



House renovation in Morangis – Design process and results

Living Places 2.0 - Renovation

ATELIA | VELUX | 12/05/2025 | 10820835





TABLEAU DES INDICES

VERSION	DESCRIPTION	ÉTABLIÉ(E) PAR	DATE
0	Initial	Lillan Endrass	05/05/2025

ARTELIA
Transitions et Performances environnementales
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Comfort

Energy

Environment

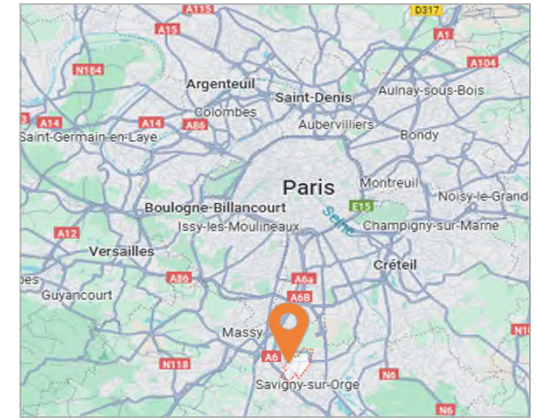


I. Project presentation

Project's description

Description and location

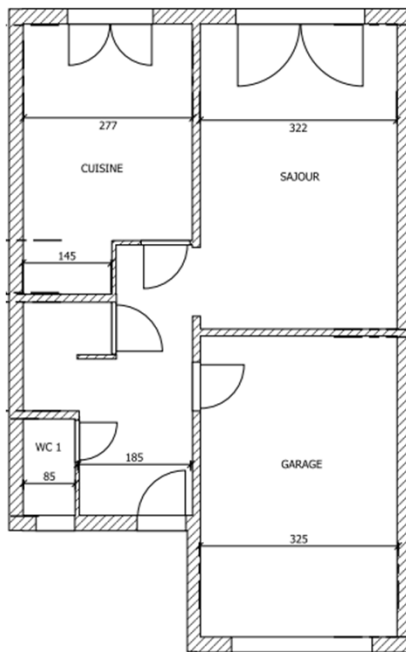
- The house is an adjoining house located in the Paris suburbs in Morangis (Essonne) in the south of Paris.
- The house is spread over a ground floor and a first floor, has a garage on the ground floor, on the street side a courtyard with a tree, and a garden at the back of the house.
- The attic of the house was not fitted out and was used for storage.



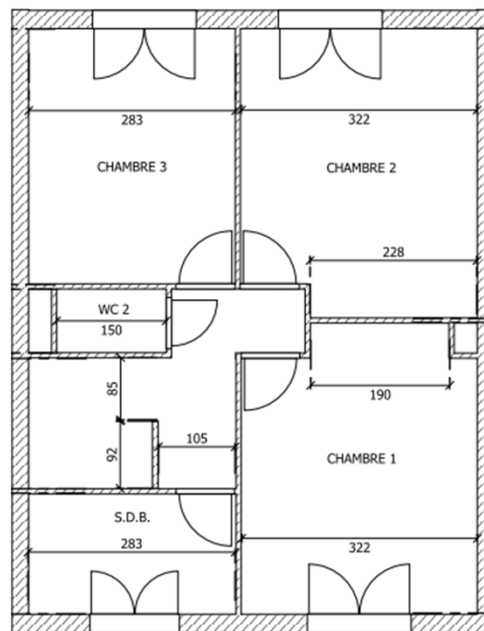
Fiche projet	
Year of construction	1948 - 1974
Surface habitable	79 m ²
Room Breakdown	Ground floor: Entrances, WC, kitchen, living room, garage, storage 1 st floor : 3 bedrooms, bathroom, WC and corridor
Heating system	Individual consensation gas boiler
Ventilation system	Single-flow ventilation for the toilets and bathroom of the 1 st floor.
Enveloppe	Absence or very poor insulation of the entire envelope, PVC double-glazed windows
Orientations	East-West

Project's description

Floor plans and external aspect



Ground floor



First floor



Measurements and studies

Scope of work and challenges



On-site measurements :

- Air Quality
- Acoustic quality
- House's materials, water device consumptions
- Temperature measurements

Theoretical calculations and simulation :

- Thermal comfort
- Energy consumptions
- Daylight autonomy
- Air quality
- LCA
- Biodiversity loss

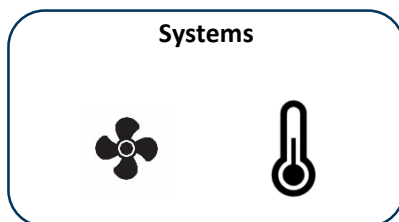
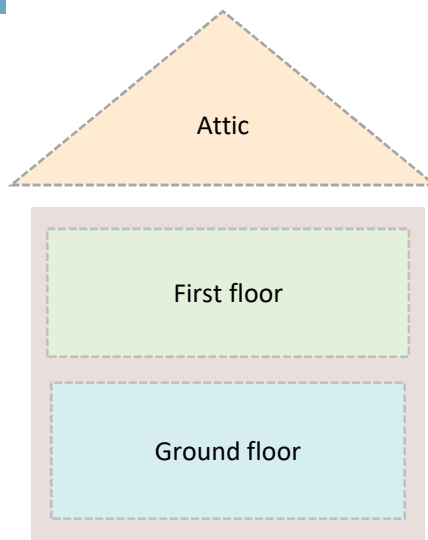


Challenges on the project :

- Improve the house's comfort, energy consumptions and sustainability according to the Active House radar – especially in the attic
- Define more specifically the scope of work, possible modifications to the original project and final work version to implement
- Experimental measurements on temperature to assess thermal comfort
- Occupied housing during works

Planned renovation work

General overview between planned works and Velux proposition



Work initially planned	Additional work or modifications by VELUX project
External insulation Velux Roof Windows Electric radiators	Internal insulation added Modification Velux types Interior cladding added
Extension of the stairs to the attic	Removal of stair risers
External insulation with polystyrene New windows	External insulation with glass wool
Wall modification between living room and garage Expansion of the entrance	Addition of insulation between living room and garage Insulation under screed Motorisation of living room's sliding doors

Initial state	Work initially planned	Modification by VELUX project
Individual gas boiler	Air/water heat pump	-
Single-flow ventilation	Insufflation ventilation system	Acoustic insulation of ducts and technical cabinet. Additional air inlet/outlet.

Details and explanation of modification are given here after

Planned renovation work

Detailed modification and explanation

Element	Explanation	Carbon impact (kgCO ₂ e/m ² SHAB)	Thermal comfort	Final choice
External roof insulation	Reflexion on changing the polyurethane insulation (Utherm) to a more sustainable material such as glass wool or wood wool.	Glass wool : - 4,78 Wood wool : - 5,45	Wood wool : -11h at T≥26°C, -14h at T≥28°C	The cost of the Utherm was more accessible and lighter.
Internal insulation – Gable and slope	Addition due to high glass surface: improving thermal resistance. Study wood wool v.s. glass wool.	Glass wool : - +1,8 Wood wool : +3,24	Glass wool : +2h at T≥26°C, -9h at T≥28°C Wood wool : -8h at T≥26°C, -16h at T≥28°C	Even though glass wool was a little less carbonated, wood wool presented better thermal comfort quality for summer comfort.
Attic floor	Reflexion on adding mass to the building for summer comfort : exchanging wooden plates to Fermacell	Fermacell : +2,63	Fermacell : -25h at T≥26°C, -30h at T≥28°C	Fermacell has a higher inertia and allows to reduce the temperature in the attic during summertime.
Velux window sizes	Reducing glass surface to improve the summer comfort.	-	-101h at T≥26°, -54h at T≥28°C	Changing 4 x 3-in-1 FFKF08 into 2 x FFKF06 + 2 x MK06
Automatization of room windows	Motorisation of windows and sun shading allow to automatically control air inlet to cool the house during night, and limit solar heat gain in summer.	Min +2	-121h at T≥26°, -126h at T≥28°C* <i>*includes a panel of modification – not only variable</i>	Motorisation of both attic windows and living room's window will allow air flow during summer nights.
External insulation	Replacing plastic based external insulation (polystyrene) by a less carbonated material with similar properties.	Glass wool : -4,78	-5h at T≥26°, -5h at T≥28°C	Wool external insulation instead of polystyrene. Additional improvement on construction site : no polystyrene marbles.



II. Key results

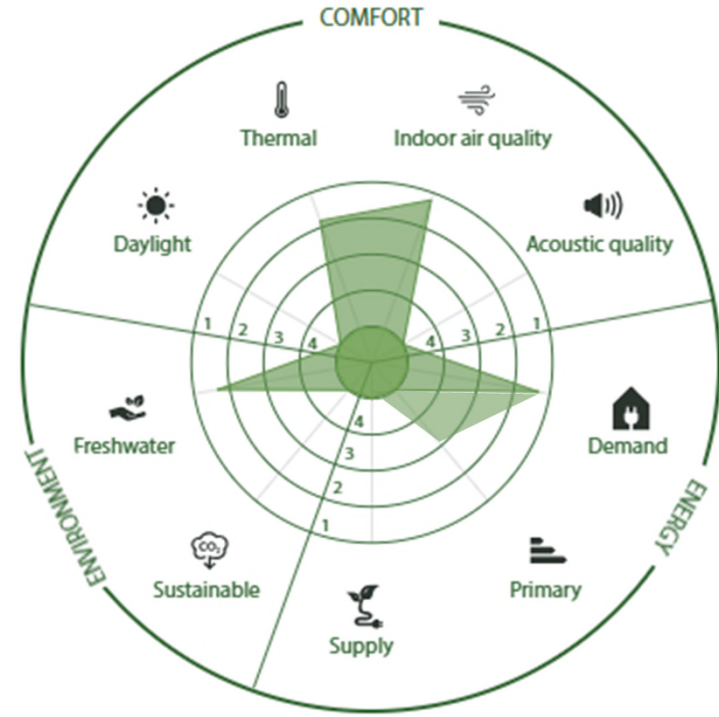
Comparison of initial house v.s. planned renovation

Active House Radar

Initial house results compared to planned works



Morangis – before works



Morangis – after works

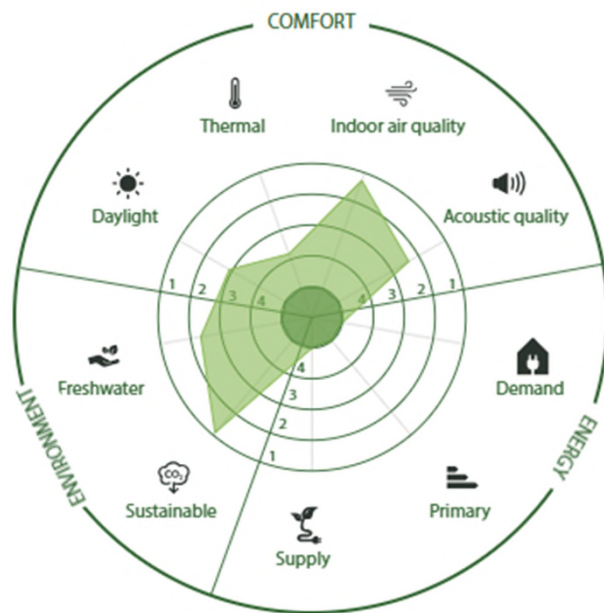
Active House Radar

Initial house results compared to planned works – Excluded ‘Out of Scope’

In the Active House radar, when the calculated value is worst then the 4th threshold, the item is ‘Out of category’ -> then the whole theme at 0.

It is however not always representative when only one room or value is ‘Out of Category’.

=> For this reasons, Active House rating has been modeled here again with **putting ‘Out of category’ values at 4** – for better comparison between project :



Morangis – before works



Morangis – after works

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Active House Radar

Initial house results compared to planned works – Table vision

	 Before works		 After works		
Active House theme	Radar	Radar w.o. Out of cat.	Radar	Radar w.o. Out of cat.	Explanation
Daylight	Out	2,9	Out	2,3 ↗	Attic space added
Thermal environment	3,8	3,8	1,8	1,8 ↗	Insulation, window changing, natural ventilation
Indoor air quality	1,3	1,3	1,3	1,3 →	<i>See specific part</i>
Acoustic quality	Out	2,4	Out	2,1	Window changing and external insulation
Energy demand	Out	Out	1,3	1,3 ↗	Insulation and heating system modification
Energy supply	Out	Out	Out	Out	No renewable energy
Primary energy	Out	Out	3	3 ↗	Reduction of energy demand
Sustainable construction	1,1	1,1	Out	3,1 ↘	Adding of new materials
Freshwater	Out	2,3	1,7	1,7 ↗	Toilet flushing modification and tap flow reduction



III. Detailed results

COMFORT

ENERGY

ENVIRONNEMENT



COMFORT



Daylight

Thermal environment

Air quality

Acoustic quality



COMFORT – Daylight

Before renovation works



Zone	Surface (m ²)	Calculated autonomy (Ac)	sDA Area in Range (%)	Compliant surface (m ²)	Active House rating
Bedroom 1	12,0	50	95	11	1
Bedroom 2	13,0	50	88	11	1
Bedroom 3	11,0	50	100	11	1
Living room	17,5	50	39	7	Out of category
Kitchen	11,8	50	55	6	3

- All rooms on the first floor have a good daylight autonomy. The kitchen and the living room, both on the ground floor have less sun entering the room, thus less daylight autonomy.
- The living room is the deepest and biggest room, explaining the out of category value, from 2%.



COMFORT – Daylight

After renovation works



Zone	Surface (m ²)	Calculated autonomy (Ac)	sDA Area in Range (%)	Compliant surface (m ²)	Active House rating
Bedroom 1	12,0	50	85	10,2	1
Bedroom 2	13,0	50	81	10,5	1
Bedroom 3	11,0	50	99	10,9	1
Living room	17,5	50	35	6,1	Out of category
Attic	37,9	50	91	34,4	1
Kitchen	11,8	50	45	5,4	3

- The daylight scoring is not changed in the renovation.
- As the living room is being expended, the compliance surface is lower in percentage as previously.
- The attic has a verry good light autonomy.

COMFORT – Thermal environment



Before renovation works



Zone	Surface (m ²)	Overshoot		(%)		Active House rating	Active House rating
		High Limit	Low Limit	High Limit	Low Limit	WINTER	SUMMER
Bedroom 1	12,0	71 h	407 h	3,1%	17,8%	4	4
Bedroom 2	13,0	65 h	549 h	2,6%	22,1%	4	4
Bedroom 3	11,0	68 h	323 h	3,3%	15,6%	4	4
Living room	18,0	62 h	44 h	2,5%	1,4%	3	4
Kitchen	12,0	19 h	9 h	2,9%	1,3%	3	4

- Thermal environment is very low mainly due to poor insulation on the house and bad ventilation.

COMFORT – Thermal environment

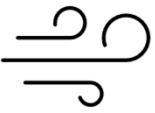


After renovation works



Zone	Surface (m ²)	Overshoot		(%)		Active House rating	Active House rating
		High Limit	Low Limit	High Limit	Low Limit	WINTER	SUMMER
Bedroom 1	12,0	3 h	0 h	0,1%	0,0%	2	2
Bedroom 2	13,0	2 h	0 h	0,1%	0,0%	2	2
Bedroom 3	11,0	3 h	0 h	0,1%	0,0%	2	2
Living room	18,0	0 h	0 h	0,0%	0,0%	1	1
Kitchen	12,0	0 h	0 h	0,0%	0,0%	1	1
Attic	25,0	11 h	0 h	0,7%	0,0%	3	2

- Thermal comfort is improved by the external insulation, window replacement, adding of ventilation and nocturn natural ventilation.



COMFORT – Indoor air quality

Before works – On site measurement



Active house radar rates only the CO2 ppm values.
The on-site measurement acknowledged the following :

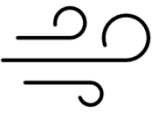
Measured element	Conclusions	
Carbon dioxide (CO2)	The average measured CO2 concentrations in the surveyed areas were higher than the HCSP guide value (800 ppm) during the measurement campaign. Nevertheless, these exceedances are logical in a home without mechanical ventilation everywhere. The concentrations measured are rarely extreme (>1500 ppm) and remain on average below 1000 ppm, which is satisfactory for this type of space.	

 No abnormalities  No risk, improvement possible  Exceeding thresholds

All rooms achieve a score of 1 for indoor air quality, except for bedroom 1 which reached the score of 2.

The average indoor air quality is good.

Other air quality indicators have been measured; they do not exceed threshold – some can be improved.



COMFORT – Indoor air quality

After works – Simulation



To assess future air quality after renovation, ie: CO2 concentration, a theoretical model has been used to run simulations.

The results and active house radar rating are given below

	Average CO2 concentration over a week (ppm)	Max CO2 concentration over a week (ppm)	Active House score
Kitchen	824	3 448*	4
Living room	1 518	5 629*	4
Bedrooms	545	1 301*	4
Attic	678	2 777*	4
Average outside (measurment campain : 429 ppm)			

*At the beginning of the simulation stage, flow rate for ventilation have been underestimated and are not entirely representative. This explains the poor performance - it will be updated with the specific ventilation planned. The score is therefore considered to be at least the same as the on-site measurements.



COMFORT – Acoustic quality

Before works - Measurement results



Measure	Location	Measured result	Regulatory threshold	Active House rating	
Indoor Airborne Noise	Living room ⇔ Neighbor's living room	49 dB (DnT;A+C)	≤ 53 dB	4	
Indoor Airborne Noise	Bedroom ⇔ Neighbor's bedrooms	48 dB (DnT;A+C)	≤ 53 dB	4	
Shock sound transmission	Living room ⇔ Neighbor's living room	64 dB (L'nT,w)	≥ 58 dB	Out of category	
Shock sound transmission	Bedroom ⇔ Neighbor's bedrooms	52 dB (L'nT,w)	≥ 58 dB	3	
Outside airborne noise	Street => Bedroom 1	31 dB	≥ 30 dB	-	
Outside airborne noise	Garden => Living room	30 dB	≥ 30 dB	-	
Equipment noise	Closed kitchen	40 dB	≤ 50 dB	4	
Internal noise	Bedroom 2	Lp = 26 dB(A)		2	
Internal noise	Bedroom 1	Lp = 26 dB(A)		1	
Internal noise	Living room	Lp = 26 dB(A)		1	

 Regulatory compliant

 Sufficient

 Insufficient for regulations

COMFORT – Acoustic quality

After works – Expected improvements



	Possible improvement	Planned work score
Airborn sound between houses	Adding of acoustic insulation on neighbours' side walls	Not included in the work scope. <i>No score improvement.</i>
Shock sound transmission between houses	Modification on neighbours' floor covering.	Out of scope. <i>No score improvement.</i>
Outside airborne noise	External insulation and new windows installation	Yes Estimated upgrade : score 2 → 1
Equipment noise	Change of heating and ventilation systems. Sound insulation planned between garage and living room, and for the ventilation box.	Hypothesis : score at 1 for all rooms, except attic and living room with a score of 2 .

ENERGY



Energy demand

Energy supply

Primary energy



ENERGY – Energy demand

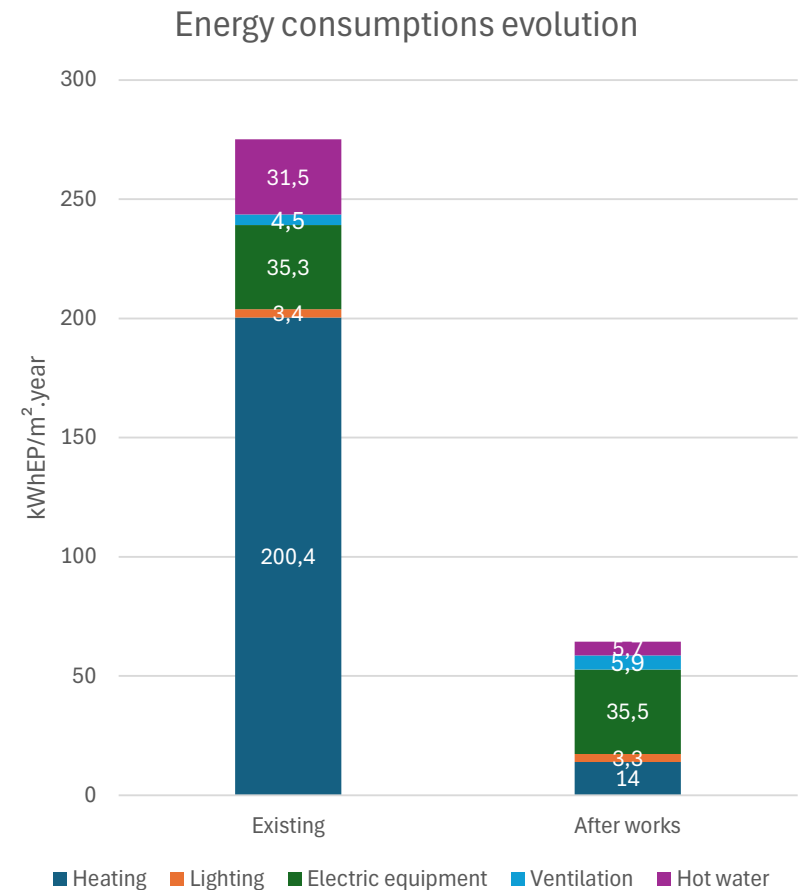
Reduction of energy consumption and energy demand



The energy demand on house are significantly lowered by :

- The house external insulation
- The window renewal
- The modification from gas boiler to heat pump
- The modification from gas to thermodynamic water heater

This allows to improve the score from 'Out of category' to **1,3**.





ENERGY – Energy supply and primary energy

Reduction of energy consumption and energy demand



The initial project and the renovation project do not include renewable energy – on energy supply these two cases are thus out of category.

Concerning energy demand, the initial project is out of score due to its high energy consumptions.

For the renovated house, the total of the primary energy demand is of 65 kWhEP/m² which allows to reach a score of **3**.



ENVIRONMENT



Sustainable construction

Freshwater consumption

ENVIRONMENT – Sustainable construction



Before works



In the initial case, we consider that no material has been added to the project.

Therefore, all the Active House radar rates are at the maximum, except for the GWP where it score at 2.

Indeed, the score 1 of Active House for GWP is a negative value, which cannot be reached without adding bio-based materials.

ENVIRONMENT – Sustainable construction

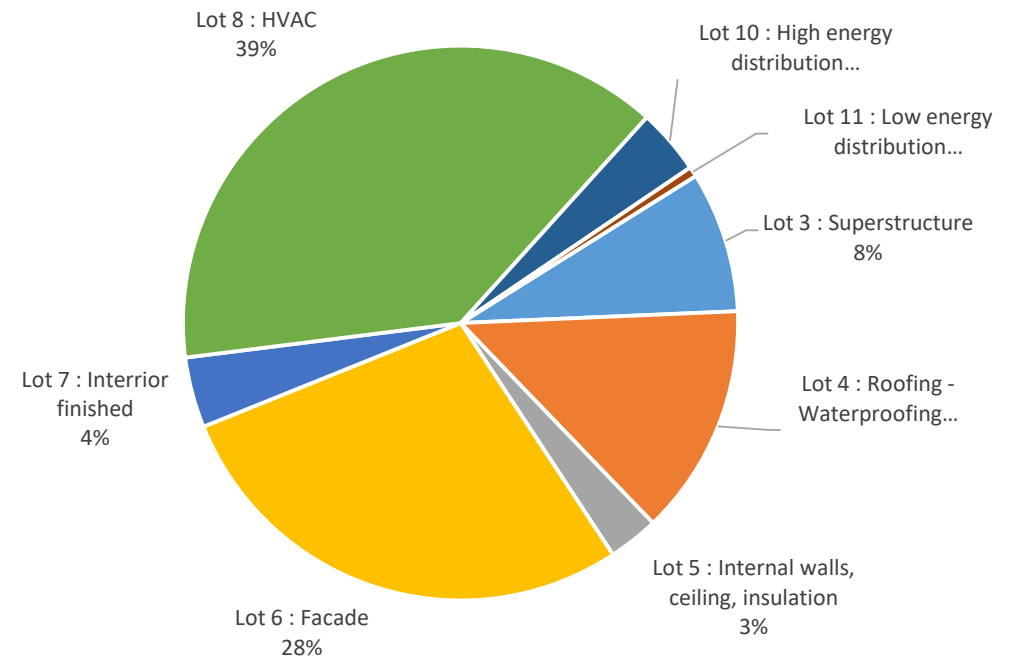


After works – GWP indicator with French RE2020



Ic Construction	Ic Construction (kgCO ₂ e/m ² SHAB)
Lot 1 : Site works	0
Lot 2 : Fondation and infrastructure	0
Lot 3 : Superstructure	28
Lot 4 : Roofing - Waterproofing	54
Lot 5 : Internal walls, ceiling, insulation	21
Lot 6 : Facade	96
Lot 7 : Interior finished	14
Lot 8 : HVAC	132
Lot 9 : Sanitary installation	0
Lot 10 : High energy distribution	13
Lot 11 : Low energy distribution	2
Lot 12 : Lifts	0
Lot 13 : Photovoltaïque	0
Total	360

GWP repartition according to french RE2020 allotment



ENVIRONMENT – Sustainable construction



After works – Other LCA indicators



Active House Radar			Score
GWP	7,2	kg éq. CFC 11/m²Sref.year	2
ODP total	1,64E-05	kg éq. éthylène/m²Sref.year	Out of scope
Photochemical ozone creation potential (POCP)	5,32E-01	kg éq. SO ₂ /m²Sref.year	Out of scope
Acidification potential (AP)	2,22E-02	kg éq. (PO ₄) ³⁻ /m²Sref.year	2
Eutrophisation potentai (EP)	7,10E-03	kg éq. CFC 11/m²Sref.year	3

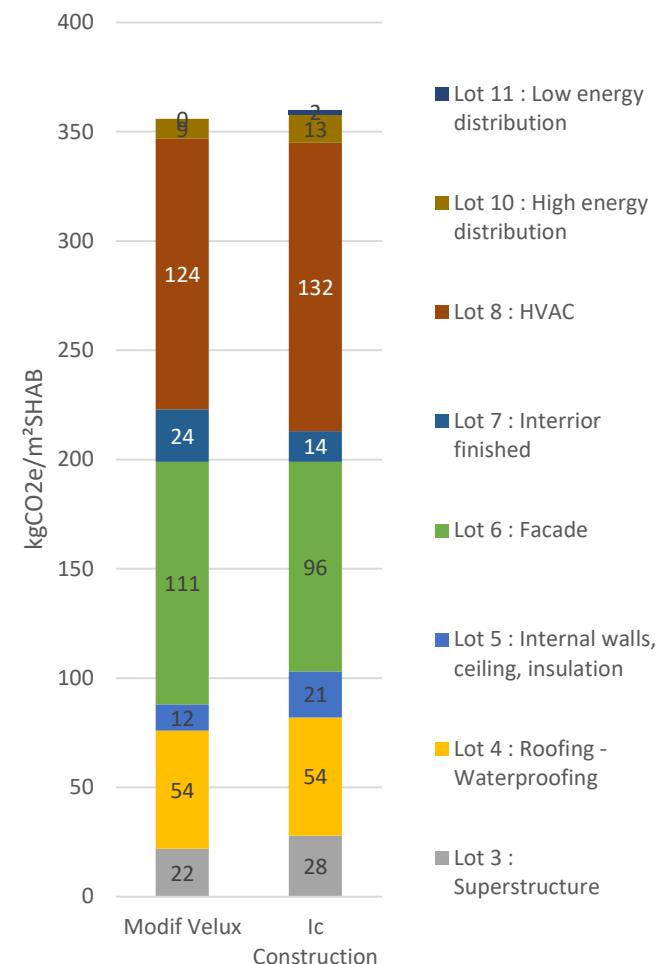
Recycled content	<5% by weight	Only flooring reused for attic	4
Recyclable or reusable virgin content	<i>TBC</i>	<i>TBC</i>	3
Responsibly sourced wood	50 %	To be confirmed	2
Declared origin	<25 %	of products with EPD	3

ENVIRONMENT – Sustainable construction



After works – Comparison initial works and modified works

Ic Construction	Base	Velux changes	Difference	Modifications, add ins
Lot 1 : Site works	0	0	0	
Lot 2 : Foundation and infrastructure	0	0	0	
Lot 3 : Superstructure	22	28	6	=> Fermacell floor, ground floor insulation
Lot 4 : Roofing - Waterproofing	54	54	0	
Lot 5 : Internal walls, ceiling, insulation	12	21	9	=> Attic internal insulation
Lot 6 : Facade	111	96	-15	=> Insulation material
Lot 7 : Interior finished	24	14	-10	=> Bio-based paint suggestion
Lot 8 : HVAC	124	132	8	=> Radiator
Lot 9 : Sanitary installation	0	0	0	
Lot 10 : High energy distribution	9	13	4	=> Heat pump meter
Lot 11 : Low energy distribution	0	2	2	=> Somfy module
Lot 12 : Lifts	0	0	0	
Lot 13 : Photovoltaïque	0	0	0	
Total	356	360	+4	
Indicative RE2020 threshold (new)				
2022	812			
2025	672			
2028	602			
2031	526			



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ENVIRONMENT – Freshwater consumption



Before and after works water consumptions

Most water consumption devices have been measured before works.

Two improvements are possible through the modification of one toilet flush and the kitchen tap water flow rate reduction.



Equipment	Water consumption	Active house rating	Recommendations	Active house rating with recommendation
Toilet flush ground floor	Single control (double dummy) – guess 6 L / flush	2	Dual flush system 3/6 L	1
Toilet tap RDC	Not measurable at audit – hypothesis 7 l/min	3	-	3
Kitchen tap	9,7 l/min	Out of scope	Installation of an aerator or flow reducer	4
Bathroom tap	5 l/min	2	Installation of an aerator or flow reducer	1
Shower bathroom	3,7 l/min	1	-	1
Toilet flush 1st floor	Dual control – supposed 3/6 L	1	-	1

It is to be noted that there also is a **rainwater collector** in the garden, allowing to reduce freshwater consumption, which is not considered in the radar's final score.

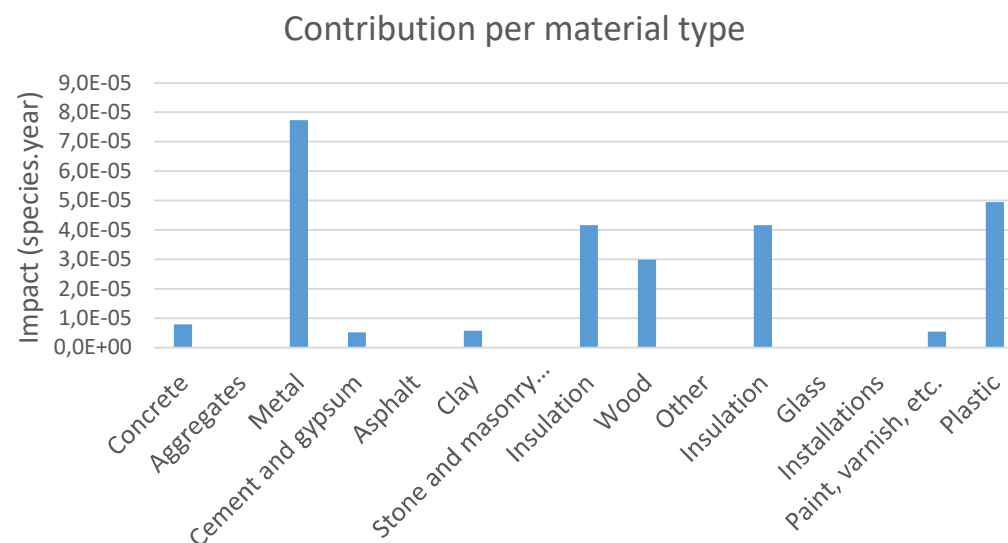
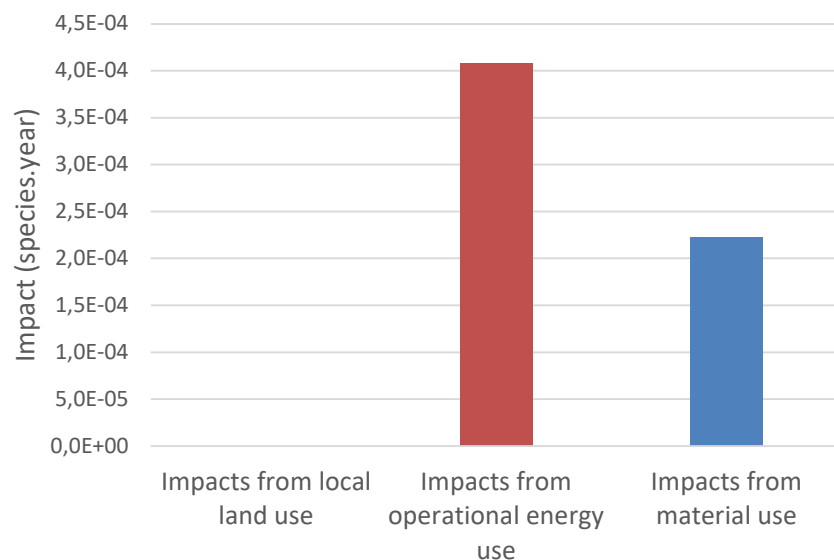


ENVIRONMENT – Biodiversity loss (out of scope)

Additional indicator : biodiversity loss



To go further, the biodiversity loss indicator has been calculated for the renovation project. For the existing project, the loss is considered void as there are no modifications. The tool used is the one developed by Doughnut for Urban Development - Life-cycle biodiversity impact tool, based on a 50-year life cycle.



- ⇒ There is only urban area on the project, ie: no impact on local land use
- ⇒ Energy represents the major impact on biodiversity
- ⇒ Metal and plastic are the two most impacting materials on the project



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IV. Detailed modification

Detailed work modification

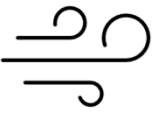


Many discussion have been going on during the design stage on how to modify the initial project, in order to improve the various indicators. These solution have been abritrated depending on technical feasibility, actual improvement calculated, owner's wishes, etc.

=> The complete detail of the on-going decision on the project can be seen here :

[Morangis evolution Excel Sheet](#)





COMFORT – Indoor air quality

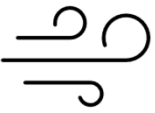
Before works – On site measurement



The other elements measured during this campaign were:

- Particulate contamination (PM2.5) and particle count
- Enumeration of bacterial flora
- Fungal flora count (yeasts and moulds)
- VOC (Volatile Organic Compounds) Index
- Benzene
- Formaldehyde
- Nitrogen dioxide (NO₂)
- Carbon monoxide (CO)
- Carbon dioxide (CO₂)
- Comfort parameters (temperature and humidity)

The results are given here after



COMFORT – Indoor air quality

Before works – On site measurement



Measured element	Conclusions	
Particulate Concentration	No abnormal accumulation of particles was detected.	
Microbiological enumeration	No accumulation of fungal flora was detected.	
Total VOCs	The concentrations of TVOC are higher than the external referent but nevertheless remain below the level 1 threshold recommended by the German Federal Environment Agency of 300 µg/m ³ . No health risk related to this parameter has been identified.	
Screening VOC	Analyses carried out in the living room and the master bedroom revealed the presence of several compounds that can be explained by exposure to cleaning products, air fresheners, the use of care and hygiene products (perfumes, deodorants, creams, lacquers) and furniture treated with varnishes or glues, these substances can accumulate there. These substances come mainly from domestic activities and materials in rooms, thus influencing indoor air quality. Regular ventilation would limit their accumulation and improve the quality of the ambient air. All the compounds found remain well below the existing reference values, no health risk has been highlighted.	
Benzene	No abnormal accumulation was identified for this compound.	
Formaldehyde	No abnormal accumulation was identified for this compound.	
Nitrogen dioxide	No abnormal accumulation was identified for this compound.	
Carbon monoxide (CO)	The CO measurements are satisfactory and well below the ANSES guideline value.	
Temperature and relative humidity	The temperature and relative humidity parameters are in the comfort zone for the two spaces investigated.	



No abnormalities



No risk, improvement possible



Exceeding thresholds





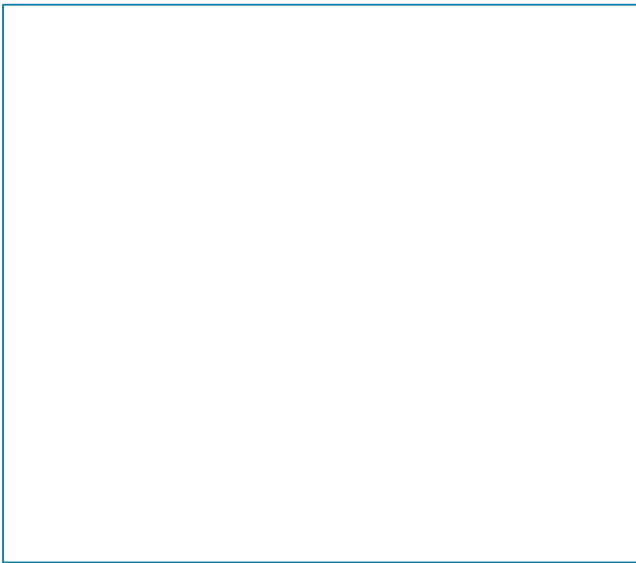












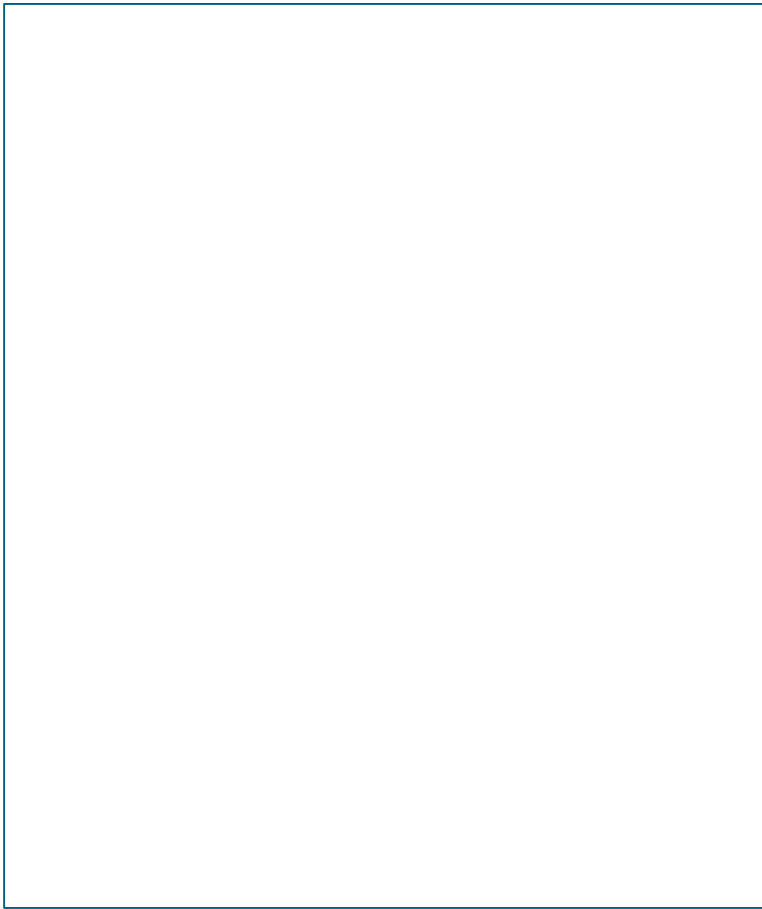










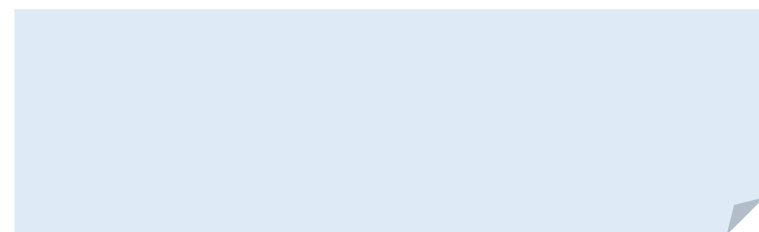




Conclusion



Votre contact



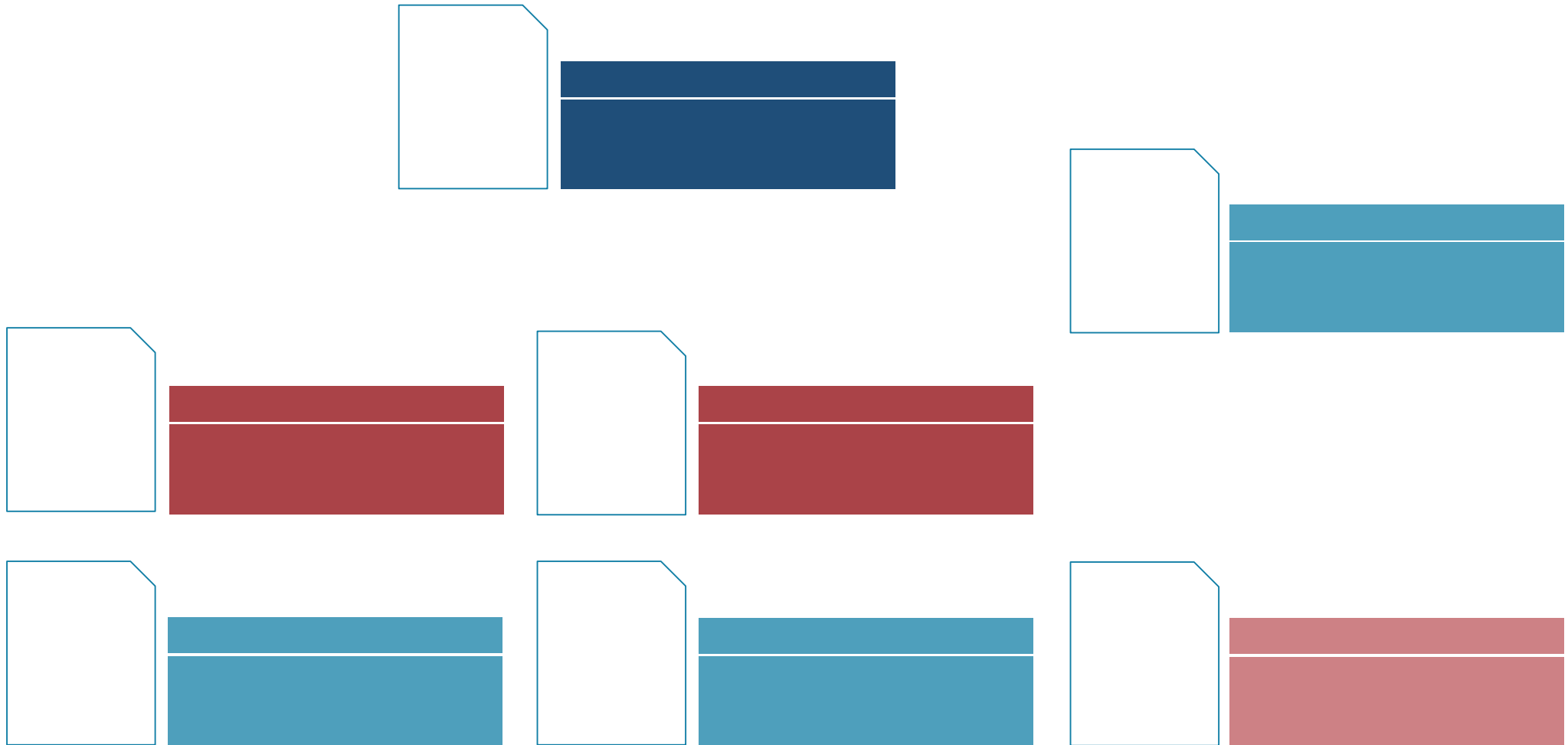
ÉLÉMENTS GRAPHIQUES

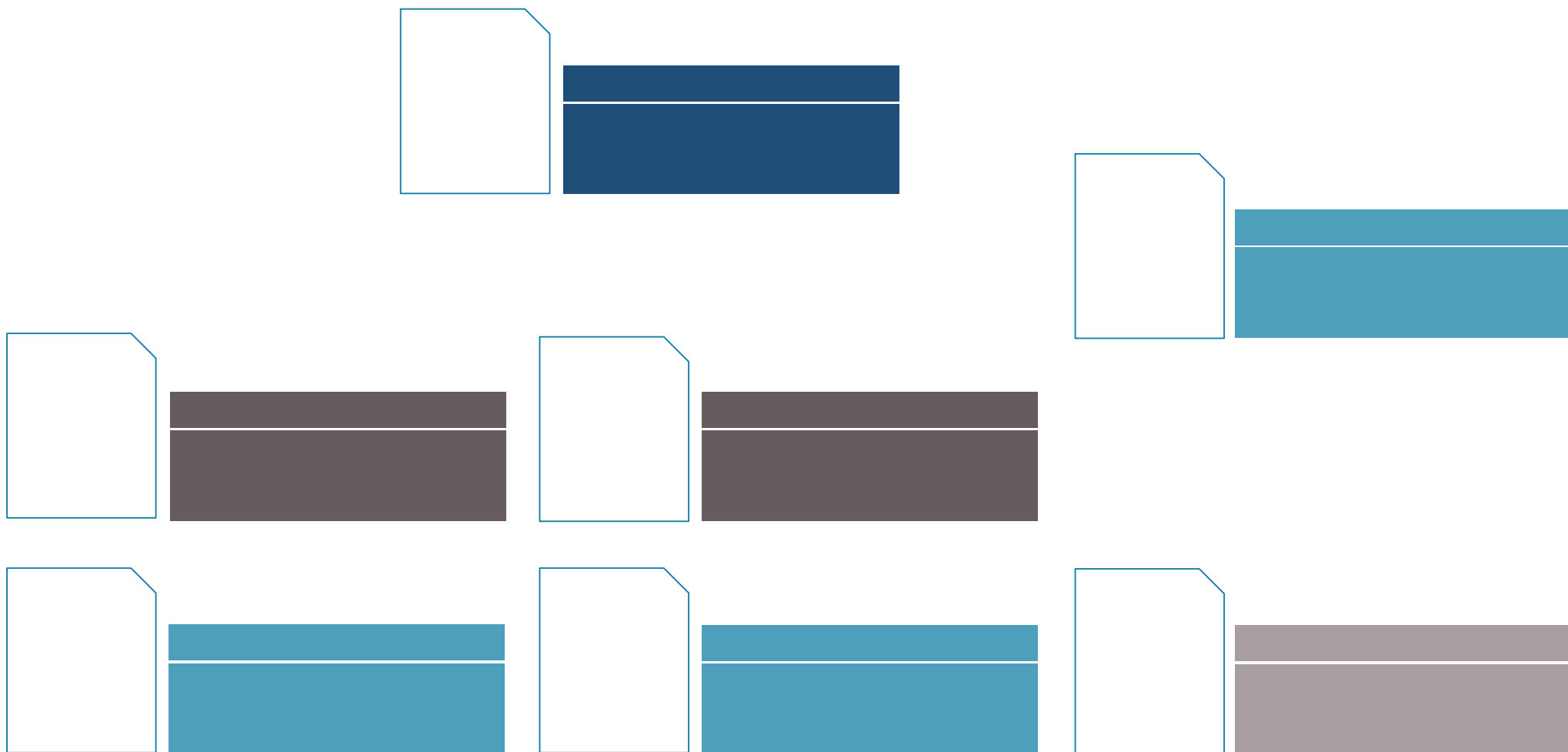


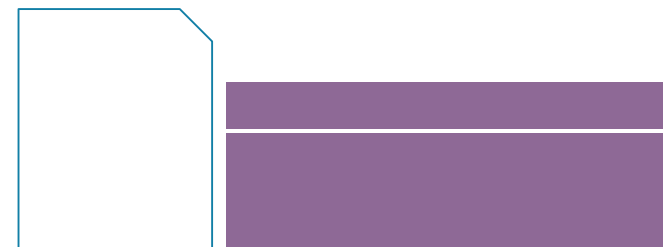
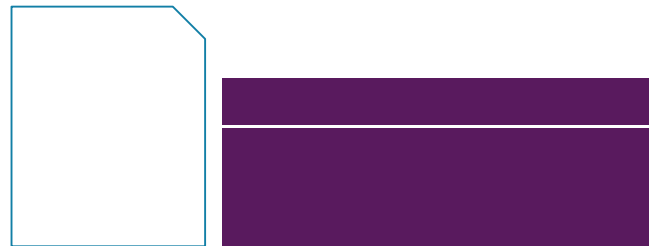
- I. ORGANIGRAMMES
- II. PROFILS CLÉS - CV
- III. PLANNING
- IV. RÉFÉRENCES
- V. CHARTE
- VI. PICTOS

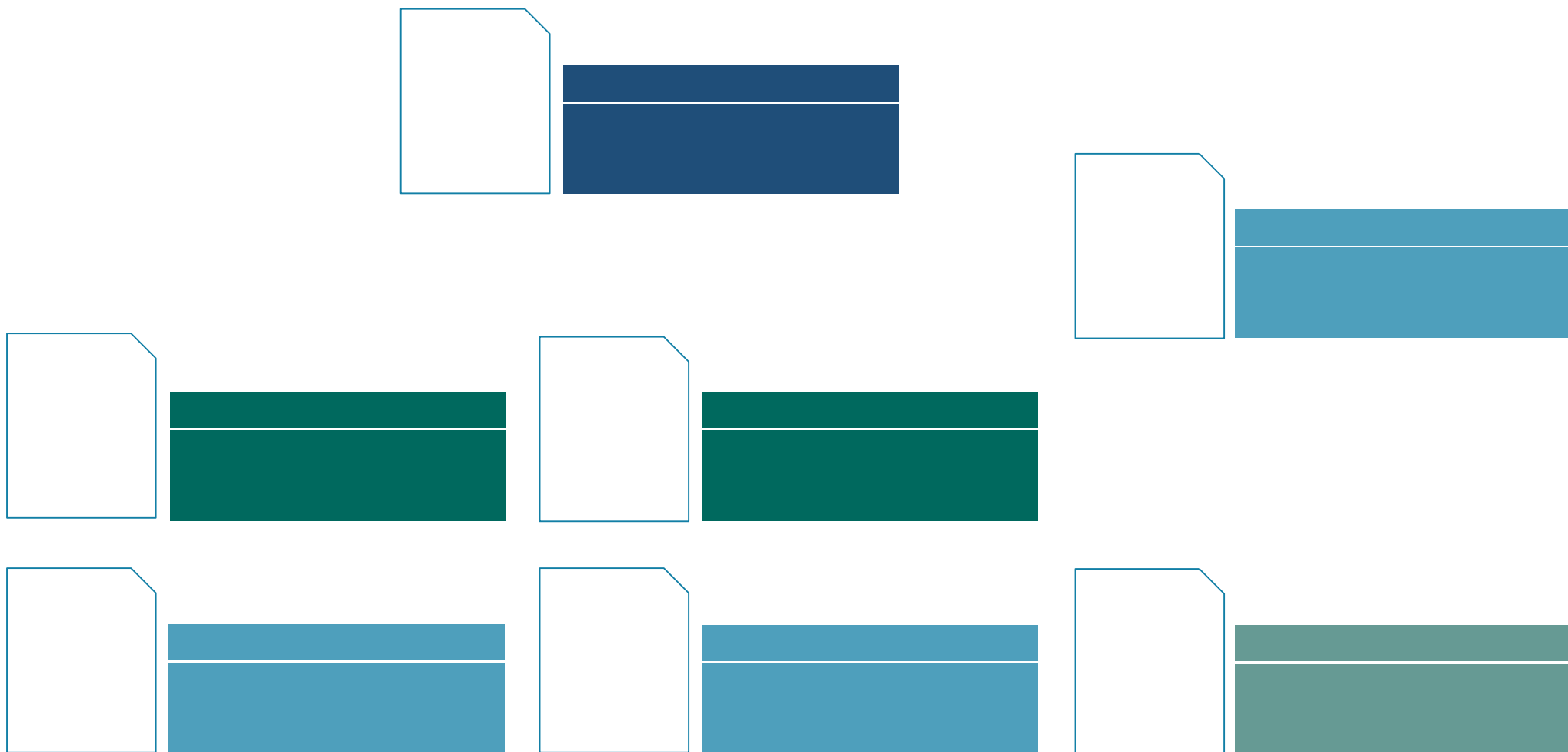
ELEMENTS GRAPHIQUES

ORGANIGRAMME (Masque : Nouvelle diapositive → Organigramme couleurs)



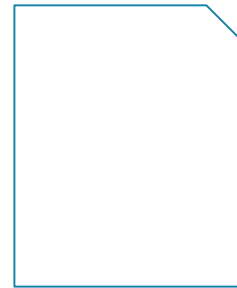
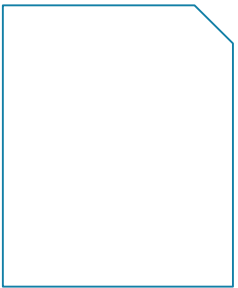
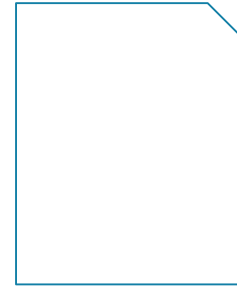
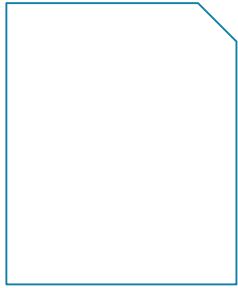






ELEMENTS GRAPHIQUES

PROFILS CLÉS (Masque : Nouvelle diapositive → Profils clés





ÉLEMENTS GRAPHIQUES

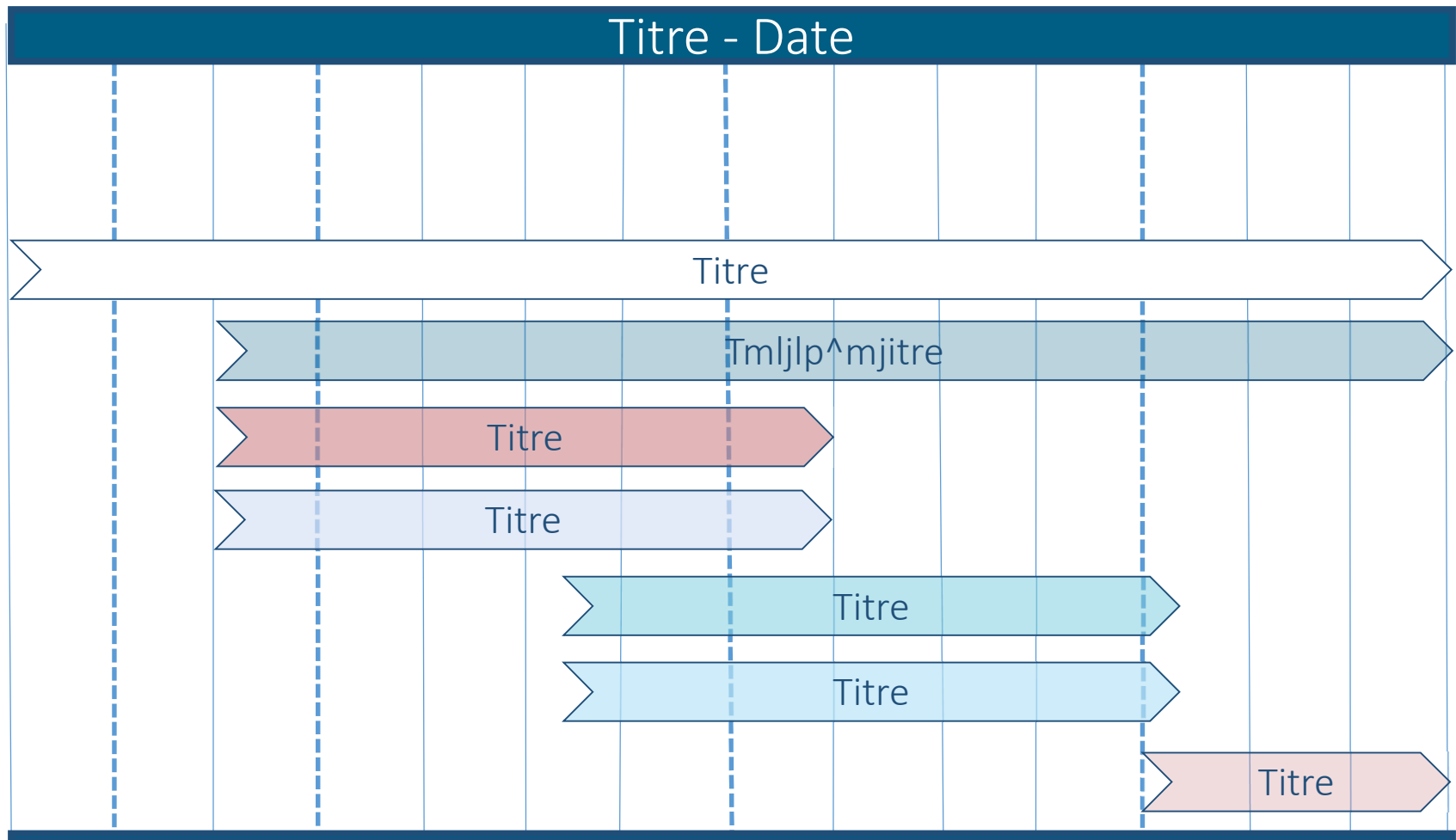
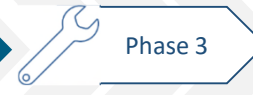
CURRICULUM VITAE

Exportation de MYCV : 1 CV / page

Copier/Coller → « conserver la mise en forme »

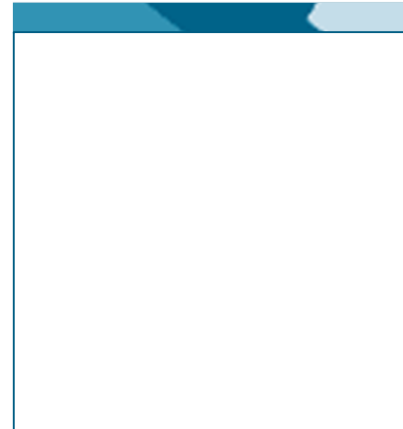
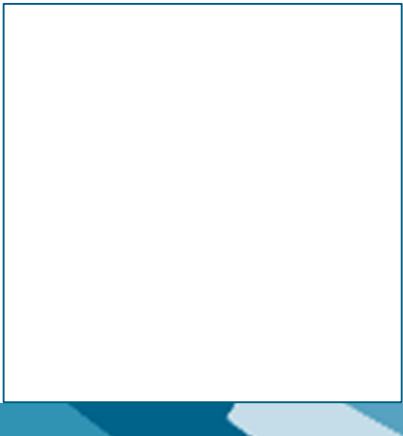
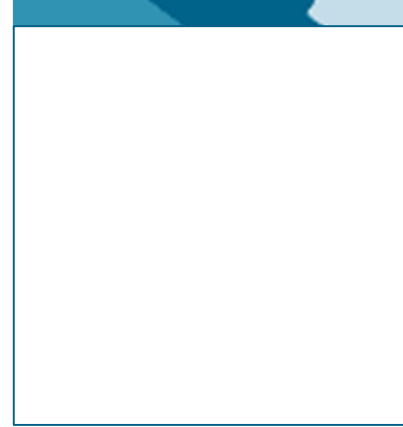
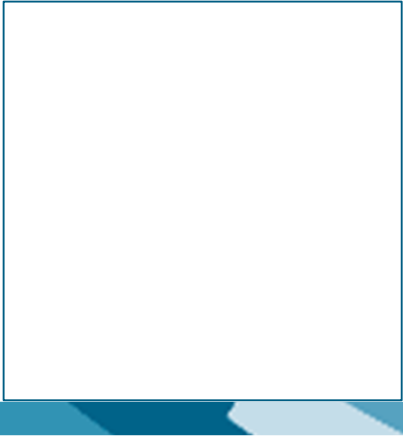
ELEMENTS GRAPHIQUES

PLANNING



ELEMENTS GRAPHIQUES

RÉFÉRENCE 1/3 – **Version courte : 4 projets/page** (Masque : Nouvelle diapositive → Référence_4 contenus)





ÉLEMENTS GRAPHIQUES

REFERENCE : 2/3

Exportation de MyREF : 1 référence/page (version 4:3)

Copier/Coller → « conserver la mise en forme »



ÉLEMENTS GRAPHIQUES

REFERENCE 3/3 : 1 référence/page

Masque : Nouvelle diapositive → projets (3 propositions) - voir ci-après.

Prestations

Client

Date

Montant des travaux



Client

Prestations

Montant des travaux





Prestations

Client

Montant des travaux

ÉLÉMENTS GRAPHIQUES

Couleurs et éléments de charte



Palette de couleurs : RVB ▼

Rouge :	0	▲▼
Vert :	93	▲▼
Bleu :	131	▲▼



Palette de couleurs : RVB ▼

Rouge :	0	▲▼
Vert :	105	▲▼
Bleu :	94	▲▼



Palette de couleurs : RVB ▼

Rouge :	172	▲▼
Vert :	68	▲▼
Bleu :	73	▲▼



Palette de couleurs : RVB ▼

Rouge :	85	▲▼
Vert :	35	▲▼
Bleu :	100	▲▼



Palette de couleurs : RVB ▼

Rouge :	102	▲▼
Vert :	91	▲▼
Bleu :	96	▲▼

ÉLÉMENTS GRAPHIQUES

PICTOS



Délai



Idée



Travaux



Risques



Conception



Maintenance

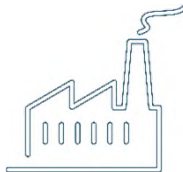
Domaines d'activité :



Bâtiment



Multi-sites



Industrie



Eau



Maritime



Environnement



Energie



Transport



Ville