

More with Less

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Building material manufacturers and construction companies are searching for options to run their businesses more sustainably, with more social responsibly. Reducing the environmental impact from construction activities is the priority. "More with Less" is the slogan. Players in the construction chain, from architects and consultants to contractors and building material manufacturers are faced with questions and orders involving designing more sustainably, with better building insulation, and are asked to apply alternative construction methods using sustainable construction materials. This demands an innovative approach from building material manufacturers in order to ensure their company's continuation.

Brick slips as a sustainable facade cladding according to the Trias Ecologica

There is a long tradition of brick production and use, and bricks are always seen as sustainable in the sense of a long lifespan. People will continue to use bricks, but there is also a market for brick slips. De Boer Machines/NL and Instalat/NL have developed a concept that enables sustainable production of brick slips as facade cladding using much less raw material and with less impact on the environment by manufacturing according to the Trias Ecologica standard. The 3 steps of the Trias Ecologica standard are:

- Step 1: reduce the demand for raw materials and products
- Step 2: to as great an extent as possible use sustainable raw materials and products to meet the demand
- Step 3: use non-sustainable raw materials or products as effectively as possible for the remaining demand

Step 1: reduce the demand for raw materials and products

In addition to aesthetics, brick slips also have a protective function in the construc-

tion of homes and non-residential buildings. This is realised in construction systems for new construction and renovation with external insulation. Brick slips are applied to protect the external insulation from arson and damage. Brick slips are also applied to plaster that is susceptible to moisture, to prevent cracks, mold, moss and algae. The result is aesthetically pleasing facades inside and outside, sustainable, non-toxic, maintenance-free, shape-retentive and colourfast.

Due to the infinite choice of formats, shapes, ceramic colours, surface structures and top layers with all kinds of minerals in many colours and colour patterns, buildings can have their own character appropriate to the surroundings that take the client's preferences into account. These brick slips can also be an addition or alternative to wall tiles inside and outside.

De Boer Machines fulfils the 1st step of the Trias since water-struck, moulded and hand-shaped brick types can now also be manufactured directly as brick slips without loss from sawing. Innovative shaping methods are used to accomplish this, so that brick slips can be formed directly with the original moulded, hand-shaped or Pe-



Fig. 1 The 3 steps of the Trias Ecologica standard

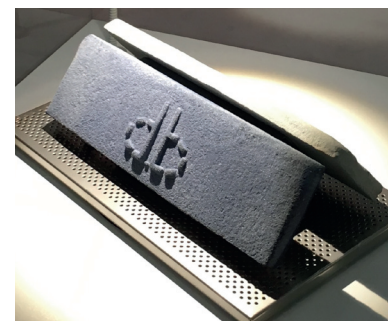


Fig. 2 Moulded brick slips manufactured by De Boer Machines

tersen water-struck appearance and properties turning each strip into a unique one, without repeating structures. The applicable hand-shaping principles are Hubert, Aber-son or Handformatic. In addition to the natural structures, internal and external reliefs

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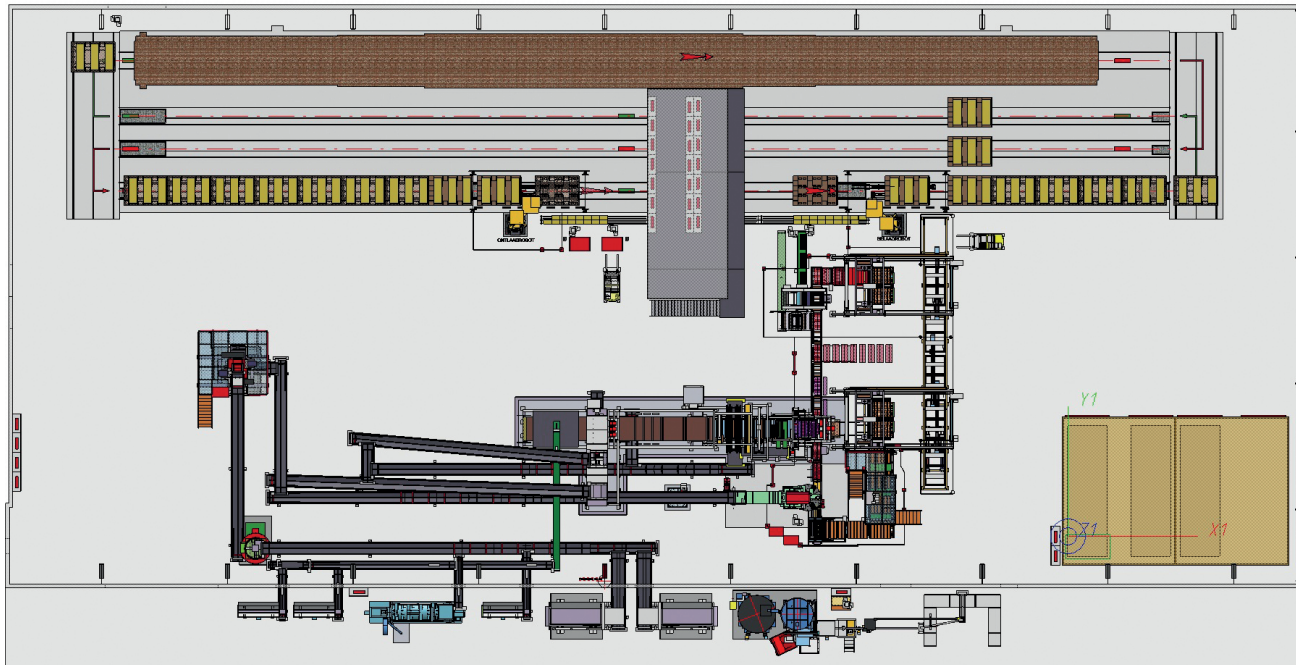


Fig. 3 Joseph Bricks: 1st of Instalat's and De Boer Machines' customers ready to manufacture direct brick slips according to the Trias Ecologica standard

or lettering on the brick slips are options as well, even in batch manufacturing or mass production.

Additionally, the direct production of brick slips allows for rapid switching of product types, an absolute necessity to meet the requirements of the current market. Due to the flexible manufacturing method, production can be fast and according to customer preferences without having to keep large supplies in stock or having to wait for additional processing involving sawing bricks or mixing product types.

To date, two of these strips of approximately 20 mm thickness were sawn from fired bricks at a width of at least 100 mm, since the direct production of this type of strips was not yet possible. The sawing loss is 60 % in this method, with the addition of another 25 % breakage during sawing. With the innovative direct shaping method there are no more losses because the surplus clay is recycled in the press during shaping. Just the thin brick slips require drying and firing instead of the entire brick in order to obtain the unique properties of brick, which eliminates sawing fired brick. The result is 60 – 80 % less raw materials and 40 – 60% less energy per m² facade surface area, depending on the firing method required for manufacture of the brick slips.

The CO₂ reduction is nearly linear to the energy savings and also 40 – 60 %. The strips can even be manufactured at 10 mm thick, even further improving savings on raw materials and energy. In practice, thicknesses between 10 – 20 mm are standard applications.

Step 2: to as great an extent as possible use sustainable raw materials and products to meet the demand

Bricks as well as brick slips are distinguished by the use of a natural and often automatically renewing, locally available raw material, an undisputed lifespan with no maintenance requirements, non-toxicity, colourfastness and shape retention. Above all, the products are beautiful and are the basis for good designs and a pleasant and safe environment with character and high emotional value. They form the decor of our daily lives with excellent user experience and future value. Brick slips are thus "permanent goods" from a social as well as factual standpoint.

Add to this the emissions reduction and energy savings due to the hybrid drying system developed by TCKI for the ceramic industry and applied to this project by Instalat. The principle is that a great deal of ambient air can first be used for drying in favourable

weather conditions (aero-thermal drying), and that for the remaining time drying can take place at high temperature with high relative humidity and extremely low air consumption (semi-steam drying). The setup and use of material of the chamber dryer is geared to these extreme drying conditions. This drying principle can also be implemented in most existing drying chambers. The energy consumption and CO₂ emissions for drying and firing together can be reduced by 18 % relative to the state-of-the-art technology. Reduction of the specific energy consumption in chamber dryers from approximately 4000 – 3000 kJ/kg water evaporation is typical. To obtain this result, the tunnel kiln is built longer than usual and with better insulation materials, so almost no more waste heat is released from the cooling zone of the kiln when the counter-flow heat exchange is sustained longer. The result is that there is no mandatory intake of waste air and that drying can take place in the most energy-favourable way, with no heat surplus.

Due to the low weight per m² facade surface area, the fuel consumption for transport and transport costs of brick slips is less for the same facade surface area. Additionally, the mechanical and controlled application of brick slips is easily an option for many kinds of surfaces. The use of brick

slips often makes facade remodelling of residences and business buildings feasible while improving the facade insulation and retaining the original foundation and character of the building.

The strips can also be used in combination with facade remodelling and embellishment of the appearance of buildings. Brick slips are also quite suitable for prefabricated construction methods. One can always choose to use masonry joints or glue structures where practically no joints are visible. The latter case also requires less grout.

Products also become more verifiably sustainable if they correspond with the circular economy values. This involves unlimited use of raw materials and limiting of dumping costs for the processor. In comparison with usual construction methods, the amount of material to take off people's hands when demolishing the building is reduced significantly and the options for re-use increase. This is in keeping with Michael Braungart's and William McDonough's cradle-to-cradle philosophy (C2C), the idea now being embraced by many authoritative institutes and market parties. Approaching the cradle-to-cradle method of working reinforces the Trias Ecologica.

Step 3: use non-sustainable raw materials or products as effectively as possible for the remaining demand

When brick slips are applied, almost no non-sustainable raw materials are used. For most product types, these are limited to raw materials available in large amounts such as clay, sand, mineral additives and water. In combination with the extreme energy savings and emissions reduction, by firing with natural gas, which is also regarded as a raw material with clean combustion, the non-sustainable components in the production process are used as effectively as possible. To present, most ceramic products are dried with the waste heat released by kilns, often in combination with gas-fuelled air heating burners.

TCKI has taken the initiative to introduce a new type of dryer with lower energy consumption and CO₂ emissions than state-of-the-art installations. Considering the enormous investments required to do so, replacing existing kilns with new ones based on energy savings alone is difficult from a

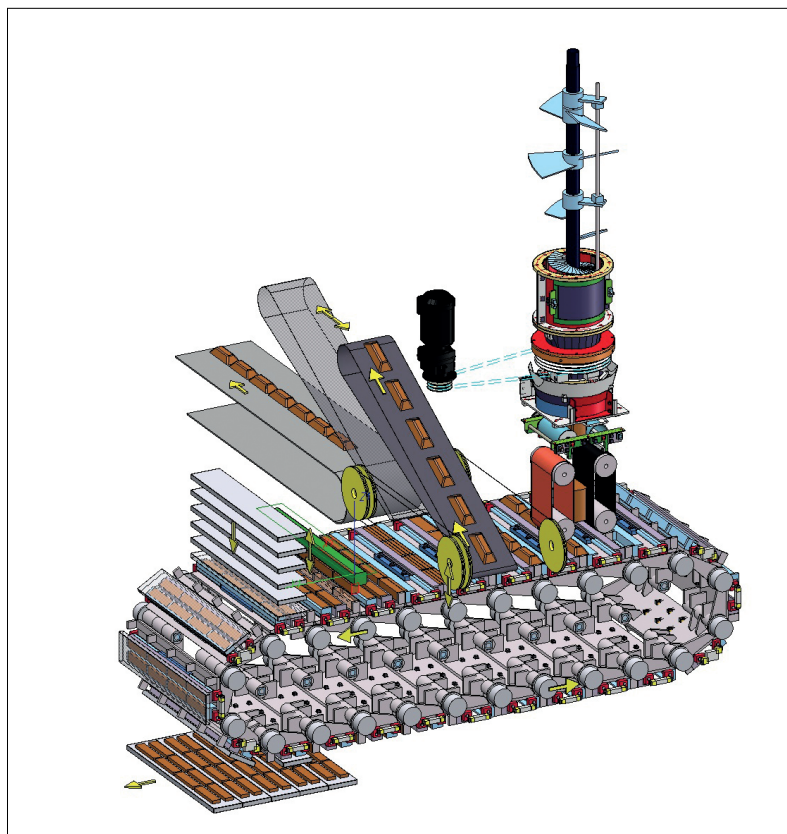


Fig. 4 De Boer mould chain with Hubert clay extruder for hand-moulded brick slips

business economics point of view. The starting point can be with most existing dryers being converted to dry aero thermally in the first drying phase, with no thermal energy consumption. In order to continue drying in the time available, the aero thermal drying process is followed by semi-steam drying. Drying in this second phase uses extremely little air at high temperature and moisture. The specific air and energy consumption in this phase is lower than in state-of-the-art dryers because of the high saturation of air with water.

The combination of aero-thermal drying and semi-steam drying is known as hybrid drying and can significantly reduce the specific heat consumption. The installation with which this is implemented is the Hybrid Dryer for Ceramics®.

Implementation at Joseph Bricks in Maasmechelen

Joseph Bricks in Maasmechelen/BE is the first of Instalat's and De Boer Machines' customers ready to manufacture direct brick slips according to the Trias Ecologica. The

production at Joseph Bricks is regarded by government as a demonstration project for new technology, techniques, energy savings and emissions reduction.

It involves the recently developed shaping machine for the direct production of water-struck strips with De Boer mould chain, Hubert clay extruders and Aberson cascades for direct production of sand-faced hand-shaped brick slips.

The demonstration of the hybrid drying in combination with a tunnel kiln with little waste heat is a big leap forward and suitable as an example to introduce in new and existing companies as the plant of the future.

The shaping and handling machines of De Boer Machines and the hybrid drying developed by TCKI, along with the Instalat chamber dryer and tunnel kiln enable Joseph Bricks to realise the extreme reduction in raw materials consumption, energy consumption and flue gas emissions per m² facade surface area and thus complies with the Trias Ecologica.