

Electra-Slate

OBJECTIVES

- In order to offer a cost effective production Solution for a Photovoltaic(PV) Roof system cosmetically similar to standard Slate roofs, the following Objectives were highlighted as key areas:-
- To develop a novel 3 head laser system to reduce PV processing time.
- To develop a polymer/mould combination that will function as a connector suitable for mass production and to capable of meeting PV IEC61646 standard.
- To develop a material/process combinations for roof mounting the PV Electra-Slate (ES).

SUMMARY

The design specification of the Electra-Slate has been finalised and prototype parts produced to prove the concept in both installation and manufacturing. The desired manufacturing costs of the product can be achieved

with conversion to a large scale manufacturing set up.

CONTRACTOR

ICP Solar Technologies UK Ltd
 Unit 1 Horsefair Road
 Waterton Industrial Estate
 Bridgend
 Mid Glamorgan
 CF31 3YN
 Tel: +44 (0)1656 766322
 Fax: +44 (0)1656 766324

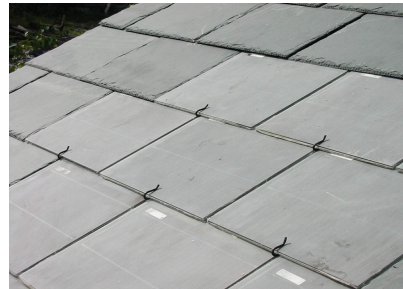


Fig 1 Electra-Slate demo roof

(Contract Number: S/P2/00468)
 URN Number: 05/1207

COST

The total cost of the project was £425k, with the Department of Trade and Industry (DTI) contributing £140k, and ICP Solar Technologies UK Ltd, Exitech and PV Systems, the balance.

DURATION

18 months – April 2003 to September 2004.

BACKGROUND

The UK was one of the first countries to identify the specific potential for building-integrated Photovoltaics (BiPV) following a project commissioned by (the organisation then known as) ETSU in the early 1990's. This identified the suitability of building roofs and facades for accommodating PV arrays.

In considering ways of exploiting this potential, Intersolar Group (the original concept creators) believed that the optimum approach would be to develop PV elements as close as possible to standard building products. This would enhance the appearance, compared to traditional solar modules 'bolted on' to the building (as practised in most countries at the time). It would also enable the products to be introduced through the existing building industry channels, rather than requiring a separate sub-contract to a specialist PV system installer.

This approach led to certain design features, which have been fundamental to the Electra-Slate concept to this day, in particular:

- a) The configuration of the unit to a standard size and shape, virtually identical to roofing slates already in use
- b) The appearance of the unit to be virtually indistinguishable in colour and texture from a standard slate

- c) The relatively high voltage output from each slate, to obviate the need for both series and parallel connections on the roof (if all units can be simply parallel connected to achieve system voltage, no special electrical expertise is required of the roofer)

It was requirement (b), which led the company to work first on an equivalent slate, because this has a colour and appearance that can be readily emulated using an amorphous silicon solar plate. However the company also entered into collaboration with the Swiss company Atlantis, using a similar approach for roofing tile, and this acted as a useful proof of concept.

Atlantis were already involved in a similar device using crystalline silicon cells, but were impressed by feature (c) above – the potential to increase the voltage to levels, which were uneconomic using individual cells due to the series interconnection costs. The monolithic interconnections in amorphous silicon are, of course, produced by laser scribing as part of the production process, so have very little associated cost.

The first DTI-supported Electra-Slate project enabled Intersolar Group to prove that the design was practicable and to demonstrate the three key features above. An installation on the Track 2000 building in

Cardiff was successfully undertaken and the Electra-Slates were virtually indistinguishable from the synthetic slates, which made up the rest of the roof.

THE WORK PROGRAMME

1) Development of 3 headed laser

Working with collaborating Partners Exitech –

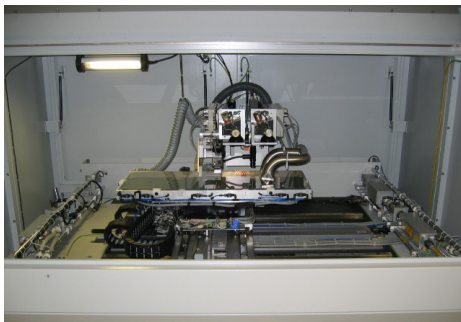


Fig 2 3 Head Laser

Exitech's addition to the team complements the programme with their industry-recognised expertise on Laser systems and associated technology. Their ability to design and prove a cost effective prototype Laser system being key in achieving the complicated and closely tolerated laser scribing required on the product and in doing so reduce the time taken to achieve the laser patterning.

2) Development of Polymer/mould Connector.



Fig 3 Connector

ICP having learned through Intersolar's experience determined a cost effective plastic connector that would be relatively straight forward to integrate into the Electra -Slate plate and capable of being IEC61646 complaint and EU low voltage Directive 1973.

3)Development of Innovative fixing method

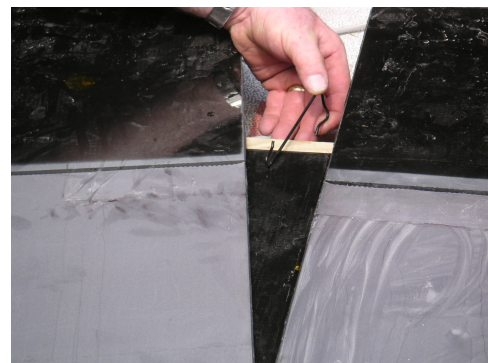


Fig 4 Roof Hook

Working with collaborating Partners EETs
EETs (PV Systems) have a celebrated track record of both large and small-scale PV installations with balance of system equipment integration. Their expertise in the roofing installation and system integration, being key to the success of translating the project brief into an all-encompassing system that meets the needs of the product and installation in line with standard roofing practise.

The need for an rugged but easy to install Electra Slate connection method was fundamental to the project.

Drilling holes in the slates during manufacture was considered to both a) expensive and b) a source of weakness. The possibility also existed that the slate may suffer damage during installation because of the necessity to hammer nails through the holes. This was borne out by the Clapham folly and Track 2000 Installations where a number of slates were cracked during installation via the use of roof nails. Although site visits to both installations some four years on have shown these cracks have not caused any de-lamination of the product or electrical failure of the individual cells. The cracks were undesirable in a finished product designed to be easily installed.

In an effort to ascertain the feasibility of other methods it was decided to manufacturer a number of samples and fix them to a trial roof assembly at the PV Systems factory. The slates used were of the old 500x300 pattern, but the methods employed would have easily transferred to the 600x300 current definition.

CONCLUSIONS

- A Laser system has been developed that will replace the need for 4 separate laser systems taking in excess of 20 minutes processing time.
- A 2 part connector was developed within ICP -with – the female being on the Electra-slate and the male being on the wiring loom.

- An Effective system of mounting the Electra-Slate with out the need for drilling holes in the Electra-Slate has been developed using commercially available hooks and established that hooks were available in sizes ranging from 60mm to 160mm increasing in length in 10mm increments. The availability of these hooks thus enabling the 600 * 300mm slate definition to be installed in all of the various geographical regions and associated pitches of roof structures in that area.

POTENTIAL FOR FUTURE DEVELOPMENT

The outputs of the project will enable ICP to undertake post qualification production of the Electra-Slate in order to achieve a profit line within two years after the completion of the project. ICP will utilise the intervening time between submission for IEC 61646 qualification and successful results of such qualification to conduct investigative marketing and strategic planning for entry into the global market place. Plans to partner with large-scale roofing product manufacturers and System integrator's will be brought into action and ICP will look to establish a mutually beneficial collaboration between these groups to support the launch of the Electra-Slate product.