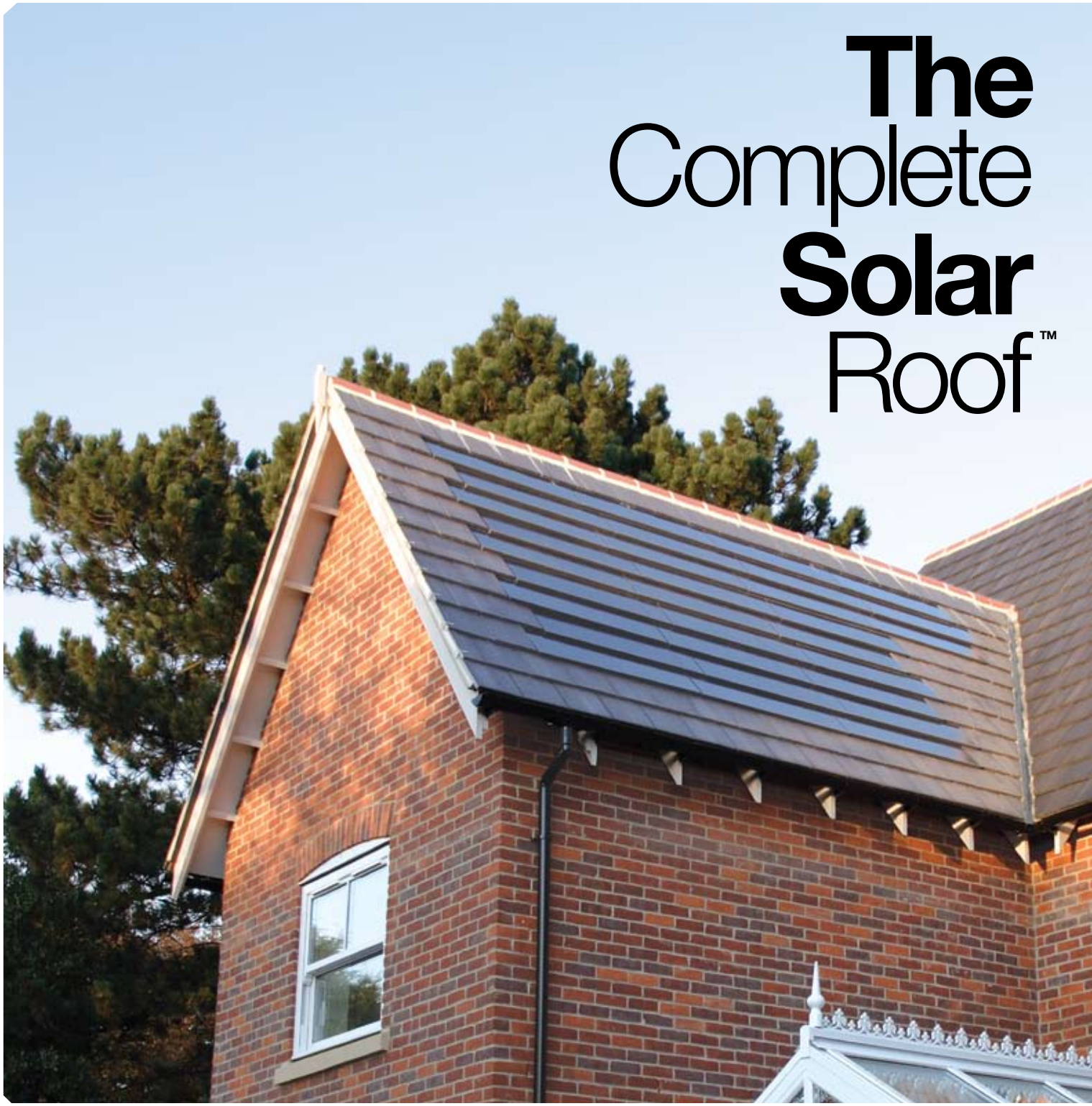


The Complete Solar Roof™

C21e & C21t

solar **electric** & solar **thermal** roof tiles

solarcentury

The Complete Solar Roof™

A world first, delivering a completely integrated solar thermal and solar electric roofing system.
A house with **C21e** and **C21t** tiles can supply the owners with two thirds of their domestic hot water needs and half of their electricity.

Why install TheCompleteSolarRoof™?

Installation Benefits for the Developer

Improve your chances of gaining planning permission

Incorporating C21 solar tiles helps developers gain planning permission by reducing the carbon dioxide emissions from their developments. As planning rules strengthen, the use of renewable technology is becoming a prerequisite for every building developer in the country. Local Authorities are redrafting their Local Development Frameworks (LDFs) to comply with Central Government guidelines (Planning Policy Statement 22) and demanding that all new developments, over a certain size, provide a proportion of their energy from on-site renewables. (see www.TheMertonRule.org)

Incorporating The Complete Solar Roof can help 'fast track' planning applications.

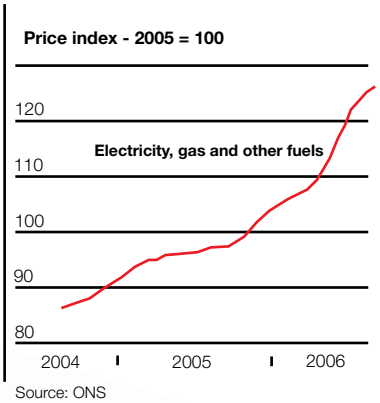
Gain a marketing advantage

Incorporating The Complete Solar Roof into a project presents several opportunities for developers to promote their commitments to sustainability. Eco-measures, such as solar tiles and carbon reduction initiatives are extremely topical and generate significant publicity. Pro-active developers can gain a valuable marketing advantage by emphasising their contribution to the UK's CO_2 reduction target (reducing emissions by 10% by 2010) through the incorporation of renewable energy technology.

As fuel prices rise and renewable energy moves up the political and media agenda, house buyers are becoming increasingly interested in sustainability measures. The Complete Solar Roof can play an important part in a developer's marketing strategy.

Make more profit

Homes which produce their own renewable energy are obviously more attractive to home buyers. As well as protecting themselves against rising fuel prices (see graph), solar tiles can help increase the value of a home by up to 10%*, far more than the cost of the solar tiles. The installation of C21e solar electric tiles at Gleeson Homes Norfolk Park development helped the houses with solar sell for 8.6% more than identical houses without. Read the full case study on page 8.



Source: ONS

*Energy Saving Trust
'Green Homes are hot property' 27/03/06

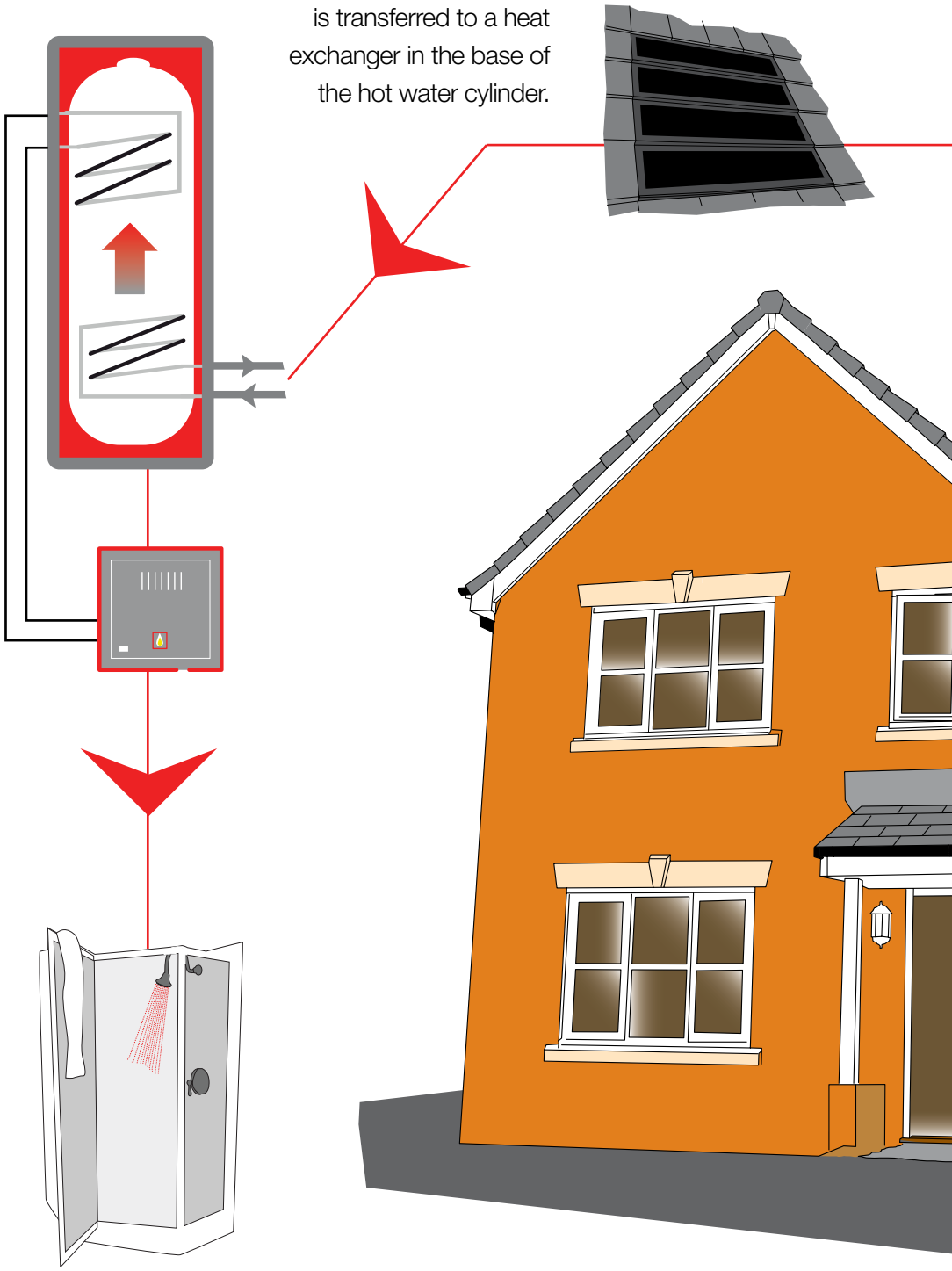
C21t Solar Thermal Roof Tile

The heated fluid circulating through the thermal tiles is transferred to a heat exchanger in the base of the hot water cylinder.

The heat exchanger transfers the suns thermal energy to the water and the heated water rises to the top of the tank ready for use.

The traditional boiler is connected to the top of the cylinder, providing additional heat to the water if required.

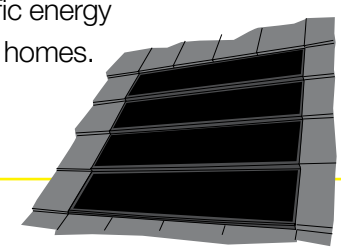
Hot water is delivered for use throughout the house in the normal way.



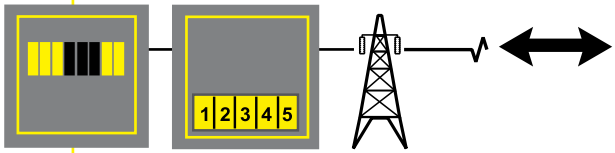
How The System **Works**

C21e Solar Electric Roof Tile

The ‘mix and match’ design of the thermal and electric tiles allows for complete flexibility in any roof layout to meet the specific energy requirements of different homes.



The electrical energy is sent from the tiles to a inverter, usually installed in the loft. This converts the DC current to AC for use in the building.



The AC electricity then passes through a fuse box and metering system, where power from the grid supplements the PV energy if required. When excess energy is produced the surplus is sold to the grid, removing the need for batteries.

Finally, the clean solar electricity is used in the home exactly the same as normal grid power.

Once installed **The**Complete**Solar**Roof provides reduced cost electricity and hot water, protecting the homeowner from unpredictable rises in energy prices, with no perceivable difference in supply.

TheComplete**Solar**Roof™
Key Features

C21e
Solar Electric Roof Tile

C21t
Solar Thermal Roof Tile

High efficiency

C21e:
- Delivers high power output - 52Wp per tile, less than eight square metres per kWp (kilowatt peak)
- Back mounted contact strips increase the effective collector area and reduce surface glare, typical with standard solar cell technology
- Integrated 'thru-flow' ventilation enhances PV performance

C21t:
- Less than eight square metres provides roughly two thirds of the hot water for an average three bedroom home
- Latest insulation technology maximises heat retention

No extra planning
- No need to alter roof lines, colour or pitch. **C21** tiles sit flush with conventional roof tiles
- Discrete 'SunPower' PV laminate blends superbly with regular roof tiles offering an unrivalled aesthetic
- All roofing work carried out by the roofing contractor allowing electrical and plumbing work to follow build programme
- The benefit of C21's building integrated design is that no additional planning consent should be required for standard new-build developments

Fast to fit & no specialist skills
- Tiles arrive on site as complete units avoiding the need for on-roof assembly
- No electrical or plumbing work required on roof
- Electrical and plumbing connections are completed by the existing contractors as part of the standard build program

Standard installation
- C21 tiles fit with conventional roofing practice without the need to adjust battens. One solar tile takes the place of four standard tiles
- The tiles screw to standard roof battens avoiding the need for bespoke roof layouts

C21e

Standard screw fixings enable fast, efficient installation.

Interlock design allows compatibility with many leading roof tiles and a wide range of accessories.

'Super subtle' SunPower laminate delivers maximum efficiency for C21e.

C21t

Highly engineered structural frame designed for optimal strength to weight ratio

Pre-fitted connections allow fast roof installation.

Selectively coated collector plate and high efficiency solar glass maximise energy absorbed by C21t.

I thought it was going to be really technical but, having done it, it's really very simple."

Bob McGrath, roofing contractor, working on a Complete Solar Roof installation for St James Homes in Reading

Ease of Installation

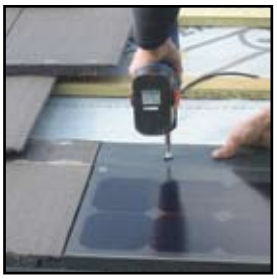
As a **building integrated solution** C21 takes the place of four conventional tiles, fixing to standard roof battens with simple screw fixings.

Fast to Fit

C21 tiles are as fast to install as conventional tiles. Each unit can be easily carried onto the roof by a single person. Tiles hook onto the roof battens and are secured with simple fixing screws. C21 is designed to interlock directly with additional solar tiles or regular roof tiles, without the need for specialist flashings. All external roofing can be carried out by the regular roofing contractor after minimal training, which solarcentury can provide.

1. C21 tiles are easily manoeuvred into position on the roof.

2. The tiles simply hook on to normal roofing battens.



3. C21 is secured with simple screw fixings, similar to regular tiles.

4. The tiles are overlaid and quickly cover the roof. This example took under two hours to complete.

5. The finished installation is weather proof and requires no additional exterior work.

Connecting the system

C21e tiles connect together with simple push-fit connectors, the electrical installation is carried out within the building by the electrical contractor. C21t tiles arrive as pre-assembled units; and all system connections are made within the building, avoiding the need for plumbing work to take place on the roof.

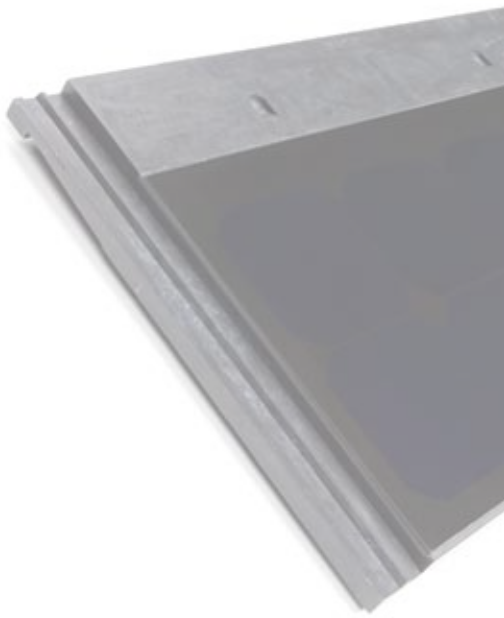
System sizing

As an example, a Complete Solar Roof comprised of 30 C21e tiles and 16 C21t tiles, requiring less than 18m^2 of roof area, would provide approximately a quarter of the electricity demand and two thirds of the hot water demand for a typical three bedroom home.

C21e system sizing

The modular nature of the C21e design provides the opportunity to select the appropriate number of C21e tiles to meet the energy generation required for each home.

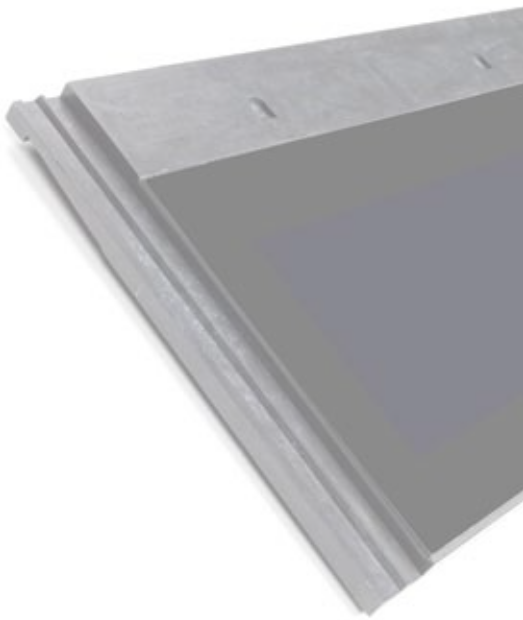
Number of C21e Tiles	Total C21e tile coverage area (m^2)	Energy Yield per year (kWh)*
20	7.8	**830**
30	11.7	**1245**
40	15.6	**1660**
60	23.4	**2490**
80	31.2	**3320**



C21t system sizing

Similarly, C21t provides the flexibility to meet the hot water needs of different sized homes by varying the quantity of tiles. The table below provides an indication of the number of tiles required to meet approx. 60% of the hot water demand for various homes in the UK.

Number of C21t tiles	Total C21t tile coverage area (m^2)	Will provide 60% of hot water for a:
10	3.9	**2 person home**
12	4.7	**2-3 person home**
16	6.2	**3 person home**
20	7.8	**3-4 person home**
24	9.3	**4 person home**
28	10.9	**4-5 person home**



* Based on south facing roof system in the UK, generating 830 kWh per kWp.

C21e Case study

Gleeson Homes

> "**C21e** solar tiles generated significant interest and helped the homes **sell faster** and at a **significant premium"**
>
> Tom Whatling, **Gleeson Homes**

The Beeches, Norfolk Park is an excellent example of how solar photovoltaics (PV) help homes sell for more money than those without.

The Gleeson Homes development, consisting of 75 three and four-bed homes, is situated in the regeneration area between Sheffield and the Peak District National Park.

Gleeson chose to offer homebuyers the choice of 'reduced electricity bills for life' by incorporating solarcentury's award winning C21e solar electric roof tiles on two homes within the development. The C21e solar tiles integrate into the buildings' fabric by replacing standard concrete tiles, sitting flush with the rest of the roof.

Using a dark SunPower PV laminate, the solar tiles do not compromise the building design, blending superbly with the grey concrete tiles. Gleeson Homes were surprised at the level of enquiries generated by the inclusion of solarcentury's solar tiles.

Gleeson Homes analysed homebuyers' interest in the C21e homes against an otherwise identical, conventional townhouse as part of this pilot project. The three-bed townhouses with C21e solar tiles sold at a premium of 8.6% (£140,000 compared to £128,000 for the property next door). The results confirm the findings from the Energy Saving Trust that there is significant demand from homebuyers for homes with lower energy bills. C21e tiles are a simple, cost effective way for house builders to meet this demand.

Gleeson Homes are among an increasing number of developers now installing this innovative technology into their new homes in the UK. St James, Barratt and several other prestige developers have recognised that solar tiles are an attractive option for home buyers.

Case study: The **Merrills**

Walking into the Merrills family home in Somerset, it all seems very normal. The coffee machine steams away and the children sit watching TV and surfing the net, just like any other home.

The only evidence that the Merrill's home is powered by **C21e** solar tiles is the small display unit on the kitchen table showing how much energy is being generated.

"It's hard to remember the solar tiles are there sometimes" says Dad, David Merrill. "But it's a great feeling to know that we're generating our own power."

The Merrills chose C21e tiles as an effective way to reduce their electricity bill, without altering the appearance of their home. Their solar tiles provide a third of the family's electricity and are guaranteed for 20 years.

"People love the look of the tiles and seem intrigued by us producing our own energy" says Mum, Mel. "And the display is a real talking point when the neighbours pop round. It's certainly taught the kids a thing or two about energy."

When David had the home re-valued he was pleased to find it had increased in value by 6% because of the tiles alone.

The **In-home** display

The Complete Solar Roof has the option of a remote display unit to provide the homeowner with details of the systems performance.

FAQ

Does it work in the UK?

Yes. The photovoltaic cells used in C21e do not need to be in direct sunlight to work, and will generate electricity even on cloudy days. The brighter the day the greater the energy generated. C21t will supply hot water in summer and on bright days in winter, typically delivering over 60% of hot water demand over the course of a year.

Isn't solar power expensive?

The Complete Solar Roof adds as little as 4% to the build cost of an average three bedroom home, but over 8%* to its final value when sold. It also helps 'future proof' a home against rising fuel prices making properties doubly attractive to price conscious house buyers; as fuel prices continue to rise, energy efficient renewably powered homes will continue to sell at a premium.

Is the C21 tile compatible with the tiles I want to use in my development?

C21 has been designed to integrate with a range of tiles from leading roof tile manufacturers. (Please refer to datasheet for detailed specification)

Does the system need batteries?

No local battery storage is required as the C21e system connects to the local electricity supply, and any excess power can be sold back to the electricity company.

Do solar tiles require planning permission?

The benefit of C21's building integrated design is that no additional planning consent should be required for standard new-build developments.

Do the C21 tiles need maintenance?

C21e tiles are silent in operation and have no moving parts, so no maintenance is required. Scheduled servicing of the C21t hot water system would normally take place at the same time as conventional boiler maintenance. The design of the tiles means that any dust or dirt that accumulates on the tiles is washed off during normal rainfall.

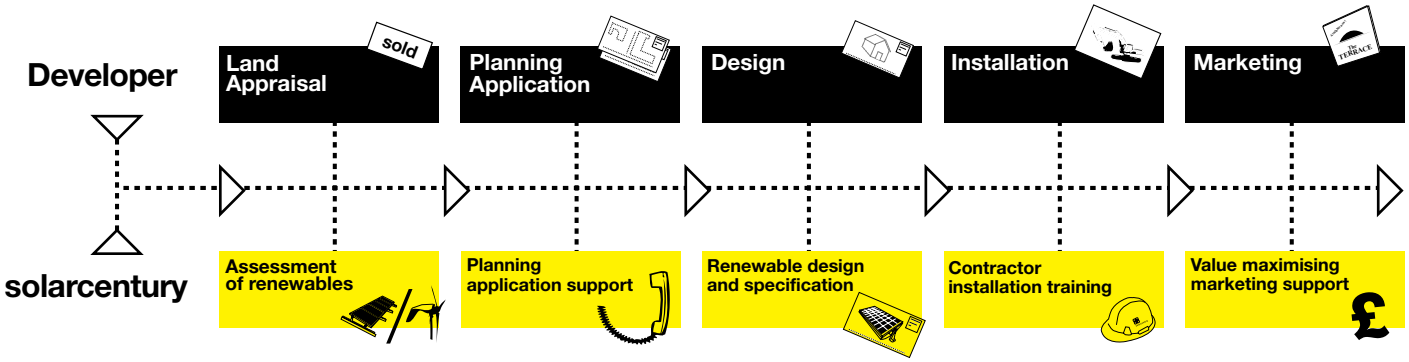
How long do the tiles last?

The tiles have a power warranty of twenty years and are expected to provide generation for fifty.

* Gleeson Homes, Norfolk Park development.

solarcentury

To find out about including The Complete Solar Roof in your development, call solarcentury now. We offer support and guidance throughout the entire planning and development process.



If you have a particular development that you would like to discuss,
please call **0207 803 0138**
or, email **commercial@solarcentury.com**

C21e : Awards

Best Exterior Product - Interbuild 2004

Building Magazine's award for Innovation in their 2005 sustainability awards.

Best Sustainable Product Award - Construct 2006, Northern Ireland's major construction show.

Best Overall Product & **Best Product for the Building Envelope** - Interbuild 2006

SUNPOWERED

C21e features SunPower solar cells, the most efficient solar cells available today.

solarcentury is the only accredited solar photovoltaic CPD provider

Patents and Patent applications
GB2407634
WO2005045328
Patent pending worldwide

Registered design
3013535
3024160

Registered Trade Mark
C21

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Printed on recycled paper using waterless printing

TheCompleteSolarRoof brochure version 0.2
All information correct at time of press