**Case Study Title: Project SolarImpulse – The Power of Energy Efficiency**

As-built building photograph (Please insert only one representative picture in a landscape format, 300 dpi, JPEG)

Class room interior with window blinds down see (from inside to outside) (City of Poissy)

Outside view of the façade with exterior motorised ZIP blinds.

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|---|---|
| Project Name | **SolarImpulse - The Power of Energy Efficiency**<br><br>*name of building/project* |
| Location | Poissy – city in France |
| Climate Zone | ASHRAE/Poissy |
| Latitude/Longitude | 48°55'44.5"N 2°02'58.3"E |
| Building Type | **south- and southwest-facing facades of 15 school buildings.** |
| Floor Area [sqm] | floor area |
| Building Height [m] | building height |
| Number of Storeys | number of storeys (e.g. B2+G+4F: *ground floor is 0) |
| Completion Year | **2020** |
| Project Team | **Project Partners:**<br>**• Thermal Simulations: Alterea (Nantes, 44, https://www.alterea.fr/)** |

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| | **• Installation: Stores Seas (Rueil-Malmaison, 92, https://www.storeseas.com/)**<br>**• Zip Blinds: Shenker Stores (Thanvillé, 67, https://fr.schenkerstoren.com/fr/**<br>**• Fabrics: Mermet, External Screen Classic range (Les Avenières Veyrins-Thuellin, 38, https://www.sunscreen-mermet.fr/)**<br>**• Motors and Wall Controls: Somfy (Cluses, 74, https://www.somfy.fr/)**<br><br>*Environmental developer, architect, engineer, contractor, consultant names* |

*mock-up experiments and other research-based experiments could be included as case study, aside from actual building construction projects if similar information could be provided.

## 1. Project Description

| Project Overview |
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| *Please describe the project overview, touching upon 1) project background (100 words), 2) passive cooling intervention (100 words), 3) project achievements (100 words). [Max 300 words] (Please write the brief explanation as the detailed info can be provided in the following sections.)*<br><br>**Schools in Poissy (France) implemented a heatwave action plan in 2020, followed by phased work over three years during school holidays.**<br><br>**The aim was to limit summer discomfort without resorting to air conditioning.**<br><br>**Dynamic thermal simulation studies were carried out by the Alterea design office, to determine the most appropriate solutions.**<br>**Following these studies, high-performance fabric roller window blinds (exterior ZIP screens) were proved to be the most effective solutions with a good price-quality ratio.**<br><br>**These exterior ZIP window blinds, equipped with motorized and thermal fabrics are effective both in summer and winter.** |

## 2. Climate & Site Context

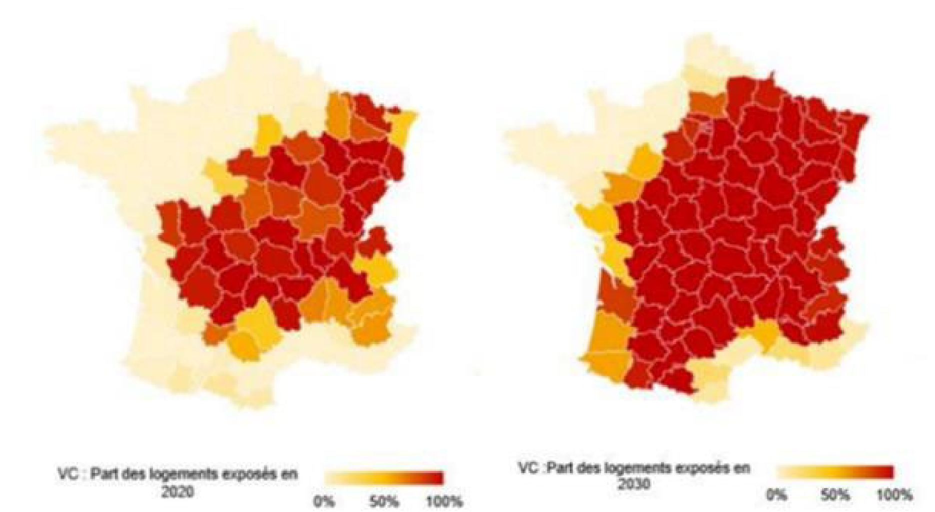
| Basic Climate Conditions | | |
|---|---|---|
| Temperature | Annual Average | XX°C |
| | Annual Range | XX°C (Month) - XX°C (Month) |
| Relative Humiditiy | Annual Average | XX% |
| | Annual Range | XX% (Month) - XX% (Month) |
| Annual Degree-Days (ASHRAE Standard 169-2020) | | HDD 18°C: XXX<br>CDD 10°C: XXX |
| **Climate Analysis** | | |

**Recent years have been marked in France by increasingly frequent and intense heatwaves, highlighting societie's inadequacy to cope with the effects of climate disruption.**

**While new buildings are taking this issue into account in specific regulations (French regulation - RE2020), this is not the case for existing buildings, which will still represent 80% of the building stock in 2050.**

**The challenge of adapting buildings to heat waves lies ahead.**

**Currently, 9.4 million homes are exposed to heat waves lasting more than 20 days in France. By 2030, this will rise to almost 21 million homes (2 out of 3) located in areas previously spared, particularly in the east and north of France.**




Percentage of households exposed to at least 20 days of heatwave per year and region.

**With climate change causing increasingly frequent heatwaves, schools and other public buildings are vulnerable to overheating. By 2030, more than 7,000 preschools in France could be exposed to heatwaves exceeding 35°C, including 100% of the schools in the Paris area. Ensuring indoor comfort without resorting to energy-intensive air conditioning solutions is vital. Excessive indoor heat can negatively impact learning conditions, health, and overall well-being. By implementing motorized solar shading systems, Poissy schools achieved improved comfort while reducing energy consumption and operational costs.**

Please describe the climate analysis for your project site. (e.g., temperature, wind, solar radiation, humidity, etc.) [Max 150 words]

**Site Analysis**

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| Please describe project site conditions that inform your building design (e.g., topography, building density, landscaping, etc.) [Max 150 words] |

## 3. Passive Cooling Design Details

| **Passive Cooling Strategies** (please tick implemented passive cooling strategies) |
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| ☐ Building Orientation & Form (site orientation, building shape, etc.)<br>☑ Envelope Design (insulation, air-tightness, shading, window system, thermal mass, etc.)<br>☐ Natural Ventilation (cross ventilation, stack ventilation, night ventilation, etc.)<br>☐ Evaporative Cooling (direct/indirect evaporative cooling, etc.)<br>☐ Ground Cooling (geothermal, ground-coupled systems, basement/underground space,etc.)<br>☐ Radiative Cooling (cool roof, night sky radiation, radiant barriers, reflective surfaces, etc.)<br>☐ Nature-based Solutions (green roof/wall, tree shading, etc.)<br>☐ Others (human behavior, clothing, semi-passive (fans, etc.)) |
| **Description** (please describe one strategy per box – you can add more boxes below if needed) |
| Please describe the feature of the adopted passive cooling strategies [Max 200 words]<br><br>**In response to rising temperatures and frequent heatwaves, the City of Poissy in France faced challenges in maintaining a comfortable learning environment for students and teachers.**<br>**Traditional cooling methods like air conditioning are costly, energy-intensive, and environmentally harmful.**<br><br>**In 2020, the city implemented a heatwave action plan, choosing to install motorized solar shading systems. These high-performance ZIP exterior window blinds were equipped with thermal fabrics designed to reduce solar gain, ensuring indoor comfort while maintaining natural light.**<br><br>**Over three years, 616 exterior motorized ZIP fabric window blinds were installed on the south- and southwest-facing facades of 15 school buildings.**<br><br>**The selected motorization allowed future automation via a centralized building management system, enhancing energy efficiency.** |
| Please describe the feature of the adopted passive cooling strategies [Max 200 words] |
| Please describe the feature of the adopted passive cooling strategies [Max 200 words] |

## 4. Active Components

**Active (Hybrid) Cooling Strategies**
(please describe one strategy per box – you can add more boxes below if needed)

**The motorizations selected can be used to automate the window blinds later (via building-wide weather sensitive centralized management.**

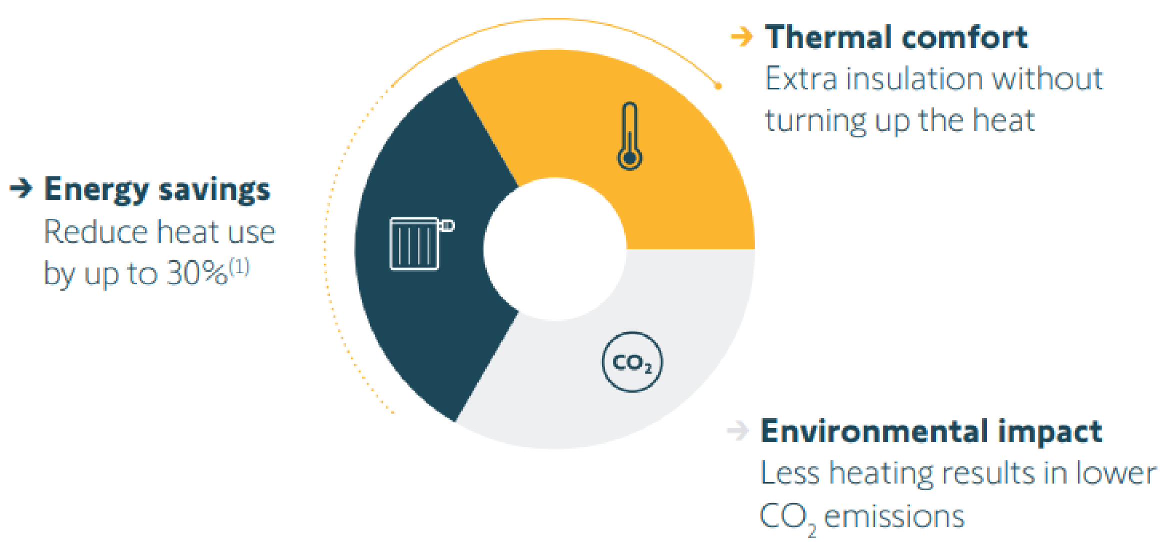
Please describe the feature of the adopted energy-efficient active cooling strategies (e.g., mechanical cooling integration (AC, fans), controlled strategies (automated shading/windows), radiative cooling, evaporative cooling, earth coupled heat exchangers, renewables, etc.) [Max 200 words]

**With automation, you can optimize the energy efficiency of dynamic shading : with automated dynamic exterior shading solutions warming up is limited to 4°C to 7°C* during heatwaves, compared to a house with no solar shading, and therefore improving home livability.**

**In winter, dynamic shading will limit the use of heating (a reduction in heating consumption of up to 30%*).**

**In summer, dynamic shading will delay the use of air conditioning (a reduction in air conditioning consumption by up to 70%). The heat released by the increasing number of air -conditioning units in the city further increases the temperature in an overheated urban environment that is difficult to cool.**

Source




Source: Somfy simulations carried out with the support of Carbone 4.

Please describe the feature of the adopted energy-efficient active cooling strategies (e.g., mechanical cooling integration (AC, fans), controlled strategies (automated shading/windows), radiative cooling, evaporative cooling, earth coupled heat exchangers, renewables, etc.) [Max 200 words]

## 5. Performance Data

| Cooling Energy Use |
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| • **The motorized blinds significantly reduced heat buildup by lowering indoor temperatures by up to 5.1°C (compared to manual blinds) which was 12°C cooler compared to the outside temperature during heatwave (39°C outside), ensuring indoor temperatures remained below 27°C during heatwaves.**<br><br>• **The dynamic shading solution resulted in an annual energy saving of 301 000 kWh compared to air conditioning systems delivering similar results.**<br><br>• **The dynamic shading solution mitigates the urban heat island effect by limiting indoor and outdoor heat emissions.**<br><br>Please describe the measured or observed reduction of cooling energy due to the introduction of passive cooling measures against baseline. (e.g. annual/peak month cooling energy, peak demand, hours of mechanical cooling, etc.) [Max 200 words] |
| **Indoor Thermal Comfort** |
| **The indoor temperature stayed below 27 °C with using the exterior motorized blinds, this was 12°C cooler compared to the outside temperature during heatwave (39°C outside).**<br>**Motorised exterior blinds achieved 5,1 °C cooler compared to old manual window blinds.**<br><br>Please describe the measured or observed improvement in indoor thermal comfort (e.g., PMV, PPD, adaptive comfort compliance, or occupants' interview, etc.) [Max 200 words] |

## 6. Financial Data

| Cost Benefits |
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- CAPEX and payback: The total investment cost for the city of Poissy: 812 000 € (around 54 000 € per school building) with expected payback in approximately 4 years.
- Yearly energy consumption avoided (in kWh): savings of 301 000 kWh/year compared with using air conditioning for the same result (Alterea Energies measurement).
- Yearly economic savings for the city of Poissy (OPEX reduction): 200 000 €/year savings compared to the cost of operating and maintaining active cooling systems.
- Lowering indoor temperatures by up to 5.1°C compared to old manual window blinds and ensuring indoor temperatures remained below 27°C during heatwaves.
- A robust, low-energy alternative to air conditioning-one that performs in both summer and winter, and that can later be integrated into centralised building management systems to optimise shading according to weather forecasts and solar intensity.
- Improved learning conditions for students and teachers, with better concentration and health outcomes.

*Please describe the financial benefits due to the introduction of passive cooling measures against baseline (e.g., positive return on investment [incremental cost versus saving operational cost], payback periods, IRR, etc.)[Max 200 words]*

*Please try to extract passive cooling cost and savings; however, if it is difficult, please annotate the premise. (e.g., the calculation includes the cost for both passive heating and cooling, etc.)

## 7. Passive Cooling Operation

| **Maintenance Requirement** |
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| Please describe the maintenance requirement to sustain the passive cooling performance [Max 150 words] |

## 8. Lesson Learnt / Recommendations

| **Technical Challenges, Solutions and Achievement** |
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| Please describe the challenges and solutions of passive cooling strategies in the design/construction/operation phase [Max 150]. |
| **Financial Challenges, Solutions and Achievement** |
| Please describe the challenges and solutions of passive cooling strategies from the financial perspective (e.g., what are the factors of incremental costs (e.g., imported materials, lack of labor skills, additional analysis cost, etc.), and how could these be mitigated (e.g., tax rebate, preferential loans, subsidies, business incentives, etc.) [Max 150]. |
| **Other Challenges, Solutions and Achievement** |
| Please describe the challenges and solutions other than the two above (e.g., capacity of design professionals, material availability, cultural resistance, users' low awareness, etc.) [Max 150]. |

## 9. Free Description

| **Free Description** |
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| **Key factors for successfully reproducing this case study:**<br><br>**• Maintain a healthy indoor environment for teachers and students, with an acceptable indoor temperature and without the use of air conditioning (energy-consuming solution).**<br>**• A minimum of yearly energy consumption avoided (in kWh).**<br>**• The choice of solar shading and the implementation of associated automation systems than can help building managers to improve solar shading management.**<br>**• Visual and interior comfort for teachers and students: glare, concentration, impact on student health, noise reduction.**<br>**• Well-known solutions with an established network of installers that can support local collectivities for the adaptation of their buildings**<br><br>**Out of this project the company Somfy that took care of the motorization part of the exterior blinds is now a partner of the EduRenov program (Banque des Territoires*) which aims to finance the renovation of 10 000 school buildings by 2027.** |

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| *Please describe the information that could be useful to readers (e.g. replicability of case studies, tips on design and material specifications, cost information, etc.) [Max 300].* |

## 10. Annex

| Supporting documentations |
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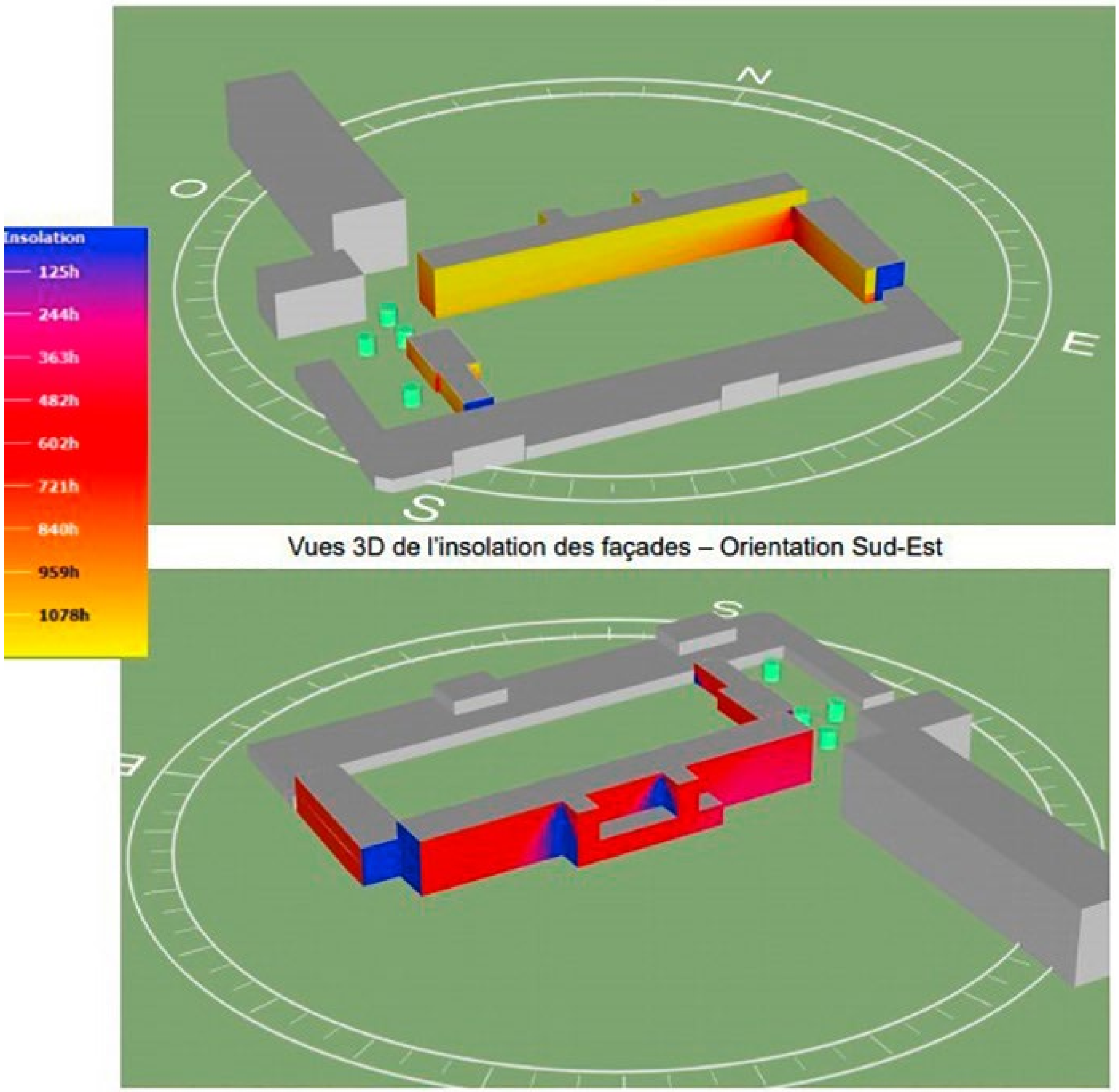


Vues 3D de l'insolation des façades – Orientation Sud-Est

Vues 3D de l'insolation des façades – Orientation Nord Ouest

Dynamic thermal simulation on a building school to investigate the overheating risk.

Please insert any complementary visual materials such as drawings, analysis, performance data, thermal fluid simulation imaging, 3D rendering, as well as descriptions to explain those, etc.

## 11. Citation

| Citation |
| --- |
| Energy efficient renovation – automated dynamic shading – healthy buildings – heatwaves |

## 12. Contact

| Contact Person | |
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| Organisation | ES-SO  European Solar Shading organisation |
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