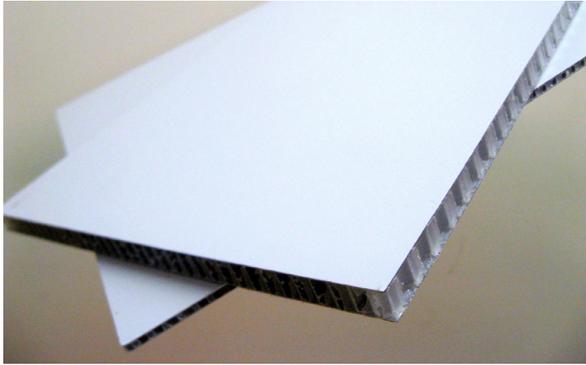


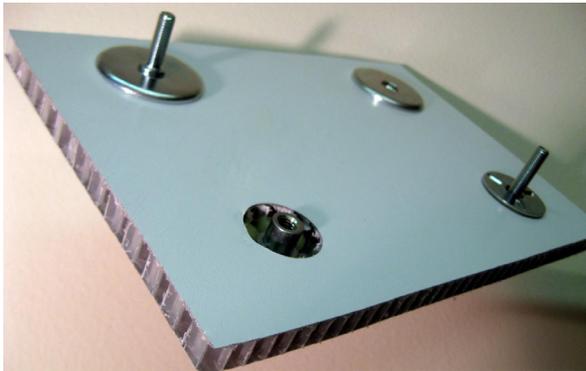
## INNOVATIVE COMPOSITE PANELS WITH STEEL SKINS



**Steel sounds heavy already as we hear the word, but ways to make it lighter are now available. It is not a modification of the material as such but the smart hybridizing of steel with a light weight honeycomb structure that makes “steel” less massive.**

Steel is one of the most common engineering materials in the world. It is a fundamental resource used in a variety of industries for constructing buildings, infrastructure, tools, ships, automobiles, machines, appliances or weapons. It is known for centuries as an incredibly strong and tough construction material.

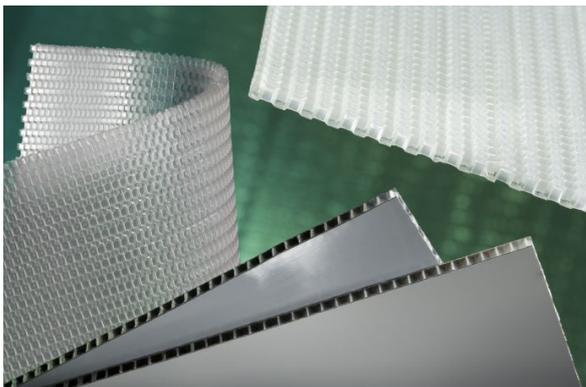
EconCore combined its thermoplastic ThermHex honeycomb core with steel skins into a well balanced material system. Outstandingly low weight of this solution compared to any solid metal sheet is just one of the product features. After gaining know-how and through optimisation of interfacial bonding and efficient structural design, EconCore explored the steel - thermoplastic hybrid product, proving its excellent mechanical performance-to-weight ratio.



Due to ultra small size of honeycomb core cells, with cell diameters as small as 3 mm, a very smooth surface of the sandwich panel is achieved, even if the metal skin thickness is below 300µm. The 3 mm cell size allows for a 4-5 mm thick panel, but the same production process can make panels up to 40 mm in thickness.

High stiffness, low weight, good thermal insulation, magnetic properties as well as smooth surface (coloured if needed) make the ThermHex product a first line candidate for use in many applications, including panels for interior and exterior cladding, visual communication, solar energy, elevators, rolling stock, automotive and trucks, ship building and many others.

ThermHex technology for Steel Composite Panels is an obvious nominee for a mass production process where production costs can be kept low by use of the patented high speed EconCore production process.

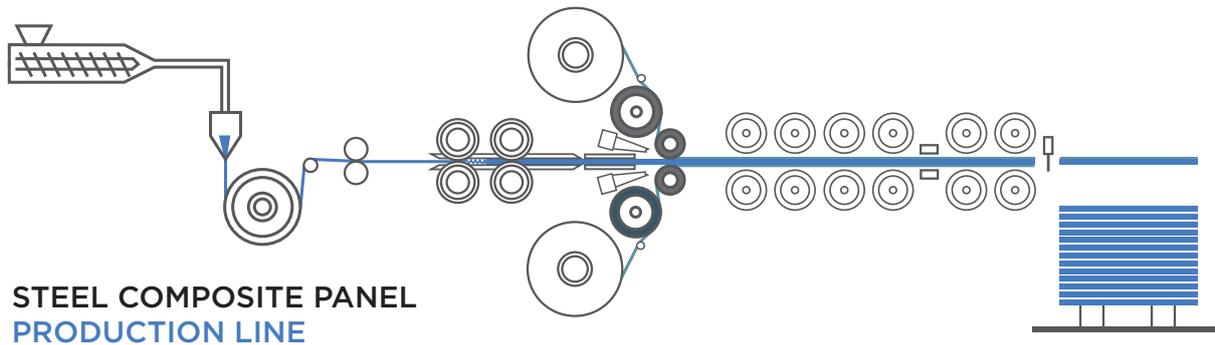


### Key advantages:

- Produced using a highly efficient continuous process
- High flexural stiffness
- Low weight
- High aesthetics
- High thermal insulation capabilities
- Eco-friendly and recyclable

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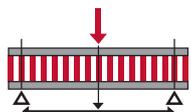
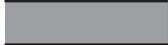
At the starting point of the production line, a thin polymer film is extruded and converted into a honeycomb core using the patented ThermHex technology. In a second production step metal skins are applied and bonded on top of the lightweight core to create a sandwich panel. This all done in the same production line and the different production steps are logical steps in the continuous production line. Even a number of post-processing operations can be integrated in-line with the panel production, adding additional value to the product.



The performance of the Steel Composite Panel is evaluated by means of a three point bending simulation. To demonstrate its load bearing capacity, the hybrid is examined at two different span length conditions and compared to typical construction materials.

On the left side of the table, a 5 mm thick ThermHex panel was compared to a 0.68 mm solid steel sheet. The Steel Composite Panel shows an enormous improvement of stiffness compared to solid steel sheet at equal weight.

On the right side of the table, a 10 mm ThermHex honeycomb panel with steel skins was compared to a typical 16 mm plywood board. The Steel Composite Panel shows the same stiffness as the plywood board with flexural modulus of 6300 MPa and density of 800 kg/m<sup>3</sup>. The wooden board is however more than factor of 2 heavier than the hybrid panel !

| Solid Steel   | Steel ThermHex Composite Panel  |  | Plywood  | Steel ThermHex Composite Panel  |
|---|---|---|--|---|
|  |  |   |  |  |
| 0.68  | 5.0   | Panel thickness (mm)  | 16.0   | 10.0  |
| -   | 0.3   | Skin thickness (mm)   | -  | 0.3   |
| 10N / 500 mm  |   | Load level / span length  | 100N / 1000 mm   |   |
| <b>16.0 *</b>   | <b>0.2</b>  | <b>Flexural deflection (mm)</b>   | <b>3.2</b>   | <b>3.2</b>  |
| <b>5.3</b>  | <b>5.3</b>  | <b>Panel weight (kg/m<sup>2</sup>)</b>  | <b>12.8</b>  | <b>5.8</b>  |

80 times better stiffness at equal weight

7.0 kg/m<sup>2</sup> weight reduction at equal stiffness

\*The 0.68 mm steel panel demonstrates high initial deflection due to high weight of the panel itself; mentioned value represents the incremental deflection.