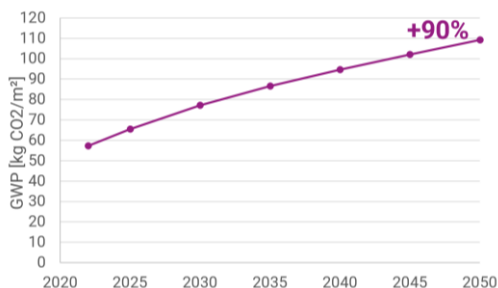


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

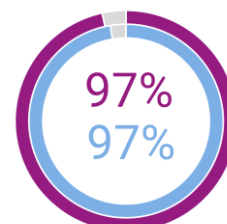


Dynamic GWP



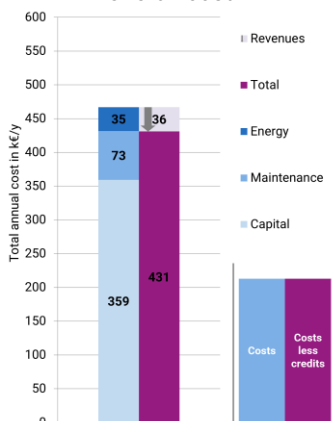
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

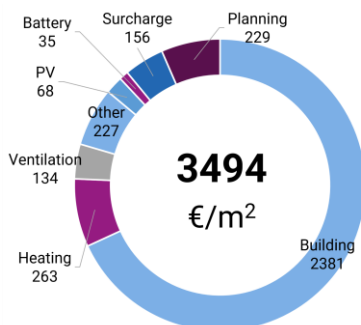


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

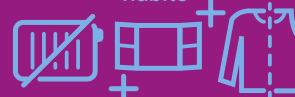
NEED

Sleeping comfortably with an adequate temperature



RESPONSE

Turning off the heating, opening windows, changing dressing habits



SOLUTION SET 1



- Mechanical ventilation through a decentralized ventilation system
- Space heating and cooling through a centralized heat pump with water storage
- Air movement through ceiling fan

LOW-RISE BUILDING

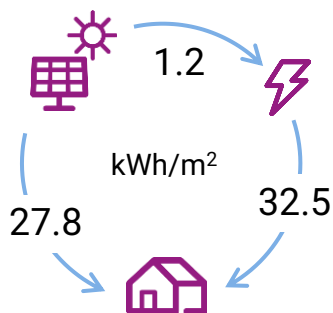
3 floors, 7 dwellings of 80-110m² each



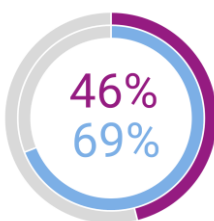
OCEANIC GEO-CLUSTER



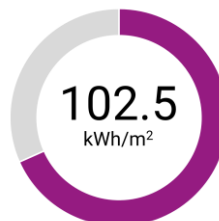
ENERGY, LOAD MATCHING AND GRID INTERACTION



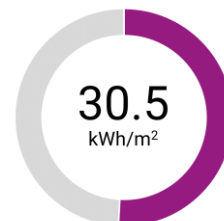
Self-generation
Self-consumption



Primary energy

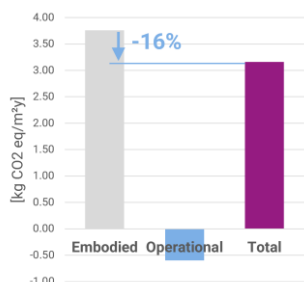


Final energy

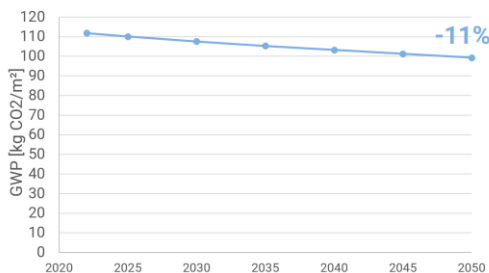


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

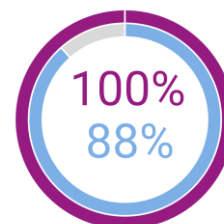


Dynamic GWP



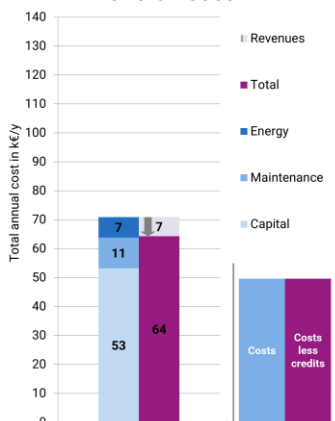
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

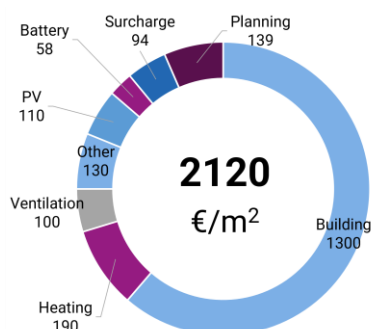


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Ventilating and being in contact with the outdoor space



RESPONSE

Opening windows



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SOLUTION SET 1



- Mechanical ventilation through a decentralized ventilation system
- Space heating and cooling through a centralized heat pump with water storage
- Air movement through ceiling fan

HIGH-RISE BUILDING

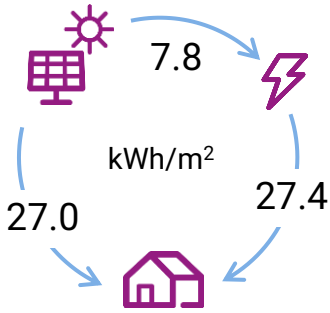
8 floors, 20 dwellings of 50-75m² each



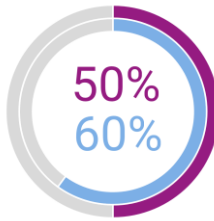
OCEANIC GEO-CLUSTER



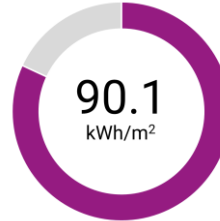
ENERGY, LOAD MATCHING AND GRID INTERACTION



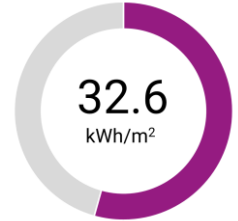
Self-generation
Self-consumption



Primary energy

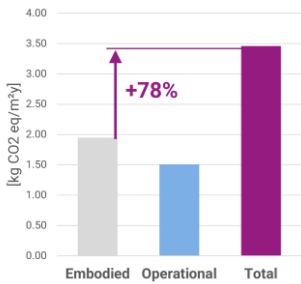


Final energy

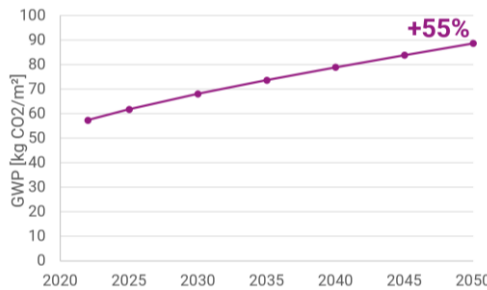


LIFE CYCLE ASSESSMENT

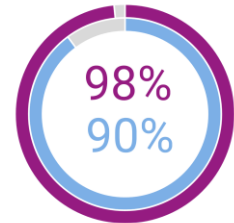
Global Warming Potential (GWP)



Dynamic GWP

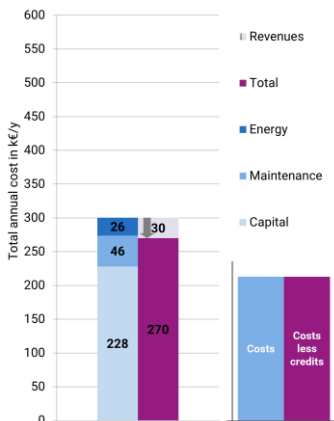


Thermal comfort
Relative Humidity comfort

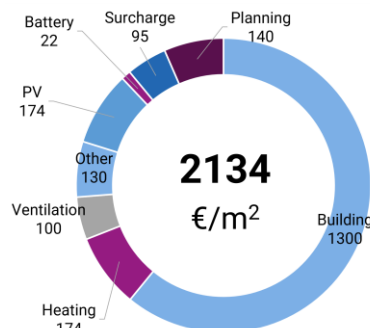


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Sleeping comfortably with an adequate temperature



RESPONSE

Cooling - having a fan always on to feel good



SOLUTION SET 1



- Mechanical ventilation through a decentralized ventilation system
- Space heating and cooling through a centralized heat pump with water storage
- Air movement through ceiling fan

LOW-RISE BUILDING

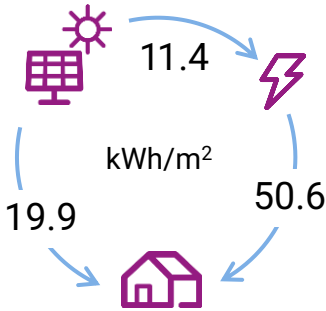
3 floors, 7 dwellings of 80-110m² each



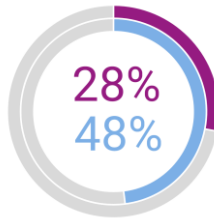
SUB-ARCTIC GEO-CLUSTER



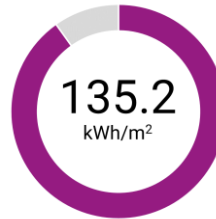
ENERGY, LOAD MATCHING AND GRID INTERACTION



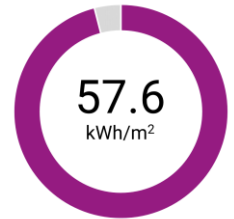
Self-generation
Self-consumption



Primary energy

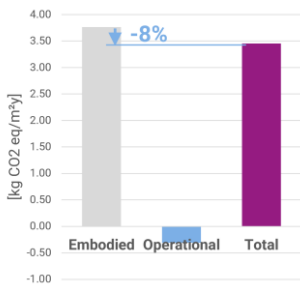


Final energy

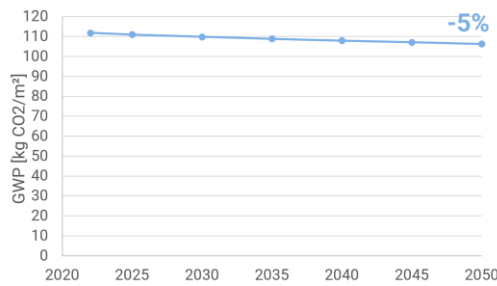


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

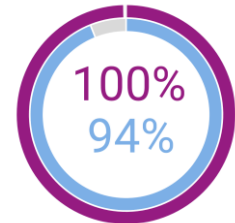


Dynamic GWP



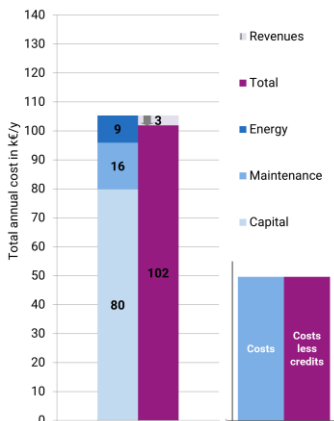
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

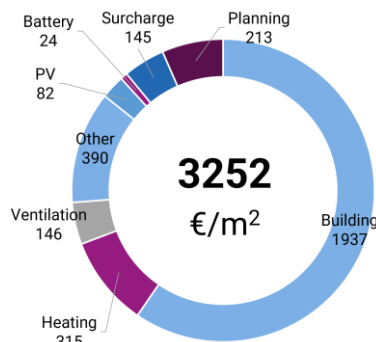


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Feeling cold/Missing a direct warmth source (fireplace)



RESPONSE

Adding an extra electric radiator



SOLUTION SET 1



- Mechanical ventilation through a decentralized ventilation system
- Space heating and cooling through a centralized heat pump with water storage
- Air movement through ceiling fan

HIGH-RISE BUILDING

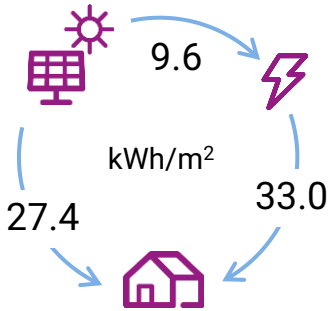
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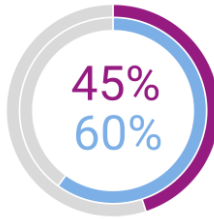
SUB-ARCTIC GEO-CLUSTER



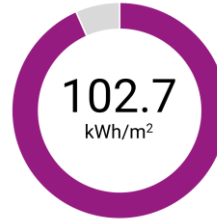
ENERGY, LOAD MATCHING AND GRID INTERACTION



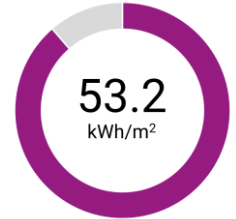
Self-generation
Self-consumption



Primary energy

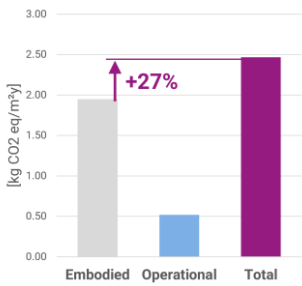


Final energy

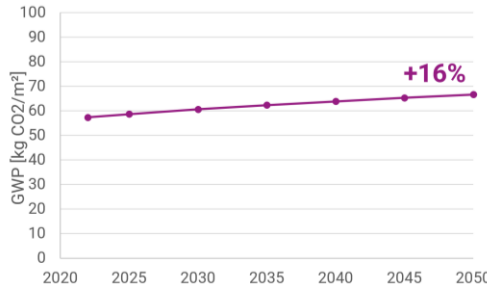


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

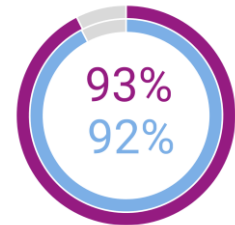


Dynamic GWP



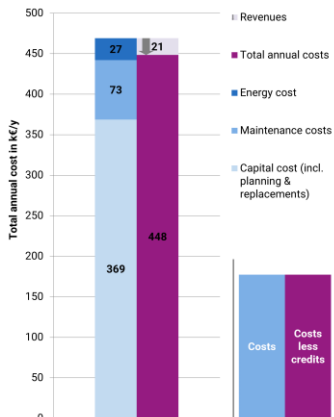
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

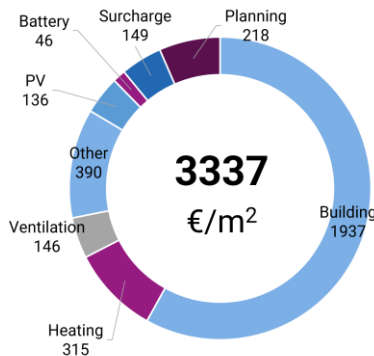


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Being in contact with outdoor space



RESPONSE

Opening windows, which interferes with the heating system and mechanical ventilation



SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

LOW-RISE BUILDING

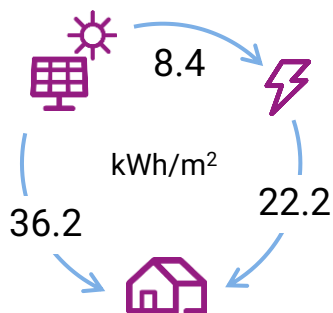
3 floors, 7 dwellings of 80-110m² each



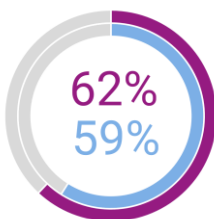
MEDITERRANEAN GEO-CLUSTER



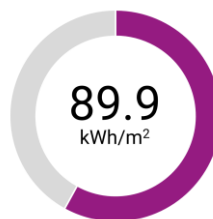
ENERGY, LOAD MATCHING AND GRID INTERACTION



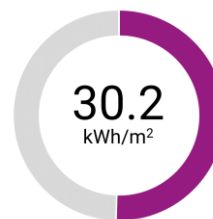
Self-generation
Self-consumption



Primary energy

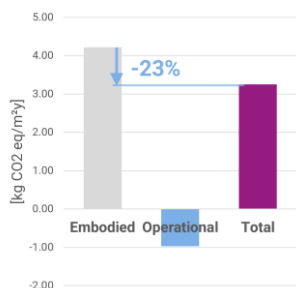


Final energy

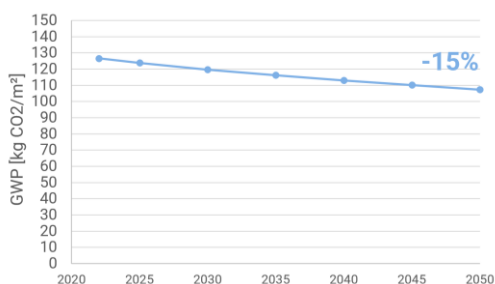


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

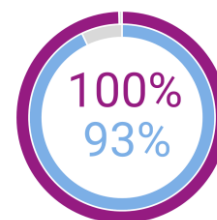


Dynamic GWP



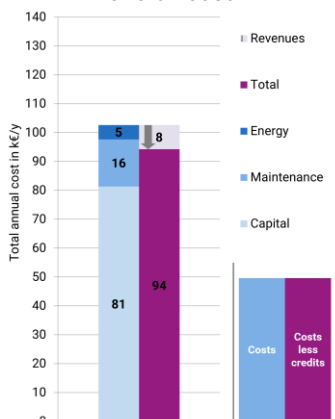
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

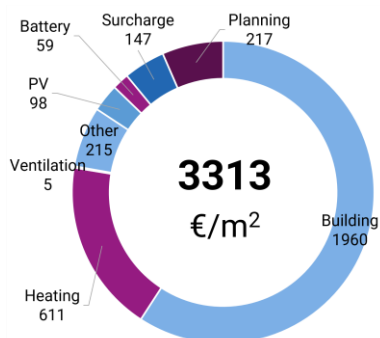


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Taking care of a loved one



RESPONSE

Extra heating by raising the temperature setpoint or adding an electric heater



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

HIGH-RISE BUILDING

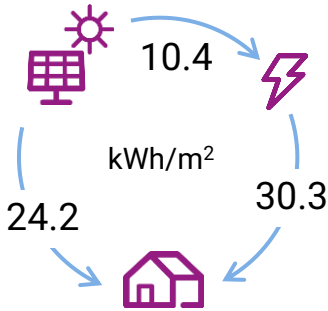
8 floors, 20 dwellings of 50-75m² each



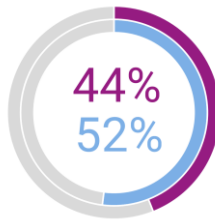
MEDITERRANEAN GEO-CLUSTER



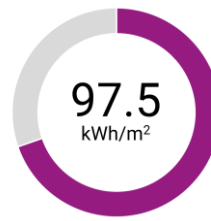
ENERGY, LOAD MATCHING AND GRID INTERACTION



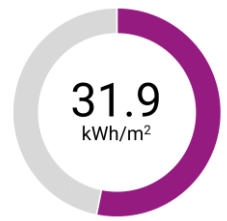
Self-generation
Self-consumption



Primary energy

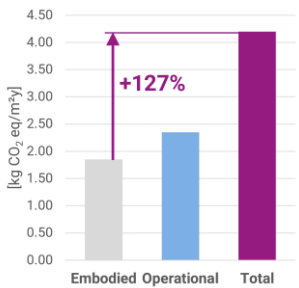


Final energy

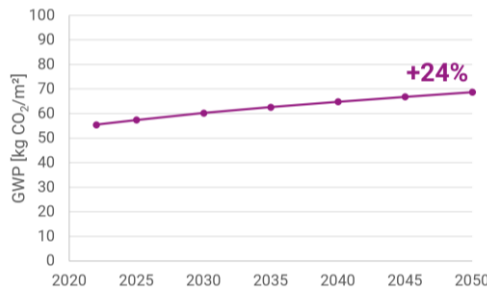


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

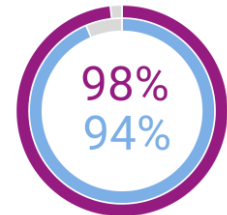


Dynamic GWP



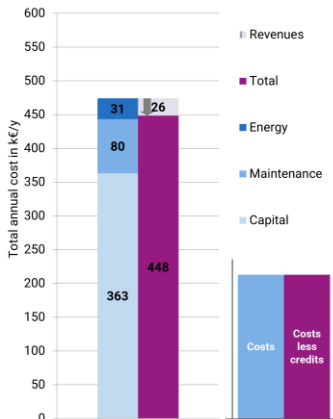
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

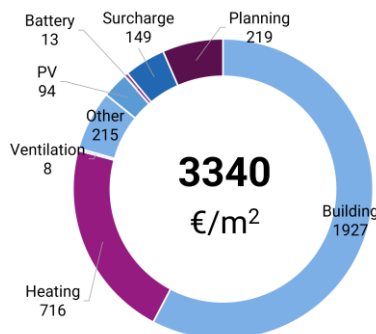


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Getting rid of cleaning odours



RESPONSE

Opening windows instead of using mechanical ventilation



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

LOW-RISE BUILDING

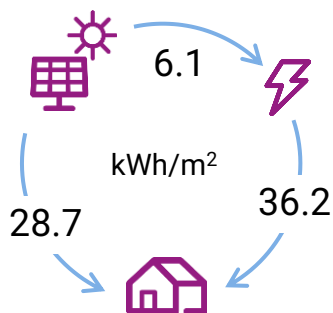
3 floors, 7 dwellings of 80-110m² each



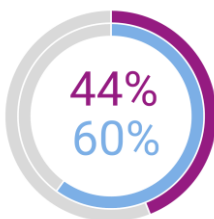
CONTINENTAL GEO-CLUSTER



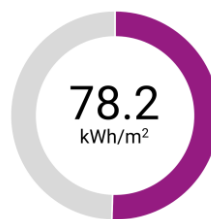
ENERGY, LOAD MATCHING AND GRID INTERACTION



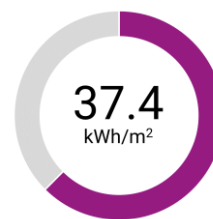
Self-generation
Self-consumption



Primary energy

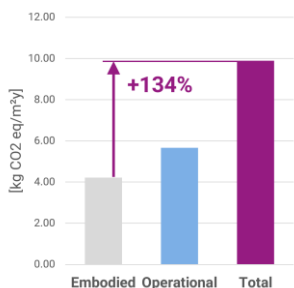


Final energy

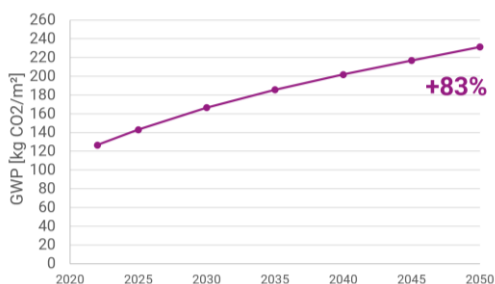


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

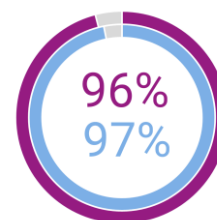


Dynamic GWP



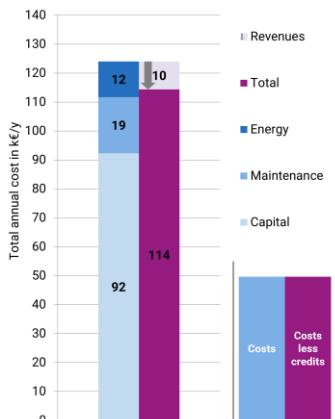
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

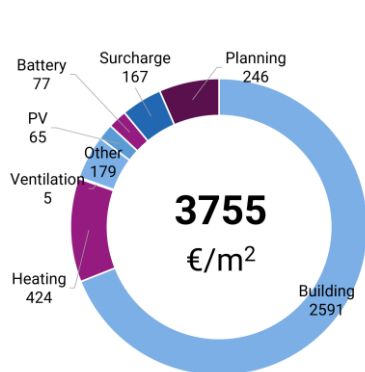


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Pleasing visitors when hosting at home



RESPONSE

Adjusting temperature to the visitors' thermal comfort expectations



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

HIGH-RISE BUILDING

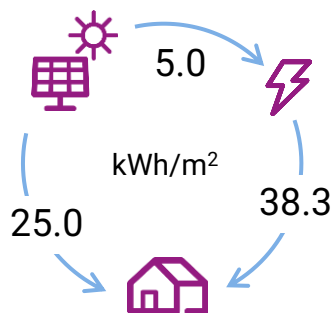
8 floors, 20 dwellings of 50-75m² each



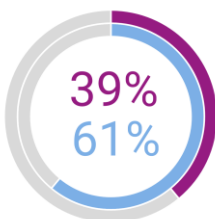
CONTINENTAL GEO-CLUSTER



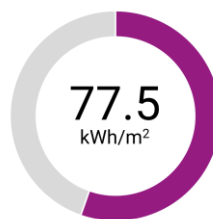
ENERGY, LOAD MATCHING AND GRID INTERACTION



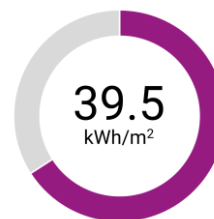
Self-generation
Self-consumption



Primary energy

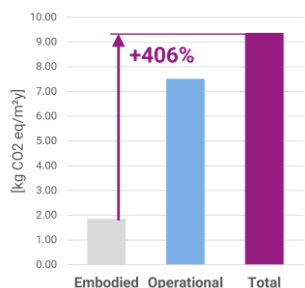


Final energy

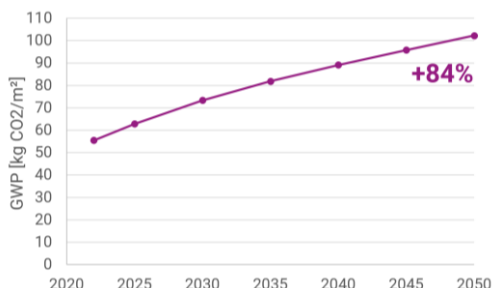


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

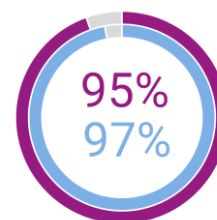


Dynamic GWP



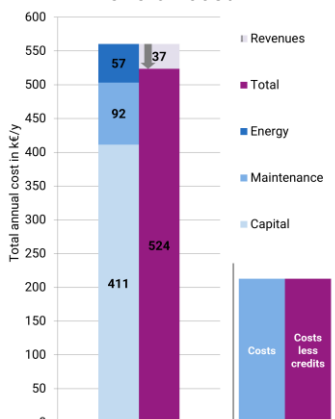
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

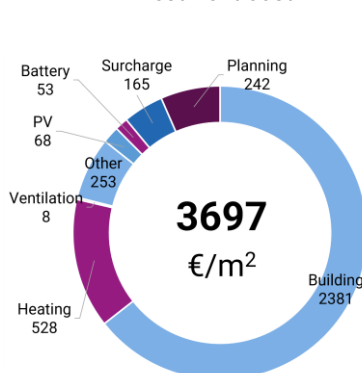


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Getting rid of cooking smells



RESPONSE

Using both mechanical ventilation and natural ventilation (creating a draught)



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

LOW-RISE BUILDING

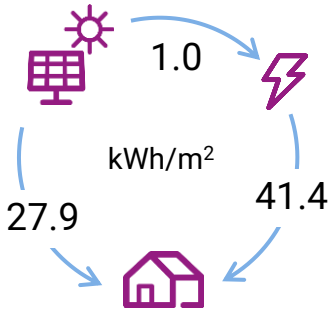
3 floors, 7 dwellings of 80-110m² each



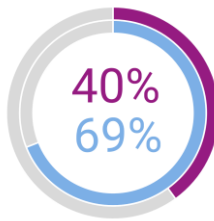
OCEANIC GEO-CLUSTER



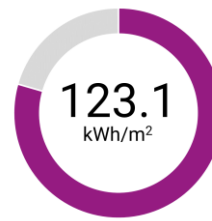
ENERGY, LOAD MATCHING AND GRID INTERACTION



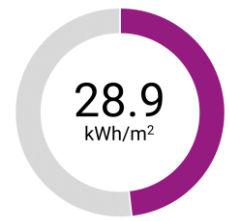
Self-generation
Self-consumption



Primary energy

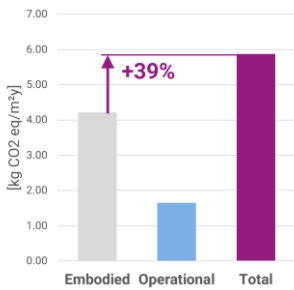


Final energy

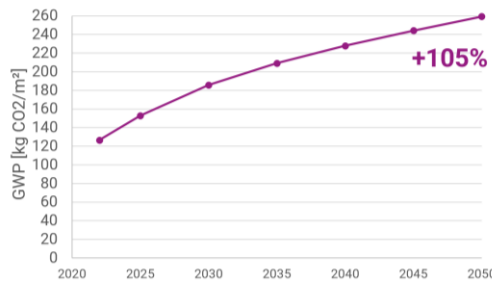


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

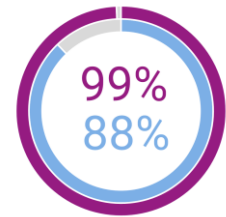


Dynamic GWP



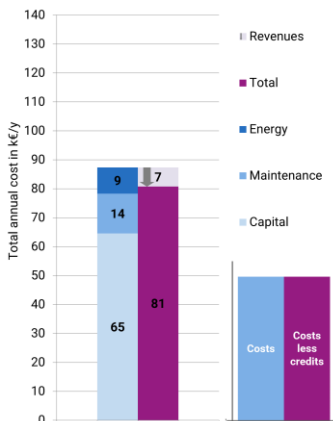
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

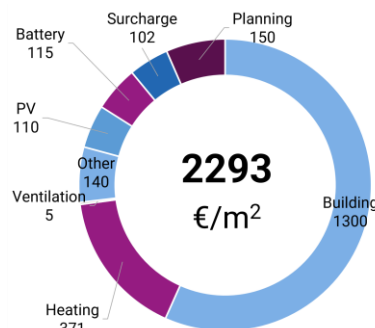


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Taking care of a loved one with special health needs



RESPONSE

Extra heating by adding an electric heater



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

HIGH-RISE BUILDING

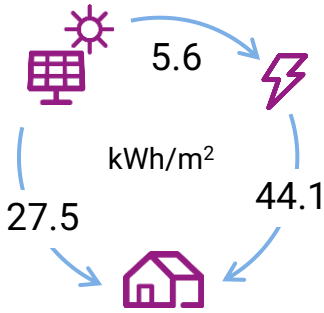
8 floors, 20 dwellings of 50-75m² each



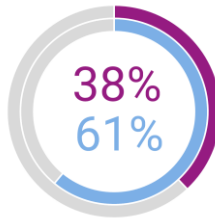
OCEANIC GEO-CLUSTER



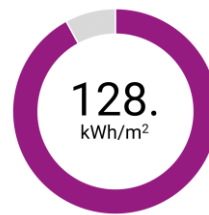
ENERGY, LOAD MATCHING AND GRID INTERACTION



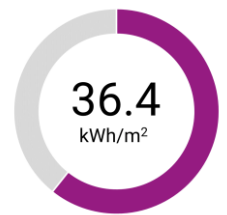
Self-generation
Self-consumption



Primary energy

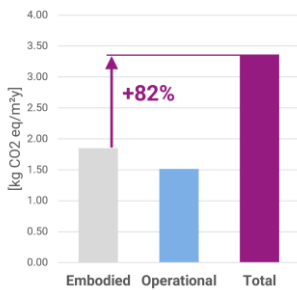


Final energy

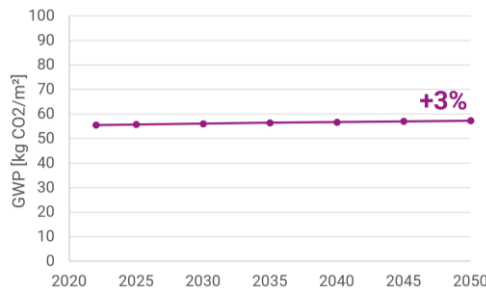


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

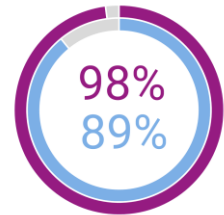


Dynamic GWP



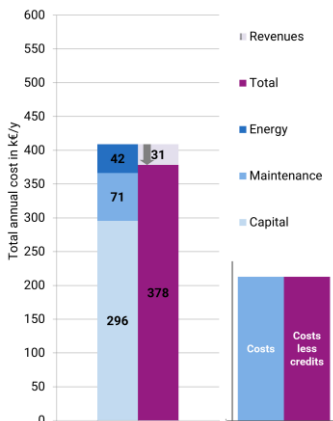
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

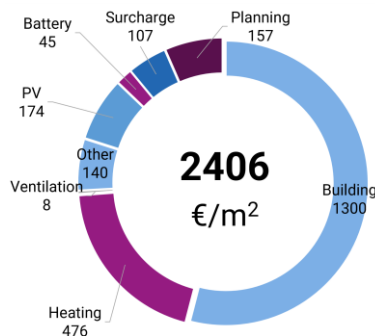


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Ventilating while having health issues (asthma, allergies)



RESPONSE

Opening windows for a short time



SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

LOW-RISE BUILDING

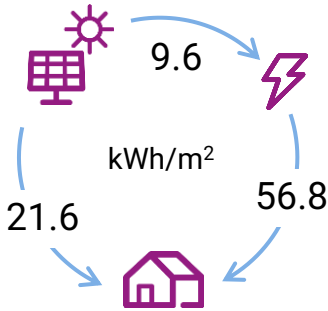
3 floors, 7 dwellings of 80-110m² each



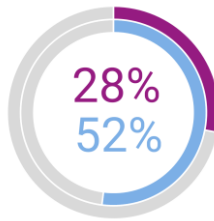
SUB-ARCTIC GEO-CLUSTER



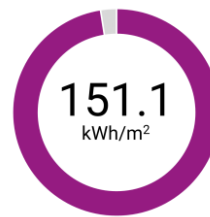
ENERGY, LOAD MATCHING AND GRID INTERACTION



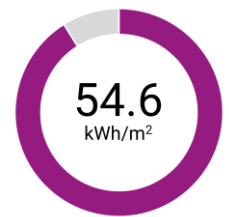
Self-generation
Self-consumption



Primary energy

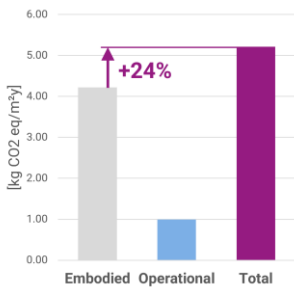


Final energy

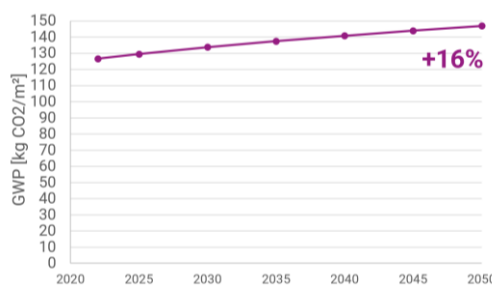


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

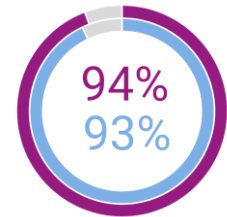


Dynamic GWP



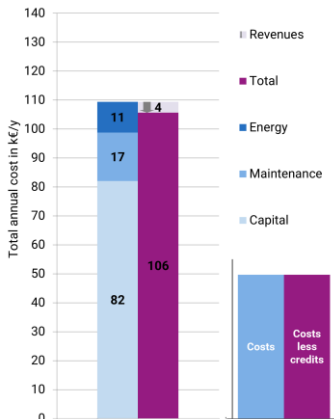
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

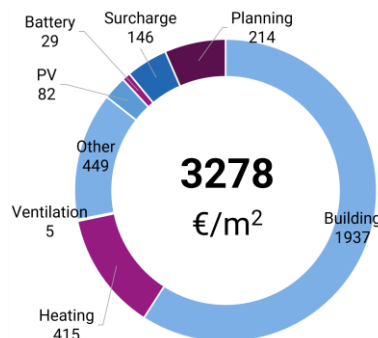


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Working easier with residents that have special needs



RESPONSE

Leaving apartment main doors open, which jeopardizes mechanical ventilation



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SOLUTION SET 2



- Mechanical ventilation through a decentralized system
- Space heating, cooling and DHW through a decentralized PHP
- Air movement through ceiling fan

HIGH-RISE BUILDING

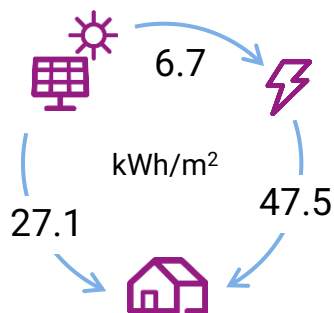
8 floors, 20 dwellings of 50-75m² each



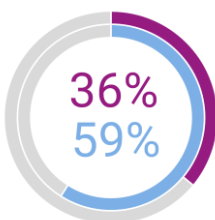
SUB-ARCTIC GEO-CLUSTER



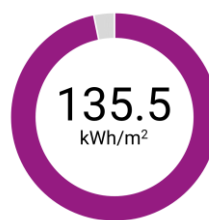
ENERGY, LOAD MATCHING AND GRID INTERACTION



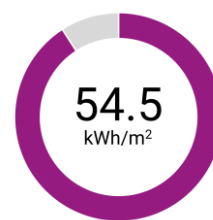
Self-generation
Self-consumption



Primary energy

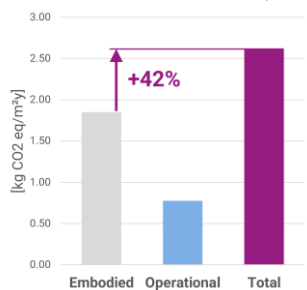


Final energy

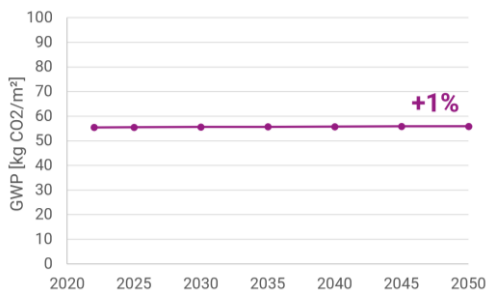


LIFE CYCLE ASSESSMENT

Global Warming Potential (GWP)

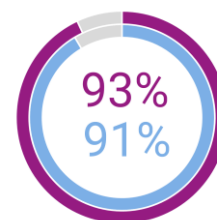


Dynamic GWP



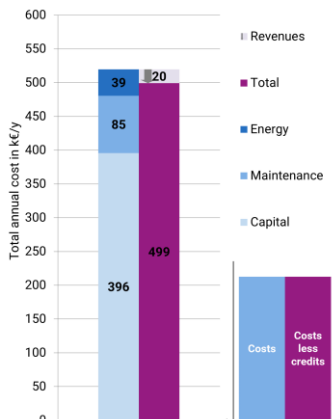
INDOOR COMFORT

Thermal comfort
Relative Humidity comfort

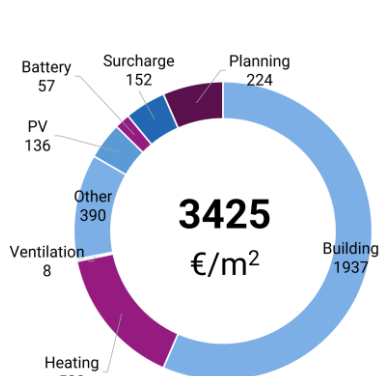


ECONOMIC IMPACT

Overall cost



Investment cost



THE RESIDENTS' VOICES

Conflicting practices

NEED

Sleeping comfortably with an adequate temperature



RESPONSE

Opening windows (having "cracked open" windows) & having appropriate duvets



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