St Faiths Church

Havant

Exploring the potential for Green Energy

Enhancing our Environment

Solar PV Panels

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Aim: "Exploring the potential for Green Energy"

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Terms of Reference:

This report focuses on the Exploration of Green Energy, In particular Solar Photo-Voltaic (PV) panels.

Four Solar companies' were invited to survey Church House Hall in the Pallant and the St Faiths Church Turret roof, produce Solar PV panel quotes and proposals, these will be considered together with the installation costs and associated revenues from the Governments Feed-In-Tariff (FIT) over a 30 year period.

The aim is to indicate how St Faiths Green Energy Exploration fits into current Havant Borough Council and Regional Strategies in order to give weight to planning submissions. Identification is given to relevant decision making bodies and also recommendations made towards the end of the report in order to strengthen the case for Solar PV panel installations on Church properties.

St Faiths Church - Mission Development Plan 2015 – 2020

Report aims to address the following:

Putting the Christian case for Solar PV & Green Energy

Mission Development Plan

Planning issues & English Heritage advice to get project accepted

Presedence in Havant for Green Energy already (Solar)

How the "Green Energy Exploration" Aim fits into current Five Renewable Energy programmes in the South East of England

What the real Climate Change problems are and how Green Energy helps

Technical Quotes & Desings

Costs & Revenue Generation

Recommendations

1. Executive Summary

St Faiths Church Mission Development Plan, adoption of the Mission Development Plan for the Church was entered into in late April of 2015 (Source 01). Within this Development Plan were the Key complementary" Aims" and associated "objectives", one in particular was the aim to "Promote and Enhance our Natural Environment" part of which was to "Explore the potential sources of Green Energy". A combination of good solar resources in Havant and growing demand for more Green Energy and this aim of exploration into Green Energy provide all the right ingredients for a demonstration by St Faiths Church to adopt Solar PV panels. The Church Turret flat roof area and also the South Facing roof of the Church House Hall in the Pallant are the two sites being considered for Solar PV panels. In this report we were concentrating of Solar PV as a technology only, no other forms of Green Energy were investigated. **There is a growing and urgent need** – Climate Change is a real issue and as such the aim to explore Green Energy by St Faiths Church is a bold and much needed development for the Parish of Havant. The UK Government, wishing to reduce the country's dependence on fossil-fuel stores and to cut carbon dioxide emissions, has made a commitment to find 10 % (percent) of energy from renewable sources by 2010, rising to 20 % by 2025 (source 02).

The way forward – Father Tom had discussions with Alan Brewer of PSECC and also a member of the Church and an invitation was made to Alan & PSECC to assist with the Aim of Exploring Green Energy. "PSECC" Portsmouth Sustainable Energy & Climate Change Centre have created, over an eighteen year development period a Solar PV market opportunity - the "Resource Ownership" concept – a concept where the Client, or Local Government or peoples in an area such as Havant could receive revenue from any Solar PV panel installation, this ensures Sustainable Energy development for St Faiths Church. Making a case for Christian care of our World and the Environment is an easy one. Love for ones fellow man, Consideration & Kindness towards the environment are three of the fruits of the Spirit, so considering the interactions of the Church with the Environment together with being kind to the Planet and hope being a gift of the Spirit, hope for a resolution to Climate Change problems, then this exploration is a worthy cause. A balance has to be maintained between adopting new Green Energy and the Heritage aspects of all historic buildings. However, this said there must be a real drive towards Climate Change Mitigation and the adoption of such Green Energy as Solar in order to maintain Man's existence on our Planet over and above long term preservation of Buildings, what is more important Man or Buildings (a thought) – Care must be taken and a balanced approach adopted in line with English Heritage guidelines, Planning Objectives (PPG's) and the Aims of the Church. Regardless of the particular size of a solar PV system installation, what is important is that St Faiths Church to demonstrate a commitment to Green Energy. Obviously the bigger the system the larger its cost, but also the larger the revenue stream from the Feed-In-Tariff (FIT). **This report focuses on the Exploration of Green Energy, in particular Solar Photo-Voltaic (PV) panels:**

Green Energy installations in a Heritage Town like Havant is a very delicate decision making process, one must give due care and consideration to English Heritage policies, guidelines together with considering the wider Climate Change Mitigation targets all Councils in the UK and Globally are trying to programme for, balanced, careful approach is required. PSECC recommend the company Sun Smart Energy Ltd as being the preferred installation company -"SunSmart Energy Ltd" has access to all the solar panels currently on the market. You can choose from standard poly-crystalline panels, which have a blueish tint, to all black mono-crystalline panels. SunSmart have an exclusive arrangement with SunPower that supplies the highest efficiency-rated black panels in the world and there is an option to have panels that look like the tiles on your roof. It was recognised at a very early stage in this process of Exploring the Green Energy potential for Church Buildings that the Havant Borough Council Conservation Officer – John Townsend was very informative, engaging and helpful together with very knowledgeable on the subject and offered advice and guidelines to the Parish Development Officer an also Alan Brewer.

Businesses up and down the country are installing solar PV systems for sound commercial reasons:

1. Church receives an annual ROI of 10% or higher
2. This government-backed return for the Church is index-linked and guaranteed for 20 years
3. Protect your Church from the inevitable price rises from the Big Six energy companies
4. Enjoy clean, free solar electricity for years to come
5. Solar electricity generation typically coincides with your main energy demand
6. Church demonstrates its green credentials by reducing your carbon footprint

Society at the moment is not doing enough to mitigate the CO_2 problems, which could spell the end of man on this planet. We must act now and in more urgency – The Mission Plan Aim of Green Energy is a good one for the local and Global Communities.

Do NOT leave Climate Change Mitigation to others to resolve – we must go beyond just a token demonstration of Green Energy and I feel this is important for the Conservation Officer to understand and support a larger solar PV system installation on the Church House Hall roof.

Just how is St Faiths going to achieve its development programme – This report does contain much background information of current Green Energy policies and Strategies that exist in England and the South East to give weight to the Green Energy Aim**.** Care and Consideration must be taken by the Church and a balanced approach adopted in line with English Heritage guidelines. Sustainable Development Agenda21 programming also indicates the need for Renewable Energy development in the Town of Havant together with the Future Solent programme in 2014 with a main objective of encouraging Green Energy along the Solent and South Coats. This Church projects also fits into the Core Strategy of HBC and also PUSH strategy. A "precedence" for Solar installations has been set in Havant in Waterloo Road by 3KW of Solar PV and one unit of Solar Thermal being installed in the Town of Havant. PSECC is a UK based consultancy service organisation with environmental & Climate Change Mitigation experience - specialist team of engineers, scientists, legal and socio economic professionals within the consortium competency including legal compliance requirements, energy sector development requirements, Environmental and social impacts assessments for diverse projects. We have twenty years' experience in this sector including Researching & help in writing the Portsmouth City Council (PCC) Energy Policy in 1995 and Energy Network coordination for Hampshire County Council (HCC) in 2002 to 2004 and Researching Renewable Energy options for MoD and Schools sector within HCC and installing seven schools with Solar PV, sourcing all grants and funding packages. We offer St Faiths our local skills, knowledge and experience necessary to produce all required feasibility studies and Tender Management. In late April four Solar Energy Companies were invited to visit, survey and quote for the two sites at St Faiths main Church & Turret together with the Church House Hall in the Pallant.

English Heritage - had published in 2010 Guidelines to Small scale solar electric (photovoltaics) Energy and Traditional Buildings. Renewable energy may come from sources such as wood that are self-regenerating, or those such as the sun that are effectively infinite. The technologies associated with these sources are sometimes referred to as 'low-carbon', in that they emit much lower levels of carbon dioxide and related compounds into the atmosphere than do fossil-fuel technologies. Planning and the Historic Environment (PPG15) – (source 03) and Planning Policy Guidance 16: Archaeology and Planning (PPG16) (source 04): from 2010 need to be considered. Work of any kind to a Scheduled Monument also requires consent from English Heritage under the Ancient Monuments and Archaeological Areas Act 1979 (source 05). Your Church building applications will need to show clearly what you intend to do, with detailed drawings and photographs. It is useful to draw the panels on a photo of the site or building in order to help the planning officer visualise it in its proposed setting and determine its visual impact. **Future Solent programme –** This is a new programme for the Solent Region to go Green – St Faiths would make a good project under this programme to demonstrate a Christian commitment to Green Energy.

How it delivers the priorities

Priority 1: New Low Carbon & Green Technology

An energy strategy can support the development of renewable technologies within the Solent

Priority 2: Resource Efficiency in Homes and Businesses

An energy strategy will promote energy efficiency and demand management as a key component of the strategy mix.

Priority 3: Generation of Secure, Renewable & Low Carbon Energy in the Solent

The energy strategy will identify assurances, opportunities and drivers of energy security for businesses and homes into the future and will help decarbonise the energy supply, thus helping meet the national and local targets. Havant Borough Council - currently developing a Sustainability Strategy for Havant Borough Council. **We can assume that for every kWh of electricity generated from on-site renewables there is an equivalent saving of 0.541 kg of CO_2.**

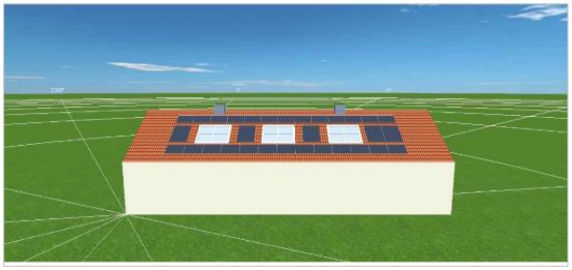
A key aspect of Sustainable Development is Sustainable Energy use and Generation – for this reason PSECC suggest that the St Faiths exploration into Green Energy & installations of Solar PV at Church House Hall in the Pallant and also St Faiths Church Turret comply with the strategic objectives of HBC and their desire in the Core Strategy to Reduce CO_2 emissions and adapt to climate change. Also the PUSH Economic Development Strategic Objective of ensuring Sustainable Development across the sub region – Havant is met. Priority 3: Generation of Secure, Renewable & Low Carbon Energy Future Solent is met by this St Faiths project. In considering the Solar PV aspects of green energy it is important to understand that this technology is one of only many Renewable Energy (Green Energy) technologies. This report gives background on five sustainable programmes significant to your Aim. Other technologies such as Ground Source heat Pumps, Biomass boilers, Wind Turbines, Solar Thermal Hot Water systems and Air Source Heat Pumps are also very important for the proposed New Build extension for the main St Faiths Church building together with Energy Efficiency. One important factor to note for the Church House Hall in the Pallant is that it is attached to a Grade 1 listed building, which needs refurbishing in a very careful manner in line with English Heritage and Conservation Officer guide lines.

2. Technical Summary – range of systems possible

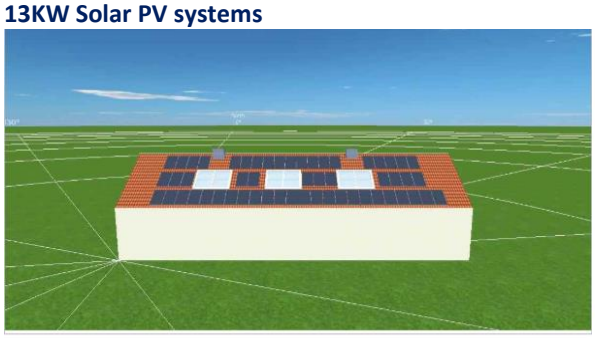
This report looked at system sizes from 3.57KW to 17.1 KW for the Church House Hall pitched roof area and a range of between 5.59KW to 6.84KW for the Church Turret flat roof of the main Church.

3.5KW Solar PV system

9KW Solar PV system



13KW Solar PV systems



3D, Grid-connected PV System with Electrical Appliances - Net Metering

Climate Data	Havant (1986 - 2005)
PV Generator Output	13.75 kWp
PV Generator Surface	90.0 m²
Number of PV Modules	55
Number of Inverters	2

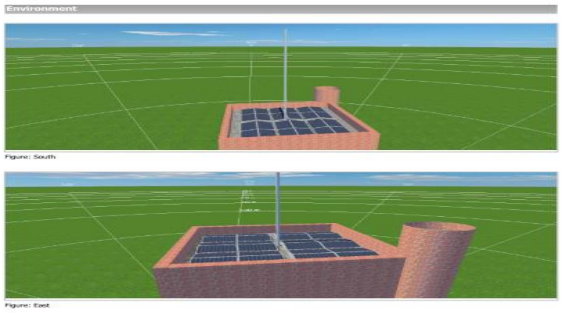
13KW Solar PV Solar PV system

3D, Grid-connected PV System with Electrical Appliances - Net Metering

Climate Data	Havant (1986 - 2005)
PV Generator Output	15.13 kWp
PV Generator Surface	89.9 m²
Number of PV Modules	55
Number of Inverters	2

15KW Solar PV system

6.84KW Solar PV system of Church Turret



Please find attached spreadsheets containing graphs showing possible revenue projections for all of the proposals. Assumptions are clearly stated in the spreadsheets and can be modified by the user. The key differences between our assumptions and Warm Space's, using the example of the largest Church House Hall quotation, are:

In summary, all our assumptions are more cautious with the exception of current energy cost.

System Size
Warm Space Ltd: 17.1 kWp
SunSmart Energy Ltd: 15.13 kWp

Energy price Inflation
Warm Space: 10%
SunSmart: 4%

Use of energy on site
Warm Space: 75%
SunSmart: 17.3%

RPI Inflation
Warm Space: 4%
SunSmart: 3%

Annual Maintenance Cost
Warm Space: £0
SunSmart: £100

Energy Cost
Warm Space: 14p
SunSmart: 15p

3. History

The first World Earth Summit at **Rio de Janeiro in 1992** resulted in the term Sustainable Development and the Agenda21 programme (source 06) commenced here in the UK and Alan has been involved in this process in the UK and throughout the World highlighting amongst other things - Green Energy.

Father Tom had discussions in early April 2015 with Alan Brewer of PSECC and also a member of the Church of St Faiths and an invitation was made to Alan & PSECC to assist with the Aim of Exploring Green Energy for St Faiths Church, Alan agreed. In this report we were concentrating of Solar PV as a technology only, no other forms of Green Energy investigated as this time.

Senior staff at PSECC, namely Alan Brewer MSc the MD was asked in 1995 to research and write one of the first UK City Energy Policies and Strategies under Agenda 21 programming to combat Climate Change. This work led onto his coordination of the Hampshire County Council Energy Network in 2002, progressing onto Sustainable Energy in the County Schools sector. In 2013 onwards, to date Alan has recently been developing Solar Farms in Kenya, Tanzania and soon Cameroon in Africa.

Following a period of time researching solar in the UK, developing PV in both domestic and business environments it became apparent to Alan that for true sustainability and commercial profitability, solar technology really needed greater awareness and installations to optimize its benefits in the UK, hence his willingness to assist St Faiths "Exploration into Green Energy".

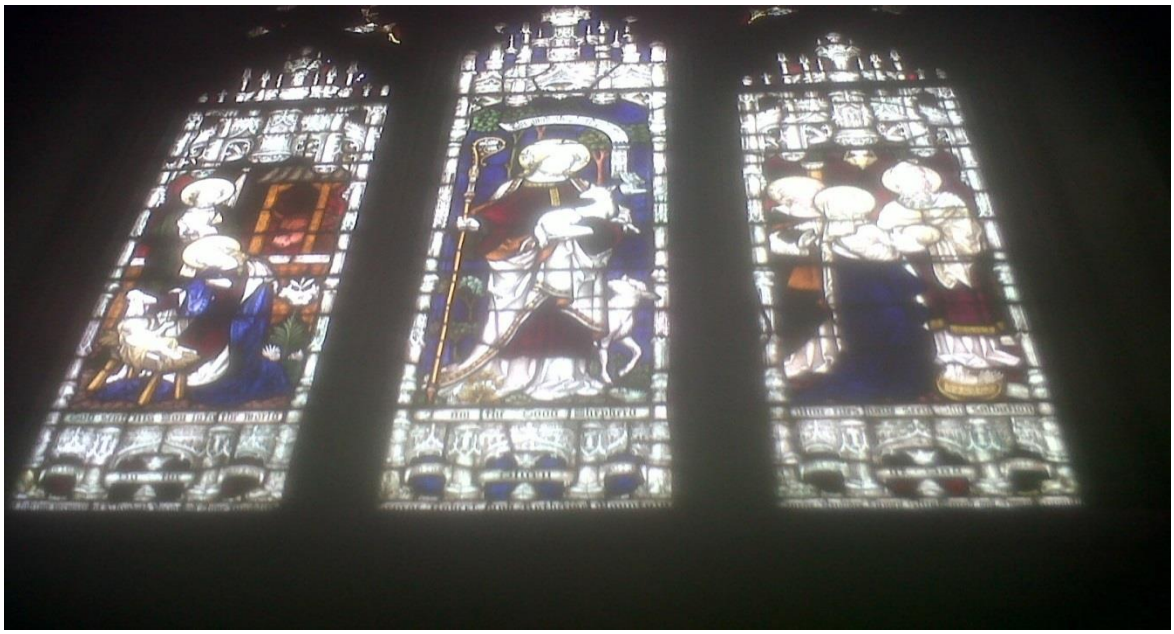
As indicated a balanced approach to Green Energy in Historic Buildings is required and encouraged by English Heritage and they published in 2010 Guidelines to Small scale solar electric (photovoltaics) Energy and Traditional Buildings. Installations of Solar technology throughout the Heritage Town of Havant already have been performed, as in the case of an installation of 3KW Solar PV and Solar Thermal at Waterloo Road so a precedent has been set from a Planning Permissions point of view.

Four Solar Energy Companies were invited to visit the two sites in late April at St Faiths main Church & Turret together with the Church House Hall in the Pallant and Father Tom and David Pearson (Parish Development Officer) were also present at the first survey time. Alan of PSECC then arranged for the other three solar companies to visit, on the same day, and take measurements, make designs and costings and to send these proposals in as official quotes to be submitted to David Pearson of St Faiths and the St Faith Church Standing Committee for consideration.

A key aspect of Sustainable Development is Sustainable Energy use and Generation – for this reason PSECC suggest that the St Faiths exploration and possible installations of Solar PV at Church House Hall in the Pallant and also St Faiths Church Turret **comply with** the strategies of HBC and their desire in the **Core Strategy** to Reduce CO_2 emissions and adapt to Climate Change & the **PUSH Economic Developmen**t Strategic Objective of ensuring Sustainable Development across the sub region of Havant.

St Faiths Church in Havant could soon have Green Solar Energy electricity supply to power all its lighting.

4 Christian Response to Climate Change - "Green Energy Exploration"



Making a case for Christian care of our World and the Environment is an easy one. Love for ones fellow man, Consideration & Kindness are three of the fruits of the Spirit, so considering the interactions of the Church with the Environment together with being kind to the Planet and hope is a gift of the Spirit, hope for a resolution to Climate Change problems, then this is a worthy cause. A balance has to be maintained between adopting new Green Energy and the Heritage aspects of all historic buildings. However, that said there must be a real drive towards Climate Change Mitigation and the adoption of such Green Energy as Solar in order to maintain Man's existence on our Planet over and above long term preservation of Buildings. What is more important, Man or Buildings? Care and Consideration must be taken and a balanced approach adopted in line with English Heritage guidelines, Planning Policy and St Faiths Church Aims & wishes. Sustainable Development Agenda21 programming also indicates the need for Renewable Energy development in the Town of Havant together with the recently launched **Future Solent programme** in 2014 by Fareham Borough Council with a main objective of encouraging Green Energy along the Solent and South Coast region (source 08) - Project Leader is Gill Kneller of HBC (Havant Borough Council) .

PSECC – Portsmouth Sustainable Energy & Climate Change Centre

PSECC is a UK based consultancy service organisation with environmental & Climate Change Mitigation experience and have a specialist team of engineers, scientists, legal and socio economic professionals within the consortium competency including legal compliance requirements, energy sector development requirements, Environmental and social impacts assessments for diverse projects as well as Renewable Energy Technology companies. We have over eighteen years' experience in this sector, which includes Researching & writing the Portsmouth City Council (PCC) Energy Policy in 1995 (source 07) and Energy Network coordination for Hampshire County Council (HCC) in 2002 to 2004 together with Researching Renewable Energy for the MoD and for the Schools sector in 2013 within HCC and installing seven schools with Solar PV, sourcing all grants and funding packages. We offer local skills, knowledge and experience necessary to produce all required feasibility studies and Tender Management for St Faiths.

To meet the Mission and Vision it was decided that there should be five key complementary aims, one of which is -

Enhancing our Environment

- Encourage respect for God's creation
- Enhance the wildlife value of our churchyard
- Enhance the churchyard for quiet relaxation and wider community use
- Explore potential sources of 'green' energy
- Reduce our 'footprint'

2KW Solar systems saves 1.2 tonnes CO_2 per year

D) ENHANCING OUR ENVIRONMENT:

We will promote and enhance our natural environment

The Way Forward

The Bible makes clear that the natural world and its creatures have value to God regardless of any value or usefulness to us. It also makes clear that *all* human beings are children of God and so we have a duty to do what we can to promote their well-being and to avoid undermining this. But we can't *care* about other people or God's other creatures without caring about the *conditions* which affect their lives – which means caring about the impact of our *own* activities and consumer choices. Although Scripture implies that the natural world is important to God in its own right, *contact* with it is also spiritually and emotionally beneficial to us all – it helps us recognise the immensity (and beauty) of God, and it may bring us closer to God.

Objective		*Responsibility*
D1	Encourage respect for God's creation, and increase understanding of how that relates to our Christian faith	***Worship Comm.***
D2	Enhance the wildlife value of our churchyard	***Churchyard Development Group***
D3	Enhance the churchyard for quiet relaxation and wider community use	***Churchyard Development Group***
D4	Explore potential sources of environmentally-friendly 'green' energy	***PBDT*** *and* ***BMC*** *and* ***Church Development Team***
D5	Foster 'green' initiatives (seeking ways to reduce the environmental 'footprint' of the church and its members)	***All Development Teams and Groups and BMC***

Mission Development Plan 2015 – 2020 (source 16)

Terms of Reference: This report focuses on the Exploration of Green Energy, In particular Solar Photo-Voltaic (PV) panels.

The aim is to indicate how St Faiths Green Energy Exploration fits into current Havant Borough Council and Regional Strategies in order to give weight to planning submissions. Identification is given to relevant decision making bodies and also recommendations made towards the end of the report. Four Solar companies' were invited to survey and produce quotes and proposals will be considered together with the costs and associated revenues from the Governments Feed-In-Tariff (FIT) over a 30 year period. **Climate Change is a real issue that needs to be addressed more urgently by each Global Country, each County, each Council and each person. Green Energy is part of Climate Change Mitigation that is so much needed now in each community. The St Faiths Aim to Explore Green Energy is a desire to demonstrate a Christian caring ethos to this and future generations Society at the moment is not doing enough to mitigate the CO_2 problems, which could spell the end of man on this planet… (If you require further evidence of Climate Change and the real problems we must tackle now then contact me).**

5. Consortium of Parties Involved

Investment

Church Standing Committee & Father Tom

ENGLISH HERITAGE

David Pearson Parish Development Officer

£

£ Financial Return

PSECC Tender Management

Support

Technical Support

HBC Local Government Planning & Conservation Consultant (John Townsend)

St Faiths Church Green Energy

Exploration

Revenue from Feed-In-Tariff

Support

Installation, FIT, Quotes, technical's & Grid Negotiations

£

£

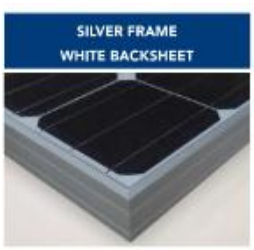
Solar Energy Company

Church House

Turret appx 5 -7.5KW Solar PV/ appx 17-20KW Solar PV

Panels (typical)

Into metre & National Grid



WARRANTIES

- 10-year limited product warranty[1].
- Limited power warranty[1]: 1 year at 98% of the minimal rated power output, 10 years at 92% of the minimal rated power output, 25 years at 82% of the minimal rated power output.

[1]In compliance with our Warranty Terms and Conditions.

6 English Heritage Guide Lines - www.climatechangeandyourhome.org.uk/live/content_pdfs/519.pdf

Full article on page 96

PLANNING AND HISTORIC BUILDING LEGISLATION

THE INSTALLATION OF A RENEWABLE TECHNOLOGY IMPLIES IN MOST CASES THE FIXING OF EQUIPMENT TO THE HISTORIC FABRIC OF A BUILDING. ENGLISH HERITAGE SEEKS TO ENSURE THAT ANY WORKS TO A HISTORIC BUILDING DO NOT UNNECESSARILY DISTURB OR DESTROY HISTORIC FABRIC.

Small scale solar electric (photovoltaics) energy and

Traditional buildings

From the 2010 publication by English Heritage – (source 02)

The UK government, wishing to reduce the country's dependence on fossil-fuel stores and to cut carbon dioxide emissions, has made a commitment to find 10 percent % of our energy from renewable sources by 2010, rising to 20 percent % by 2025. Renewable energy may come from sources such as wood that are self-regenerating, or those such as the sun that are effectively infinite. The technologies associated with these sources are sometimes referred to as 'low-carbon', in that they emit much lower levels of carbon dioxide and related compounds into the atmosphere than do fossil-fuel technologies. In deciding how best to incorporate a renewable technology, the principle of minimum intervention and reversibility should be adopted whenever and wherever possible. Installing a solar electric system will probably need planning permission. The local planning authority can grant permission under the Town and Country Planning Act 1990, and they will be looking for any issues about visual impact or proximity to land boundaries. Installing a solar electric system on a Listed Building or a building in a Conservation Area will also need permission from the local planning authority under the Planning (Listed Buildings and Conservation Areas) Act 1990. Planning Policy Guidance PPG 15 'Planning and the Historic Environment' can help you with this: see www.planningportal.gov.uk. A New Planning Policy Statement (PPS) 15 will replace Planning Policy Guidance 15:

Green Energy installations in a Heritage Town like Havant is a very delicate decision making process, one must give due care and consideration to English Heritage policies, guidelines together with considering the wider Climate Change Mitigation targets all Councils in the UK and Globally are trying to programme for, balanced, careful approach is required.

It was recognised at a very early stage in this process of Exploring the Green Energy potential for Church Buildings that the Havant Borough Council Conservation Officer – John Townsend was very informative, engaging and helpful together with very knowledgeable on the subject and offered advice and guidelines to the Parish Development Officer an also Alan Brewer.

Planning and the Historic Environment (PPG15) and Planning Policy Guidance 16: Archaeology and Planning (PPG16) from 2010. Work of any kind to a Scheduled Monument requires consent from English Heritage under the Ancient Monuments and Archaeological Areas Act 1979 (source 05). Your application will need to show clearly what you intend to do, with detailed drawings and photographs. It is useful to draw the panel on a photo of the site or building in order to help the planning officer visualise it in its proposed setting and determine its visual impact.

PV installation on a flat roof at Crichton Castle, which is now in the care of Historic Scotland *(Photograph courtesy of Historic Scotland)*

Businesses up and down the country are installing solar PV systems for sound commercial reasons:

1. Receive an annual ROI of 10% or higher
2. This government-backed return is index-linked and guaranteed for 20 years
3. Protect your Church from the inevitable price rises from the Big Six energy companies
4. Enjoy clean, free solar electricity for years to come
5. Solar electricity generation typically coincides with your main energy demand
6. Demonstrate your green credentials by reducing your carbon footprint

Before designing the installation it would be advisable to consult an experienced "lead" contractor because of the positioning of fixings and cabling that go through the roof is critical to the longevity of the lead. (This will not be required in a ballasted Solar PV installation as being proposed) Detail of a fixing through lead sheet into the roof rafter is shown in the guideline. Anyone contemplating putting PV panels on a lead roof should refer to the Lead Sheet Association (see Useful contacts) manual for guidance (ref: Rolled Lead Sheet – The Complete Manual. A guide to good practice in the specification and use of rolled lead sheet to BSEN 12588:1999. Lead Sheet Association 2003) (source 09) on detailing.

Typical Inverter installation

Equipment should be located to permit easy access for maintenance and repair. All parts of the installation should be indicated on a working drawing. Where equipment is to be fixed to building walls, the number of fixing points should be minimised by the use of a wooden pattress or frame system.

The PV system is made up of the roof top array and the electrical distribution system and equipment. The electricity generated by the PV cell is direct current (dc). An inverter is needed to convert this to alternating current (ac) so that it can be used for electrical appliances or fed back to the grid. Other essential elements of the system are an isolation switch, allowing the panel to be disconnected for safe maintenance or repair and a meter to measure the energy generated.

The Solar PV electrician will install an inverter and connects the system so that it is generating electricity. The installation takes 1 to 2 days for an average domestic-sized system but longer in the case of St Faiths Church. Please refer to English Heritage publication - Small scale solar electric (photovoltaics) Energy and Traditional Buildings – 2010.

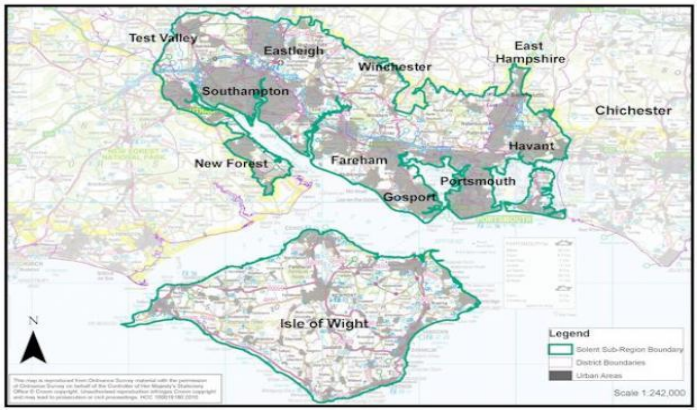
When considering these guidelines we believe that the Conservation Officer and also English Heritage should consider the wider Climate Change Mitigation goals to reduce CO_2 level and also all the four solar companies and their proposals indicated. Renewable Energy, Energy Efficiency and Sustainable Developments programme indicated in this report together with the Mission Plan - Energy efficiency should be a priority as well as Green Energy production and demonstration to the Community of Havant and younger generations coming up in Havant that the Christian Commitment tom Climate Change Mitigation is seen to be supported by Planning Officers, English Heritage and also the Conservation Officer. The Mission plan is also seen as a much needed community enhancement programme and fits in very nicely with the overall UK Solar Photovoltaic Roadmap – a Strategy for 2020. Revenue generation is so very important from a Christian point of view as much good work can be done with increased cash-flows and revenues from the Solar PV installations.

What the real Climate Change problem is - PSECC comment "As ice caps melt there is a danger that the ocean conveyor system will close down resulting in more Hurricanes, Tornadoes over land mass and not just over the sea, sea level rises and the balance of fresh water and sea water alters resulting in a desalination and major climate shift. Storm surges could result and a "Super Storm" results in pulling down much colder air resulting in much of the Worlds land mass being under thick belts of snow & ice, another ice age." We must act now and in more urgency – The Mission Plan Aim of Green Energy is a good one for the local and Global Communities. Climate Change is a real issue that needs to be addressed more urgently by each Global Country, each County, each Council and each person. Green Energy is part of Climate Change Mitigation that is so much needed now in each community. The St Faiths Aim to Explore Green Energy is a desire to demonstrate a Christian caring ethos to this and future generations and fits into the five following programmes within England and the South East to tackle Climate Change and develop more Green Energy..

7 Future Solent Programme

Programme Manager

Richard Hall



CREATING A LOW CARBON ECONOMY

The Solent is an area of strong economic growth within the UK. There is a growing "green economy" with many strengths emerging in research & development, environmental technologies, energy, waste and construction.

Future Solent aims to capitalise on these strengths to promote further development of the green economy, and with it, economic growth and jobs. Future Solent has been established as a joint approach by the Solent Local Enterprise Partnership (Solent LEP) together with the Partnership for Urban South Hampshire (PUSH) and the Hampshire Chamber of Commerce in the Solent area to achieve a low carbon, green economy, the Church Solar PV panel installations could be extremely beneficial to the Future Solent Programme.

Here at **Future Solent** we have a vision that *"the development of a low carbon, green economy in the Solent area will help stimulate sustainable economic growth, create jobs and reduce our carbon footprint. The Solent area will become the national leader and internationally recognised for its low carbon, green economy. Sustainability will be at the heart of the sub-region's success in generating economic growth, prosperity and improving quality of life."*

Solent Energy Strategy

Future Solent Board Sponsor

Ben Earl Project Leader

Gill Kneller (Havant Borough Council)

Committed Organisations

The Partnership for Urban South Hampshire (PUSH) and the University of Southampton

Project details

Meeting the energy needs of the Solent region into the future, ensuring energy security for businesses, Schools, Churches and Homes, maximising the economic benefits of energy, decarbonsing the energy supply and securing investment into the optimum renewable and low carbon energy projects by taking forward the PUSH (Arup) study.

How it delivers the priorities

Priority 1: New Low Carbon & Green Technology

An energy strategy can support the development of renewable technologies within the Solent

Priority 2: Resource Efficiency in Homes and Businesses

An energy strategy will promote energy efficiency and demand management as a key component of the strategy mix.

Priority 3: Generation of Secure, Renewable & Low Carbon Energy in the Solent
The energy strategy will identify assurances, opportunities and drivers of energy security for businesses and homes into the future and will help decarbonise the energy supply, thus helping meet the national and local targets.

The Programme has two elements to it:

1. Support for Environmental technology R&D and Innovation Businesses. Companies will be supported with access to research and development facilities at the University of Portsmouth and University of Southampton Science Park, as well as access to networks and support in developing business plans. In addition, new and growing small companies will be able to apply for grants up to £100,000 to help deliver their business plans and new products. THE GRANTS HAVE NOW BEEN AWARDED AND WE ARE WAITING TO HEAR IF WE CAN GET MORE FROM GOVERNMENT (AS AT 1ST DECEMBER 2014)

2. Sustainable support for loan capital to Solent Green Economy Businesses. Small and medium sized businesses within the green economy will be provided with access to loan capital (from 2.5% negotiable) to assist their development and expansion. Future Solent and Eastleigh Borough Council together with Local First will operate a competitive programme to award loans to green economy businesses.

The businesses benefiting will be from across the spectrum of the green economy including those within the energy efficiency / retrofit business; waste and recycling; renewable and low carbon energy production; marine and maritime; and sustainable design, engineering and construction - all areas where the Solent has a good base of businesses to grow and develop.

In addition, support will be provided to Local First CIC to establish a Hampshire Community Bank. This will provide an on-going source of loan capital to green economy businesses and remedy a market failure in loan provision to SMEs generally and green economy businesses specifically. Together with provision of a grant to Local First CIC, it is envisaged that the Bank, once established, will inherit the loan portfolio to help capitalise the bank, to enable leverage to provide further funds to SMEs and to create an on-going revolving fund of loans to green economy businesses. All ‘green economy’ SMEs in the Solent LEP area may apply to the Green Growth Business Loan Scheme.

8 Havant BOROUGH COUNCIL

Sustainable Development: Development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

Climate Change and Energy Studies

"Reduce CO_2 emissions and adapt to climate change; protect and enhance biodiversity and increase recycling" (source 13)

Overview of Sustainable Energy Opportunities in Havant (pdf)

In 2005 Savills produced a study of the renewable energy options for the borough. The study looks at national guidance and the potential application of different technologies to the borough and to three example sites. In terms of renewable energy technology and policy there has been significant development since this report was produced. Nevertheless it contains useful evidence of the applicability of renewable technology to the borough.

Energy and Climate Change Strategy

PUSH has commissioned Arup to advice on the feasibility of an energy strategy for the sub-region. View September 2008 report using link to PUSH website (Climate Change Strategy Pages).

Sustainability and Energy

What is the council doing?

We are currently developing a Sustainability Strategy for Havant Borough Council (2015)

The Solent Green Deal project - we understand the need for a trusted and transparent Green Deal service that provides impartial advice and information to Hampshire residents, landlords and trades people. Switch Hampshire - This is a free scheme to help residents across Hampshire make savings on their gas and/or electricity bills. The next Switch Hampshire scheme will be launched in the autumn. To register your interest in this or future switching schemes please visit Switch Hampshire website. Home Energy Conservation Act (HECA) - Contained within the HECA Act is a requirement for Local Authorities to publish reports by 31st March 2013 and then every two years after until 2027. The report should set out the domestic energy conservation measures that the authority considers practicable, cost-effective and likely to result in significant improvement in the energy efficiency of residential accommodation in its area.

Greenhouse Gas Emissions from Local Authorities Own Estate and Operations – The 2012/13 report.

Havant Borough Local Plan (Core Strategy)

The Havant Borough (Core Strategy) is the principal document in the council's Local Plan. It covers the Borough of Havant, setting out the spatial planning strategy for the area up to 2026. It sets out how many new homes and jobs are needed in the borough and their distribution. It also sets out what services, facilities and infrastructure such as green spaces, shops and community services are needed and when and how they will be delivered whilst having regard to the Borough's high quality natural environment. The Havant Borough Local Plan (Allocations), follows on from the Havant Borough (Core Strategy) and identifies sites for specific uses including, housing, employment, retail, recreation and green infrastructure up to 2026. Adopted Core Strategy (pdf 2.83mb)

Foreword - The Havant Borough Core Strategy is a very important document. It sets the planning framework for our communities until 2026. In preparing this strategy the council has sought to address local needs, especially for housing and economic development, with an emphasis on high quality design and stewardship of the borough's high quality natural and built environment. The Core Strategy has been prepared working closely with partner organisations, including the Havant Local Strategic Partnership, the Partnership for Urban South Hampshire (PUSH), local communities and agencies. There have been three major public consultations – Issues and Options consultation in 2006, the Preferred Options consultation in 2008 and consultation on the Draft Core Strategy in 2009. The Submitted Core Strategy was then subject to a Public Examination in September 2010.

Reduce CO_2 emissions and adapt to climate change; protect and enhance biodiversity and increase recycling. (source 13)

9. PUSH

Economic Development Strategy
Partnership for Urban South Hampshire

www.push.gov.uk/pdf/Official%20Documents/ed_strategy.pdf

Sustainable Prosperity – economic growth cannot be at all costs. The reason we seek economic growth for the sub-region is to improve the quality of life for our residents. **We must therefore seek growth within sustainable limits.** This will include environmental, social and economic sustainability. We must promote sustainable business practices to ensure we use scarce resources efficiently, reduce waste **and minimise our environmental impact**; we must use technology to enable smarter working and reduce the need for travel; we must demand sustainable construction techniques and minimising the need for travel; we must encourage growth in areas with positive long term prospects; and we must ensure social inclusion and opportunity for all.

Economic Development Strategy – PUSH – Partnership for Urban South Hampshire page 7. (source 14)

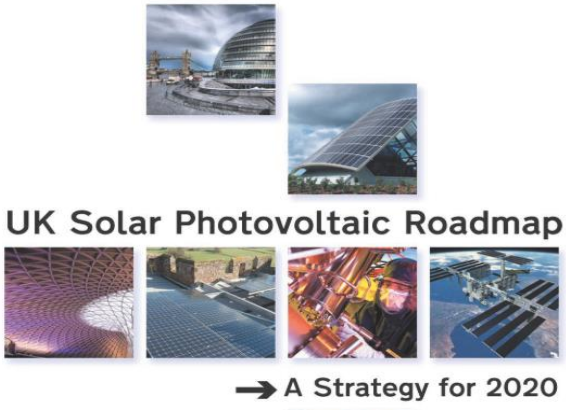
Strategic Objectives:

- Understand the sites and premises requirements across the sub-region
- Deliver appropriate sites and premises to underpin the growth of the PUSH economy
- Ensure sustainable development across the sub-region.

(source15)

A key aspect of Sustainable Development is Sustainable Energy use and Generation – for this reason PSECC suggest that the St Faiths exploration and possible installations of Solar PV at Church House Hall in the Pallant and also St Faiths Church Turret comply with the strategies of HBC and their desire in the **Core Strategy** to **Reduce CO_2 emissions and adapt to Climate Change &** the **PUSH Economic Development Strategic** Objective of **ensuring Sustainable Development across the sub region of Havant.**

10. UK solar PV Strategy to 2020



The Mission plan is also seen as a much needed community enhancement programme and fits in very nicely with the overall UK Solar Photovoltaic Roadmap – a Strategy for 2020.– Knowledge Transfer Network publication November 2013 (source UK 1)

About this Roadmap

The aim of this UK Solar Photovoltaic (PV) Roadmap is **to provide the business and research community with the tools and strategic focus to be able to transform the UK solar PV industry.** Strengthening the industry's products, manufacturing capacity, installation base and infrastructure will ensure that the UK is in the best position to create a sustainable, expanding industry with long-term growth – to 2020 and beyond.

The UK solar photovoltaic (PV) industry has significant manufacturing strengths, expertise and experience that could be enhanced to take better advantage of the global market opportunities that solar PV provides. Global installations for PV stood at 102GW by the end of 2012, showing that PV has the electrical capacity to generate as much energy as 16 coal-fired power stations [1-3].

This is just the beginning. The predicted forecast for the solar PV market globally is $155 billion by 2018, and the UK is well placed to gain at least 10% of this market - which would stimulate UK manufacturing and supply chain industries and create a wealth of new jobs for the UK workforce. By 2020 it is predicted that there could be as many as 63,000 jobs in PV manufacturing and 150,000 in installation and services.

Historically, the UK industry grew significantly after the launch of the Feed-in Tariff (FiT) scheme. Deployment levels prior to 2010 were low, with an installed capacity of less than 100 MW. But **cumulative PV installed capacity in the UK had risen to 2.4 GW by the end of Q2 2013, and reached 3 GW by the end of Q3** compared with a total installed renewable capacity of 19.5 GW. **This growth accelerated the UK to be a top ten player in the global PV market for 2011 and 2012, and sixth for global installation during the first six months of 2013** [4].

PV solar panel manufacture is well established globally and the UK has the opportunity to establish higher levels of manufacturing capability at all stages of the supply chain to feed this global market. This document highlights the significant strength and expertise the UK possesses in instrumentation, new devices and in-line production tools. The UK is well placed to take a lead in these particular aspects of the PV supply chain.

1.1. Key Strategic Recommendations

The Roadmap identifies key technology objectives linked to the R&D agenda that will enable the UK to gain recognition as one of the global leaders in solar PV, as follows:

1) Develop module technology and manufacturing supply chains in the UK to address value-added markets
2) Innovate and invest in grid connection, infrastructure and storage
3) Sustain the growth rate of PV installation
4) Improve product confidence and reliability and set a standard for high-quality British manufactured products
5) Maintain positive public perception of PV solar energy, and improve education and training
6) Develop policy for long-term stability in the solar PV industry.

5) Public Perception, Education & Training

- National campaign supported by DECC, Trade Associations & National Solar Centre
- Iconic PV demonstrations on public and national buildings, showing what can be achieved
- Shift to multi-disciplinary skills training to encompass: communication, electrical system design, aesthetics and how we use energy.

6) Policy

- Future-proofing buildings, Building regulations L2, all new builds to include PV
- Smart and net meters in-line with EU policy
- Long-term stable policy, predictable FiT. Incorporate storage and end-of-life in future policies.

These recommendations need to be the top priority for the UK Government in order for key stakeholders to adopt the recommendations and to develop the UK PV industry into a sustainable market leader that can provide sustainable jobs for the UK workforce and - ultimately - a reliable energy supply for years to come.

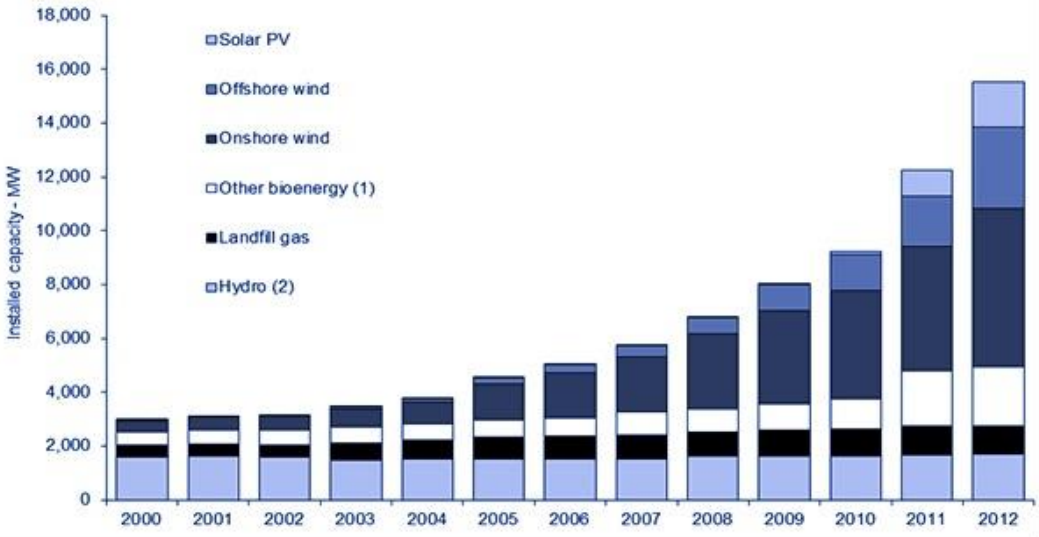
The Roadmap provides the business and research community with the tools and strategic focus to be able to strengthen the industry's products, manufacturing capacity, installation base and infrastructure. Implementing it will ensure that the UK is in the best position to create a sustainable, expanding industry with long-term growth.

It highlights how the UK can:

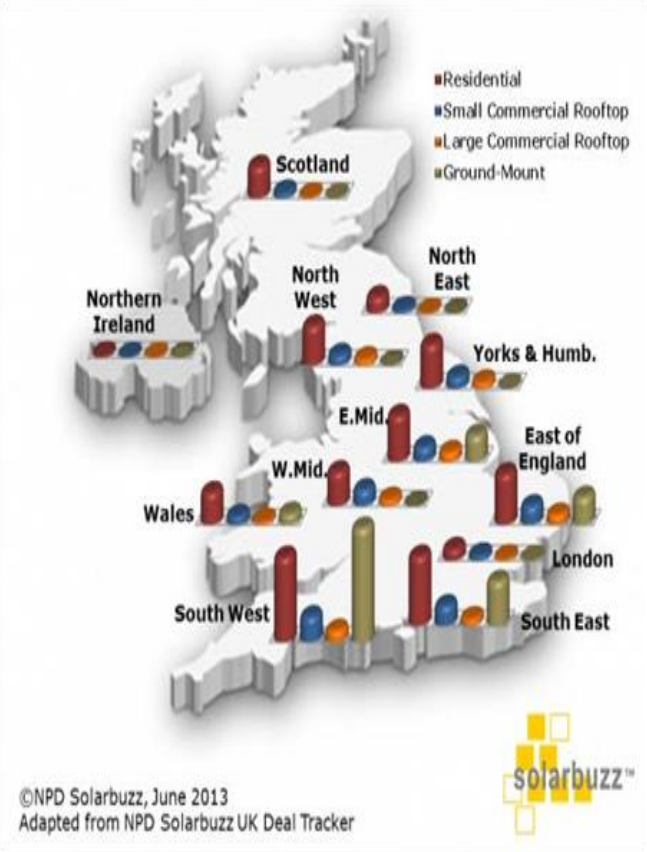
- Build on existing collaborations and its industry position to enhance UK industry in the competitive global marketplace. Spanning the breadth of the supply chain, it is intended to cultivate relationships and understanding to allow industry to compete more effectively
- Support and grow the R&D base to allow the UK to achieve reductions in specific cost per Watt peak (£/Wp) which will make the cost per kWh generated competitive with fossil fuels.

The Roadmap identifies the current status and strengths of PV in the UK and defines the key challenges and resulting opportunities that exist across the whole sector. It is an updated and substantially expanded version of the roadmap produced in 2009 [5], initiated and funded by the Electronics, Sensors, Photonics Knowledge Transfer Network (ESP KTN) and builds upon the *Solar Electricity – How can the UK best meet this opportunity?* report produced by the KTN in November 2010 [6].

The growth of the solar PV industry was encouraged largely by the attractive Feed-in Tariff (FiT) rates which raised the low levels of installed capacity (March 2011) of 86 MW to the installed capacity two years later of 2.4 GW (March 2013), accounting for 12% of the total installed capacity of renewables in the UK [7]. There has been a clear rise in the ratio of PV to total installed renewable electricity capacity since 2000, as can be seen in Figure 2. In comparison to other renewable technologies, solar PV uptake has increased from a negligible base to a rapid growth year-on-year.



The above graph is an indication of the increase in Renewable Energies since 2000 – 2012 – exponential rise expected - 2020.



The worldwide solar PV industry in 2004 provided employment for over 35,000 people with a worldwide installation of 700 MWp and projected PV jobs within the EU by 2010 stood at 59,000 rising to 100,000 if the export opportunities were successfully exploited [18]. The UK had 2% of the world market share of 102 GW installed capacity in 2012. The EPIA has proposed a model for jobs created per MW of production/installation with 10 jobs per MWp for manufacturing, 33 jobs per MW for installation and a further 4-6 jobs in wholesaling, indirect supply and R&D [19]. This model was used in the ESP KTN report *Solar Electricity How can the UK best meet this opportunity?* published in November 2010 and predicting an expansion of UK jobs in the PV industry by 2013 to 10,500 with 500 MW installed [6]. This has been exceeded due to the rapid expansion in PV installation over the intervening period and is illustrated in Figure 5. The report went on to predict that 150,000 new jobs would be created in the period 2025 to 2030 with a 30% annual growth.

To date, job creation projections have focussed on manufacturing and installation, but with the recent inclusion of PV in the WEEE and the impact of the FiT on the installation of PV systems within the UK, these projections need to also consider job creation in end of life industries and training and education [20].

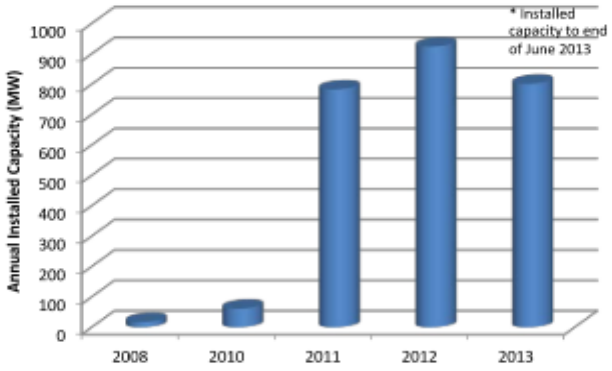
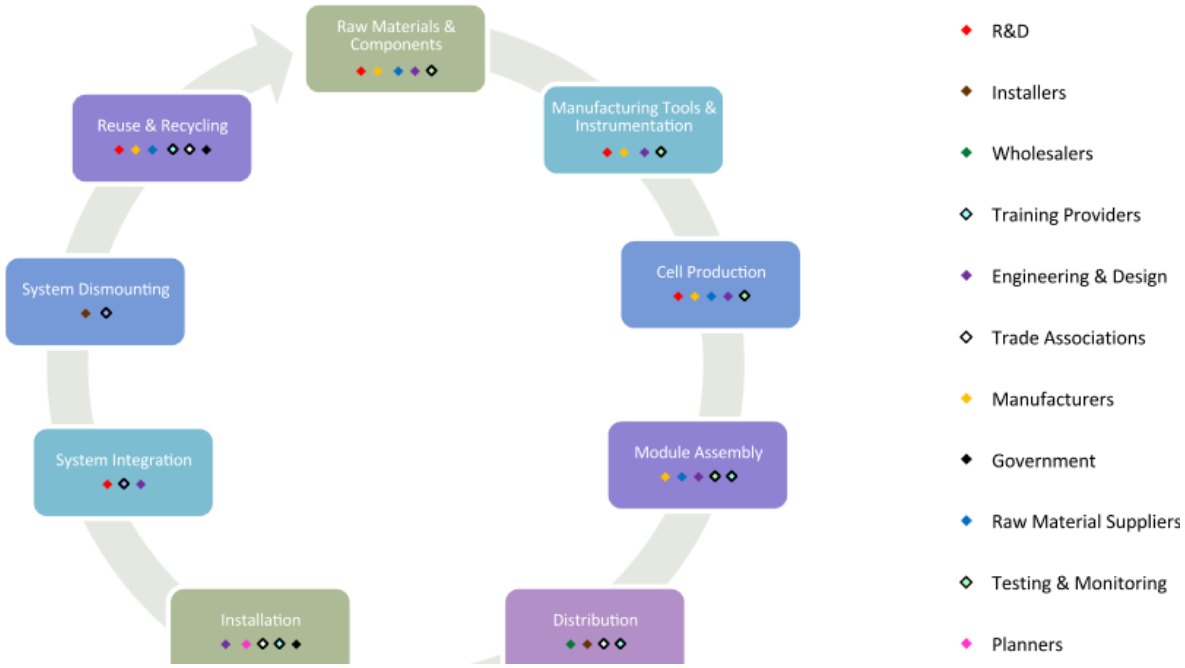


Figure 5. Growth of PV installation in the UK (year on year)

PV Supply Chain and Industry Stakeholders

The following diagram depicts the supply chain and the key stakeholders involved in each aspect:



4.7. Government Support, Initiatives and Incentives

The new incentive models from the Government now provide the UK industry with security of guaranteed FiT to 2015, allowing it to build for the future. A stable level of FiT incentive will help to avoid a repeat of the market instability experienced in 2011-2012. The Renewable Obligation (RO) bandings for solar began consultation in early 2013 and support will be needed for any unexpected changes, such as if the ROCs are reduced too rapidly. As with the FiT, there is a need to carefully manage reduction in incentives with industry price reductions. These need to be carefully monitored to ensure both investor confidence and a sustainable and growing industry.

POLICY SUPPORT

The opportunity now exists with the inclusion of solar power as one of the priority areas within the Department for Energy and Climate Change (DECC) renewable energy roadmap to grow the UK manufacturing base. The DECC Solar Strategy Group aims to bring industry and Government together to overcome the barriers to further deployment combined with the Government pledge to provide £7.6bn per year by 2020 of targeted subsidy to support the deployment of renewable energy technologies in Britain. **DECC should work with BIS to ensure that the increased adoption of PV in the UK enables a strong, globally-competitive manufacturing sector to develop.**

The DECC Renewable Energy Roadmap (issued December 2012) acknowledged solar PV and committed the UK to generating 7-20 GW of power from solar PV by 2020. This is a conservative target as the current UK-installed capacity already exceeds 3 GW. The trend in the number of installations being added per week has been broadly flat for 2013. This now brings the total number of sub 50 kW solar PV installations registered on the MCS database to just under 436,400.

The UK was the first country in the world to pass binding legislation through our national Parliament to enshrine in law, our commitment to tackle climate change. **We have legislated to unilaterally reduce CO_2 emissions by 80% from 1990 levels by 2050.**

5. RECOMMENDATIONS FOR UK PV INDUSTRY AND GOVERNMENT

The UK can expand solar PV manufacturing due to the current technology position, but linkage with the R&D base is necessary. The solar PV industry has a broad supply chain including the following sectors: plastic electronics, materials chemistry, III-V wafer growth, glass, barrier layers. **Government investment and policy to enhance the links between industry and research is a key element in strengthening the UK position in the global solar market**. There is a significant opportunity in new PV installation across all the sectors from domestic PV to large ground-mounted PV. Particular opportunity exists for PV to be incorporated into all new build where some of the build materials costs could be offset.

Domestic and Ground-mounted PV (images courtesy of The British Photovoltaic Association)

5.1. Strategic Goals and Milestones

The 2020 goal for 7-20 GW of installation is not seen as a difficult challenge to the UK solar industry, but a safe bet as the UK installed capacity already exceeds 3 GW. The UK has strong links to other potential markets and a potential strong engineering base, by building on these relationships and developing **a single large PV accredited Research Centre the UK will be better placed to impact on the global market**. The creation of the NSC is a step in the right direction, but further support and technological investment is needed in order to meet the demands the UK industry requires for new technology.

The understanding of individual business targets was assessed in order to define targets for PV installation. The timeframes were determined as;

1). Short-term 2016 to be in line with the recent EPIA PV Global Market Outlook document issued in May 2012
2). Medium-term 2020 to correspond to the DECC renewable roadmap and the requirements from the EU for smart meter installations and
3). Long-term is defined as beyond grid parity.

The strategic goals and milestones for the UK PV industry are outlined below in terms of short- and medium-term according to industry timelines. It would be naïve at this stage to form long-term milestones for beyond grid parity, therefore this document concentrates on the critical opportunities for the short and medium term but provides a vision for the longer term. The following table (Table 2) details the main strategic action points that were highlighted as essential at the consultation event in order for the UK to fully embrace the opportunities PV provides. (• signifies the number of votes per topic area).

5.1.1 SHORT TERM: 2016

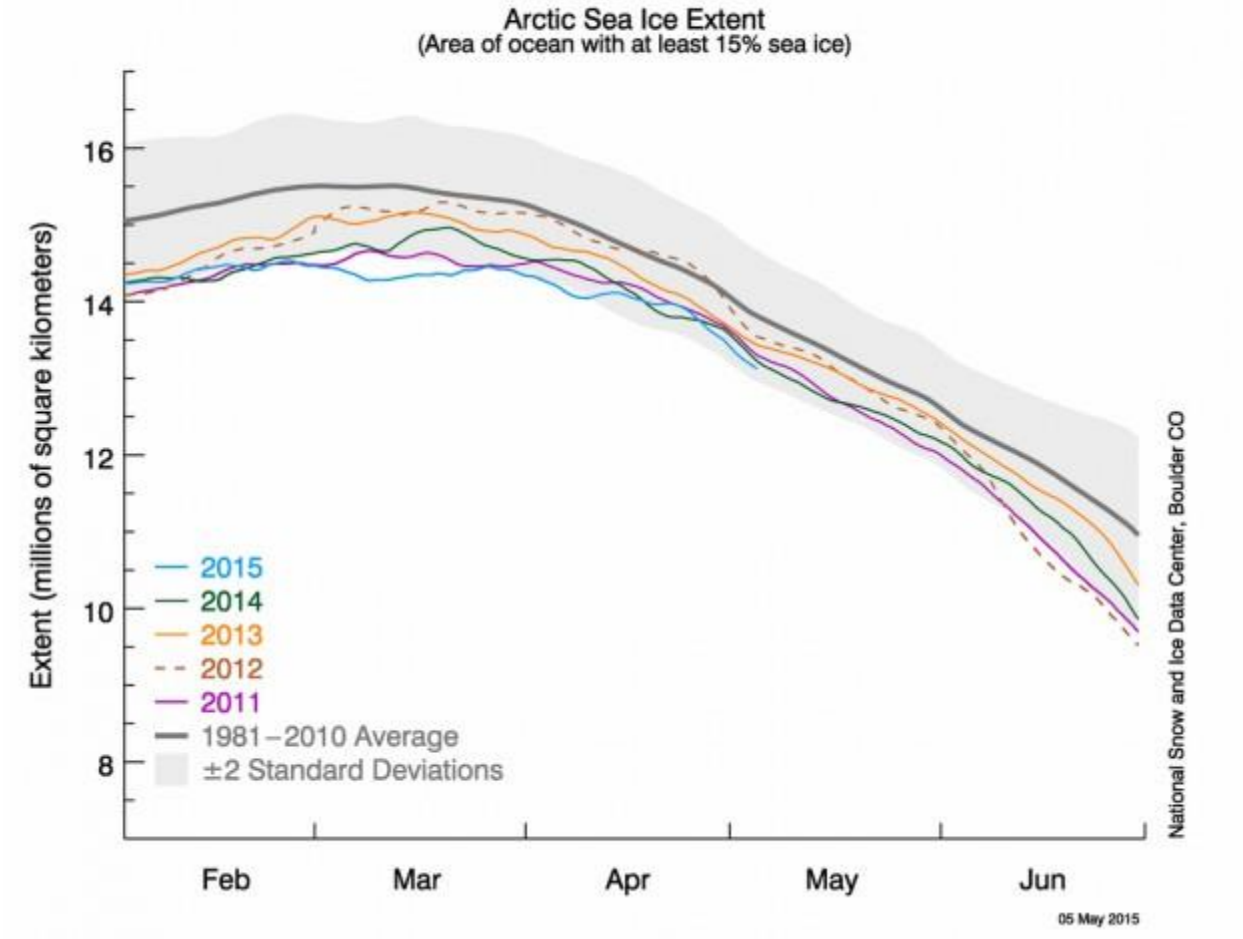
In order for the Government to fully embrace PV, there needs to be more visibility of its commitment to this renewable technology by putting PV on well-known public buildings.

The WEEE directive will mean that the UK will need to act now in order to establish protocols for end-of-life for PV. Precedents have already been set by other EU member states and the UK Government should look to follow Italy, Belgium and the Czech Republic to develop UK waste management laws for end-of-life PV modules. The Standard Assessment Procedure needs to be set at a minimum of above 1kW and the MCS accreditation needs to be more rigorous and fit for purpose than the present scheme.

Short-term targets will be to;

1) Establish which of the innovative and advanced technologies has technical scalability and lifetime durability
2) Further links of the research base to industry through knowledge transfer
3) Continue to reduce manufacturing costs per kWh
4) Enhance applied research into processes and control for materials and production in industry
5) Research and develop new device architecture.

A reminder - What the real Climate Change problem is – PSECC comment – "As ice caps melt there is a danger that the ocean conveyor system will close down resulting in more Hurricanes, Tornadoes over land mass and not just over the sea, sea level rises and the balance of fresh water and sea water alters resulting in a desalination and major climate shift. Storm surges could result and a "Super Storm" results in pulling down much colder air resulting in much of the Worlds land mass being under thick belts of snow & ice, another ice age." We must act now and in more urgency – The Mission Plan Aim of Green Energy is a good one for the local and Global Communities. www.psecc.com/html/global_warming.html



www.thinkprogress.org/climate/2015/05/11/3656442/arctic-death-spiral-deniers-confused/

Arctic sea ice extent as of May 5, 2015, along with daily ice extent data for four previous years (2015 is shown in blue). We have set many records for low sea ice this year so far.

A new study by scientists at Scripps Institution of Oceanography finds that the Arctic sea may go ice free in the summer faster than previous models had projected. Somehow climate deniers took this to mean something completely different.

Comprehensive global climate models (GCMs) had projected the complete loss of summer ice to occur at 4°C of annual warming in the northern hemisphere. The Scripps scientists developed a more complete model than the GCMs, and found, "The model becomes seasonally ice-free at 2°C of warming."

Climate science deniers, such as those at the website "Daily Caller," are touting this study because they think it says the Arctic will soon reverse its death spiral. But as the study's actual authors confirmed to me, "In short, what you write here regarding our study is correct, and the Daily Caller article that you link to is incorrect."

PSECC has been formed to provide advice, support and guidance on Climate Change, Global Warming, Renewable Energy, Grants and Funding provision for the people of Portsmouth, Portsmouth & Hampshire Council's, Governments, schools, colleges, Commercial & International clients. PSECC's advice is to not leave Global Warming to others, we must do more, energy efficiency also Renewable Energy - Solar PV, Biomass, Wind & Water Turbines, Carbon Capture & Storage & Nuclear, do we risk limited action, can we take the risk?? NO

11 Sun Smart Energy Ltd (The preferred company for St Faiths project)

PSECC recommend this solar energy company for the work on St Faiths Church and the Church House – the better professional service & offer. They have consistently throughout this exploration shown real commitment and professional services.

SunSmart Energy - explore the possibilities of Green Energy Solar PV.

If St Faiths are interested in Finance?, Solar electricity systems can either be bought outright by the Church when installed or finance is available over a number of years, either with or without an initial deposit. Talk via Sun Smart Energy Ltd to finance partners Capitas Finance for further details.

It Really Is Free Energy - We're harnessing the energy of the Sun

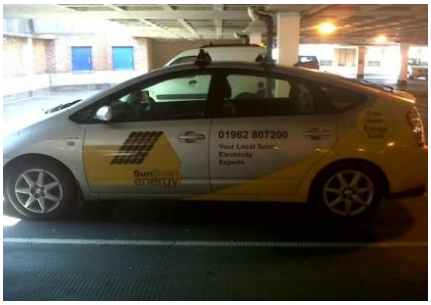
For the environment - Solar PV energy is a clean, renewable source of energy. Your St Faiths Church PV panels will save tonnes of CO_2 per year – they won't release CO_2 or any other pollutants and the sun is an infinite (and free!) source of energy: even on an overcast day, Church panels will produce some electricity. So the Church "Carbon Footprint" will be reduced, and the Church will be helping the UK become less dependent on fossil fuels.

According to the Department of Energy & Climate Change (DECC) - every kWh of electricity consumed from the grid emits 0.541 $kgCO_2e$. For on-site renewable energy generation DECC advise that a factor of zero may be used.

Therefore, we can assume that for every kWh of electricity generated from on-site renewables on the two St Faiths Church buildings there is an equivalent saving of 0.541 kg of CO_2. A 2KW Solar systems saves 1.2 tonnes CO_2 per year

For the Church

Solar PV panels are a great investment for the Church, the Solar PV systems will have paid for itself within 8-10 years. Most systems produce about 8-10% return on your money! We have carried out our free solar energy audit on your two properties we will be able to give you our predictions for your property later in the quote and report. Many customers tell us we underestimate! St Faiths Church will receive the FIT payment for all the electricity your panels produce. You can use that free electricity as it's produced, so saving money on electricity the Church no longer need to pay for from your supplier. Electricity you don't use will go into the National Grid and you'll be paid for this! (Usually this is estimated at 50% of the electricity you produce, because most homes and clients like the Church don't yet have a Smart meter – so you're getting a good deal here too)



12 St Faiths – Church House Hall

Internal roof supports – Structural survey will be needed to be performed before any installation can take place.

Bear Hotel – possible objection to installation on Church House Hall in the Pallant, discussions with its Management should be undertaken to prevent any possible objection being raised.

The Aesthetics.

Sun Smart Energy Ltd - our panels look great!

One of the installation companies "SunSmart Energy Ltd" has access to all the solar panels currently on the market. You can choose from standard poly-crystalline panels, which have a blueish tint, to all black mono-crystalline panels.

SunSmart have an exclusive arrangement with SunPower that supplies the highest efficiency-rated black panels in the world.

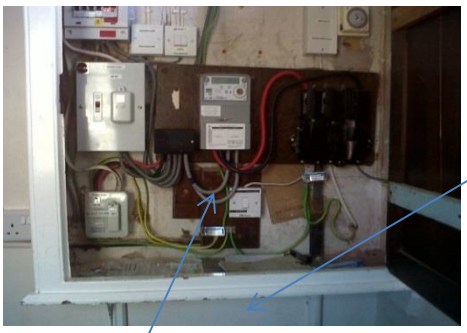
There's even an option to have panels that look like the tiles on your roof. Take a look at our case studies on our website www.sunsmartenergy.co.uk to see what some of the panels look like.

Church House Measurement process -

Infra-Red measurement was undertaken by **Sun Smart**

Sun Smart - the only company out of the four invited companies to actually use Infra-Red measurements on both the Church House Hall South facing roof area and main Church Turret roof for possible installations of Solar PV panels. **Ifra-Red – accurate measurements.**

Church House Hall South facing roof area for possible installation of Solar PV panels.



Inverter for PV should be placed near to the electrical gear.

Main door entrance - Site of current electrical gear at Church House - room for Inverter to the side of case or below.

13 St Faiths Church Turret flat roof

St Faiths Church Turret has a leaded flat roof ideal for the installation of Solar PV Panels in a ballasted arrangement requiring **no drilling of holes** in the lead roof.

The Church is a Grade II listed building in the Heritage area of Havant and as such a balanced approach and care adopted in any fixing of panels to the roof area is required. Ballasted Solar PV panel systems on a frame will not alter the fabric of the lead roof in any way.

Will you Require Planning Permission? -In most cases, No – in this case **Yes** and consultation with English Heritage, Conservation and Planning officers at HBC is required due to Heritage status of Town and listed building status of main Church.

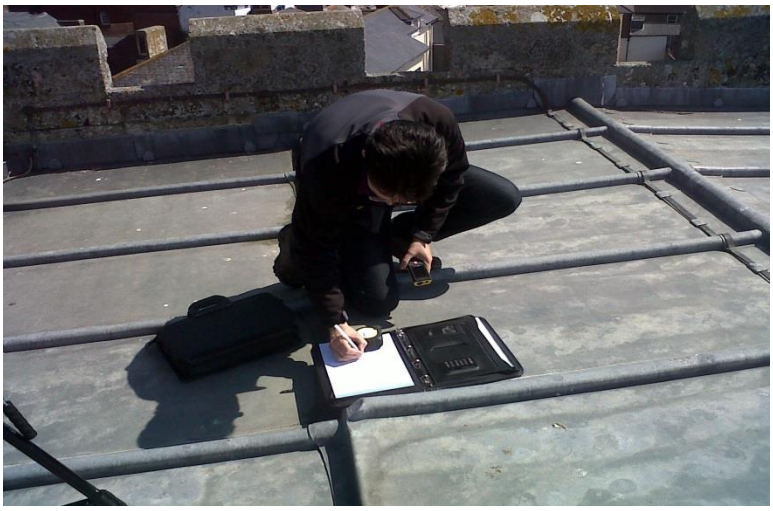
Father Tom looks on – discussing installation type for the flat roof of the Turret.

For nearly all residential and business properties, you don't need planning permission to install solar panels; this is because since September 2011, solar panels have been part of permitted development. If you live in a listed building or a conservation area we can help you confirm this, but in this case you will need planning permission and permission from English Heritage.

We must maintain a balanced approach when considering Solar PV panels for the Church, in line with English Heritage Guidelines and recommendations together with Church Policy and Aims.

Care will be taken for good access to the Flag Poll in the centre of the roof area – minimal shading.

Measurement process -



Sun Smart MD - taking measurements on the Church Turret flat roof area.

The Solar Panel Installation Process:

We want to be sure you have the most beneficial array of solar panels for your Church properties. So four experienced solar-power consultants have visited each or the two properties, measurements taken and to discuss your energy requirements. We use advanced 3D-modelling and solar-simulation software to analyse your property, its position, the shading objects surrounding it and how your buildings will work with solar panels.

Exactly what to expect

Using information about the sun and shading on each property throughout the year, we can calculate in our proposals the amount of electricity and income you can expect to generate from the Solar PV panels on your Church properties.

Before The Installation

This means you can make an informed decision about the installation: you'll have reliable information about the cost of the investment, what return you will receive, where the panels should be placed and which panels would work best for your Church properties.

The Installation Itself

Our experienced roofers and electricians will work on the Church installations. The roofers will install the PV panels. They will remove the roof tiles, attach the panels securely to your rafters and then put the tiles back, replacing any we found broken. This ensures your property is left exactly as it was, with the addition of very secure panels. The installation for the Church Turret will be a ballasted one.

The electrician then installs the inverter and connects the system so that it is generating electricity. The installation takes 1 to 2 days for an average domestic-sized system, longer in the case of St Faiths Church.

The Complete Manual. A guide to good practice in the specification and use of rolled lead sheet to BSEN 12588:1999. Lead Sheet Association 2003) (source 09) on detailing for any possible installation problems.

14 Comments by HBC Conservation Consultant - 24 April 2015 made to Alan Brewer of PSECC

"In considering proposals for green energy within conservation areas and on listed buildings it is necessary to strike an appropriate balance. Green energy is embraced where it can be tailored in a way that ensures the visual impact is contained and does not compromise the character/appearance of the conservation area, the special architectural/historic interest of a listed building and/or its setting. St Faith's Church is a grade II listed building, placing it within the top 8% of all listed buildings nationally. As a consequence Historic England, the national heritage adviser, would be consulted on any planning proposal for such work.

The provision of photovoltaic panels on the flat lead roof of the church tower would in principle have potential, if they could be shown to be visually concealed and would not interfere with the long term maintenance of the building fabric. General guidance on the subject is provided by Historic England (badged English Heritage – the former name prior to reorganisation this month).

I would not be able to support the use of photovoltaics on more prominent roof slopes. (On the main Church)

The Council does operate a **"pre-application advice service"**. This is designed to provide potential applicants with a feel for how an application would be considered and any particular factors to address. The more information provided, the clearer and more definitive the informal guidance that can be provided. It is a chargeable service. For me to comment on such a proposal(s) would necessitate a site visit. The current fee is £100. This link takes you to the guidance".

www.havant.gov.uk/development-management-more-information/pre-application-advice-and-charges

www.climatechangeandyourhome.org.uk/live/content_pdfs/519.pdf

I trust this is of assistance.

Regards

John Townsend

Conservation Consultant

Development Control

Havant Borough Council - john.townsend@havant.gov.uk www.havant.gov.uk (source 10)

15 Precedence for Solar Installations - has been set in Heritage Town of Havant

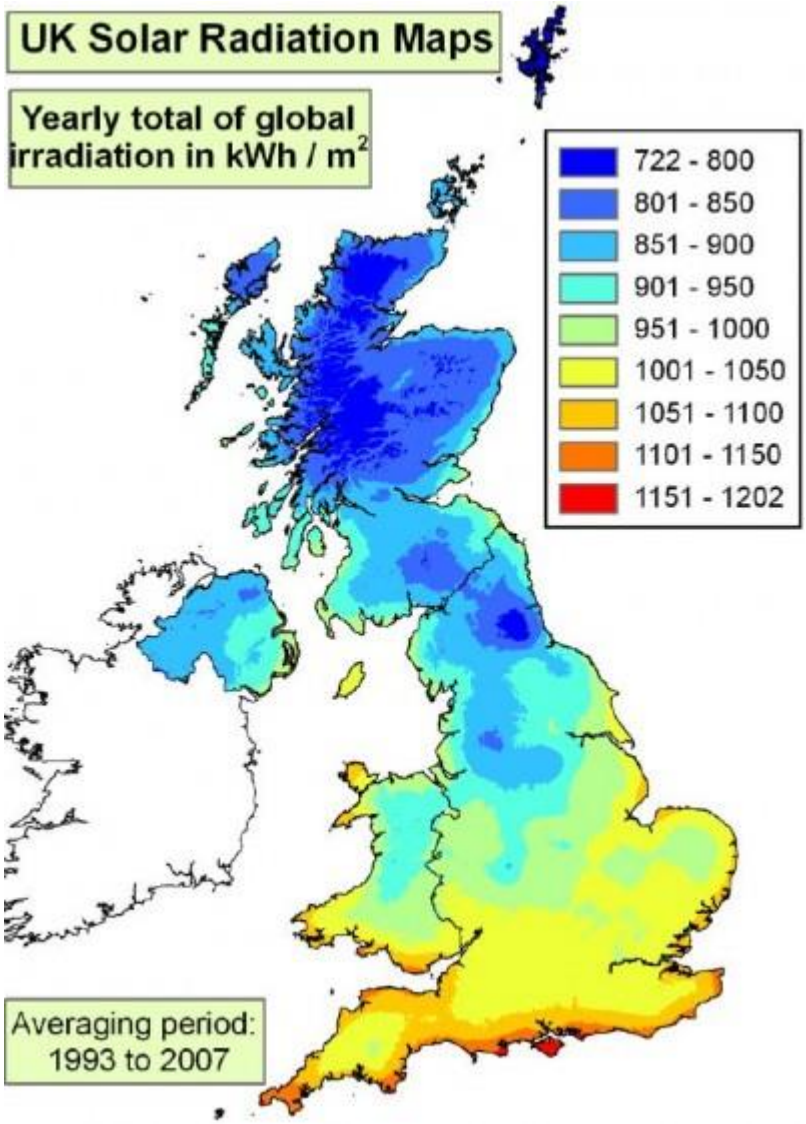
"Precedence" has been set in this Heritage area of Havant in Waterloo Road for Solar installations as can be seen by the above picture. If you look at Church House building in the middle of the picture and then follow up from the right sky light about half an inch you will see a 3KW Solar PV and Solar Thermal Water installation on another building in the distance in Waterloo Road. The Manager Rob Fryer of the Meridian Centre in Havant requested in 2013 that Alan & PSECC put proposals for Solar PV installations on the roof car park areas of both the main car park are at the Meridian Centre and also at West Street car park areas. These proposals are still being considered and ongoing, albeit somewhat stalling, if adopted – further "precedence".

Many other installation of Solar can be found in Havant, as you travel out of the Town along the old Emsworth road, just going over the old Puffing Billy line on East Street, on the left you will see a very large installation of roof mounted Solar PV panels on a block of two storey flats.

Throughout Leigh Park you will see over a hundred homes having a Free Solar Install arranged by Alan Brewer and the company Freetricity Plc.

Typical Leigh Park ex Portsmouth City Council Housing stock – Solar PV fitted via Alan

16 Solar Map of the UK



17 Appendix
Solar Quotes & Commercial Proposals

Sun Smart Energy Ltd - Planning Permissions (Sun Smart comments)

There are two types of permission to consider when connecting solar arrays larger than 4 kWp to the grid.

First, a pre-application must be submitted to the local Distribution Network Operator (DNO), Southern Electric, where more than 16A per phase could be exported to the grid. As you have a 3-phase supply and the inverter we have chosen is limited to 14.5A per phase, a pre-application is not necessary.

Second, commercial solar installations can require planning permission under certain circumstances. The Town & Country Planning Act states:

Development is **not** permitted by Class A if—

(a) the solar PV or solar thermal equipment would be installed on a wall or pitched roof and would protrude more than 200 millimetres beyond the plane of the wall or the roof slope when measured from the perpendicular with the external surface of the wall or roof slope;

(b) the solar PV or solar thermal equipment would be installed on a flat roof, where the highest part of the solar PV or solar thermal equipment would be higher than 1 metre above the highest part of the roof (excluding any chimney);

(c) the solar PV or solar thermal equipment would be installed on a roof and within 1 metre of the external edge of that roof;

(d) the solar PV or solar thermal equipment would be installed on a wall and within 1 metre of a junction of that wall with another wall or with the roof of the building;

(e) in the case of a building on article 1(5) land, the solar PV or solar thermal equipment would be installed on a wall or roof slope which fronts a highway;

(f) the solar PV or solar thermal equipment would be installed on a site designated as a scheduled monument; or

(g) the solar PV or solar thermal equipment would be installed on a listed building or on a building within the curtilage of a listed building.

We have designed the system to get round clauses (a) and (c). The only clause that could cause any issues is clause (e). ‘Article 1(5) land’ may correspond to the heritage nature of the site. Then it would come down to the question: “Does the Church House Hall front a highway?” I am not a lawyer, but I would assume that a car-park is not a highway. In which case, planning permission is not required for this solar installation. Nonetheless, you will need to make your own enquiries on this point.

Product & Workmanship Guarantees

All of the equipment, such as panels, inverters and mounting kit, come with solid warranties.
In addition, our workmanship is guaranteed for 5 years by IWA. This is an insured warranty scheme designed for the solar industry, such that if anything happens to SunSmart Energy in the 5 years following installation, IWA will honour the workmanship guarantee.

Feed-in Tariff Application

We will also help you fill in all the necessary forms to register your system for the feed-in tariff. The application is usually submitted a day or two after installation, though much of the paperwork can be prepared beforehand.

The current feed-in tariff rate for a system of this size is 12.13p. This is paid on all the units of electricity your solar system generates. You will also be paid for electricity you export to the national grid at 4.85p per unit. The government doesn't measure the export and assumes you export 50% (so-called 'deemed export').

The feed-in tariff scheme runs for 20 years and your estimated returns are protected from inflation. Every April (your first April would be April 2016) the feed-in tariff is revised in line with the RPI.

Why SunSmart Energy?

Here are some factors we hope will support our proposal:

1. We are a local company based in Alresford. If there are any questions or issues to be answered before, during or after the installation, we are available at any time to help out.

2. Our company focusses on solar PV only. We are specialists in this area and will bring all our expertise to your project.

3. We have extremely high installation standards and take pride in delivering solar PV systems that exceed our customers' expectations.

4. We are not one of the massive solar companies for whom your project would represent a tiny blip in their accounts. We will project manage your installation very carefully, watching over all the details. We are happy to provide references.

The Next Step

Best regards

David Lewis MD

a. **Sun Smart Energy Ltd Quote**

Church House Hall

No Planning Permission Option - normally no permission needed as it is a permitted development, however because the Church House Hall is attached to an older a Grade I listed building Planning Permission will be required.

Following on from my surveys, please find below and attached several proposals first of all for the Church House Hall a 9KW system followed by larger systems of 55 x 250W Perlight panels = 13.75 KWp
Or 55 x 275W JA Solar panels = 15.13KWp and then a very small system to comply with the wishes of John Townsend. The panels have been kept at least 1m from the edges of the roof and therefore this system could very likely be installed without planning permission (see Permissions below for further information).

This design is for a 9 kWp system. See the PDF "Church House Hall - No Planning Permission required as the design is a permitted one, one that arranges the Solar PV panels 1 metre from the edges of the roof - £13,903 ex. VAT". Towards the end of the design report, you will find visualisations of the panel layout and a shading analysis. Here is a summary:

9kWp Solar PV System

• 36 x Perlight 250W mono-crystalline panels

Revenue generation is very important from a Christian point of view as much good work can be done with increased cash-flows and revenues from the Solar PV installations.

Company

SunSmart Energy Ltd

Station Mill, Station Road
Alresford, Hampshire SO24 9JQ

Contact Person:
David Lewis

Phone: 01962 807 200

E-Mail: info@sunsmartenergy.co.uk

Client

St Faith's Church
West Street
Havant
Hampshire
PO9 1EH

Contact Person:
Alan Brewer

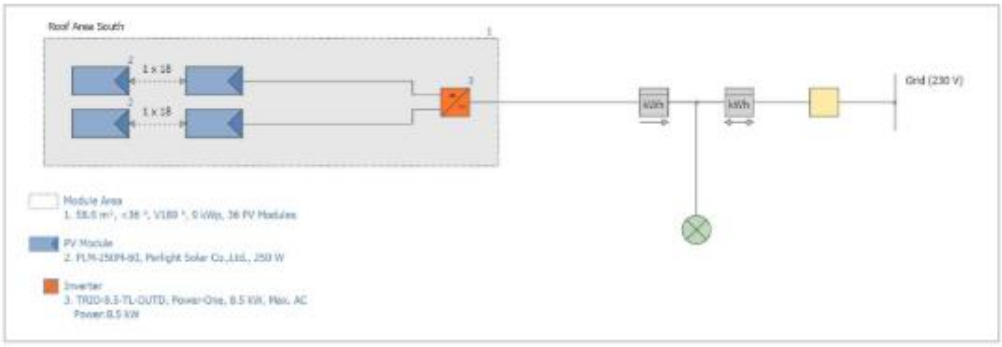
Project

Address:
St Faith's Church
West Street
Havant
Hampshire
PO9 1EH

Start of Operation Date: 01/05/2015

Project Description:
Solar PV System

3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	9 kWp
PV Generator Surface	58.9 m²
Number of PV Modules	36
Number of Inverters	1



The yield	
PV Generator Power (AC grid)	9,194 kWh
Own Consumption	2,102 kWh
Grid Feed-in	7,092 kWh
Spec. Annual Yield	1,021.57 kWh/kWp
Performance Ratio (PR)	84.8 %
Own Power Consumption	22.9 %
Calculation of Shading Losses	0.6 %/year
CO_2 Emissions avoided	5,501 kg / year

Your Gain	
Total investment costs	13,903.00 £
Return on Assets	12.45 %
Amortization Period	8.8 Years
Electricity Production Costs	£0.10

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power systen may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the system	
Climate Data	Havant
Type of System	3D, Grid-connected PV System with Electrical Appliances - Net Metering

Consumption	
Total Consumption	10000 kWh
Load Peak	23.1 kW

PV Generator Module Area	
Name	Roof Area South
PV Modules*	36 x PLM-250M-60
Manufacturer	Perlight Solar Co.,Ltd.
Inclination	36 °
Orientation	South (189 °)
Installation Type	Mounted - Roof
PV Generator Surface	58.9 m²

Figure: 3D Design for Roof Area South

Losses

Remaining power after 25 Years	80 %

Planning permission would not be required for the above array of Solar PV panels as it is within a permitted design – allowing for 1 metre from the edges of the roof.

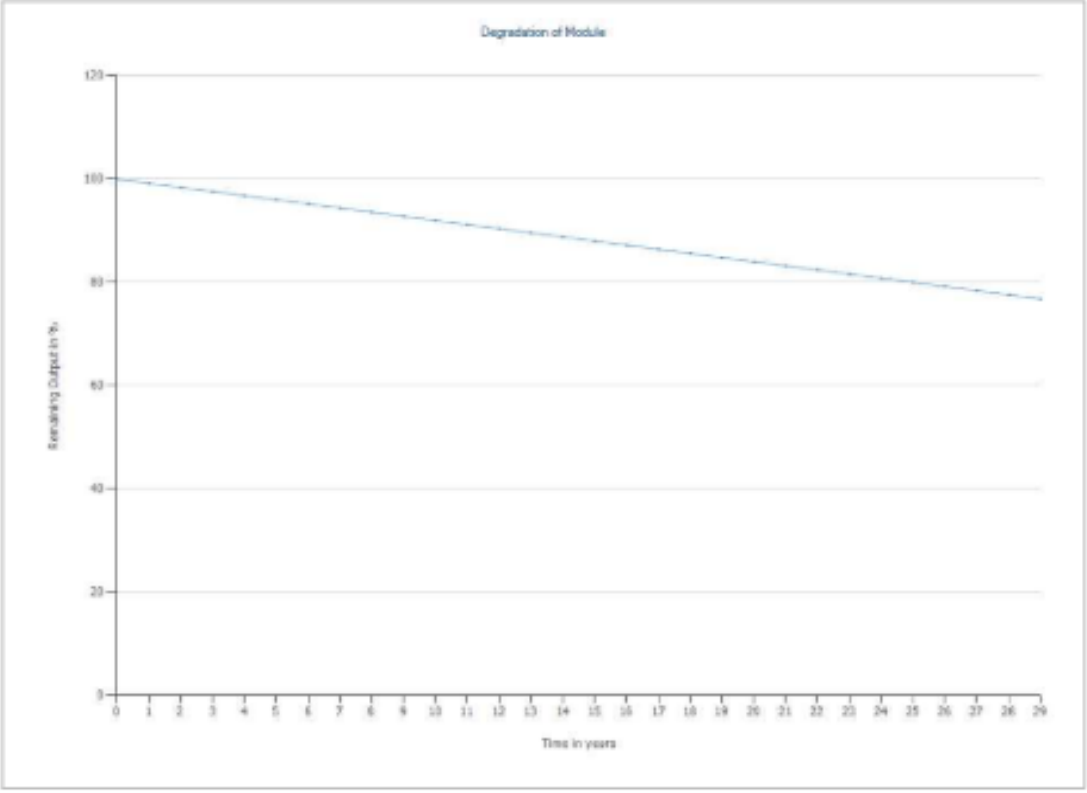


Figure: Degradation of Module for Roof Area South

Inverter	
Module Area	**Roof Area South**
Inverter 1*	1 x TRIO-8.5-TL-OUTD
Manufacturer	Power-One
Configuration	MPP 1: 1 x 18 | MPP 2: 1 x 18

AC Mains	
Number of Phases	3
Mains Voltage (1-phase)	230 V
Displacement Power Factor (cos phi)	+/- 1

Cable	
Total Loss	0.2 %

* The guarantee provisions of the respective manufacturer apply

Simulation Results

PV System

PV Generator Output	9 kWp
Spec. Annual Yield	1,021.57 kWh/kWp
Performance Ratio (PR)	84.8 %
Yield Reduction due to Shading	0.6 %/year
PV Generator Power (AC grid)	9,194 kWh/year
Own Consumption	2,102 kWh/year
Grid Feed-in	7,092 kWh/year
Regulation at Feed-in Point	0 kWh/year
Own Power Consumption	22.9 %
CO2 Emissions avoided	5,501 kg / year

Appliances

Appliances	10,000 kWh/year
Stand-by Consumption	26 kWh/year
Total Consumption	10,026 kWh/year
covered by PV power	2,102 kWh/year
covered by grid	7,923 kWh/year
Solar Fraction	21.0 %

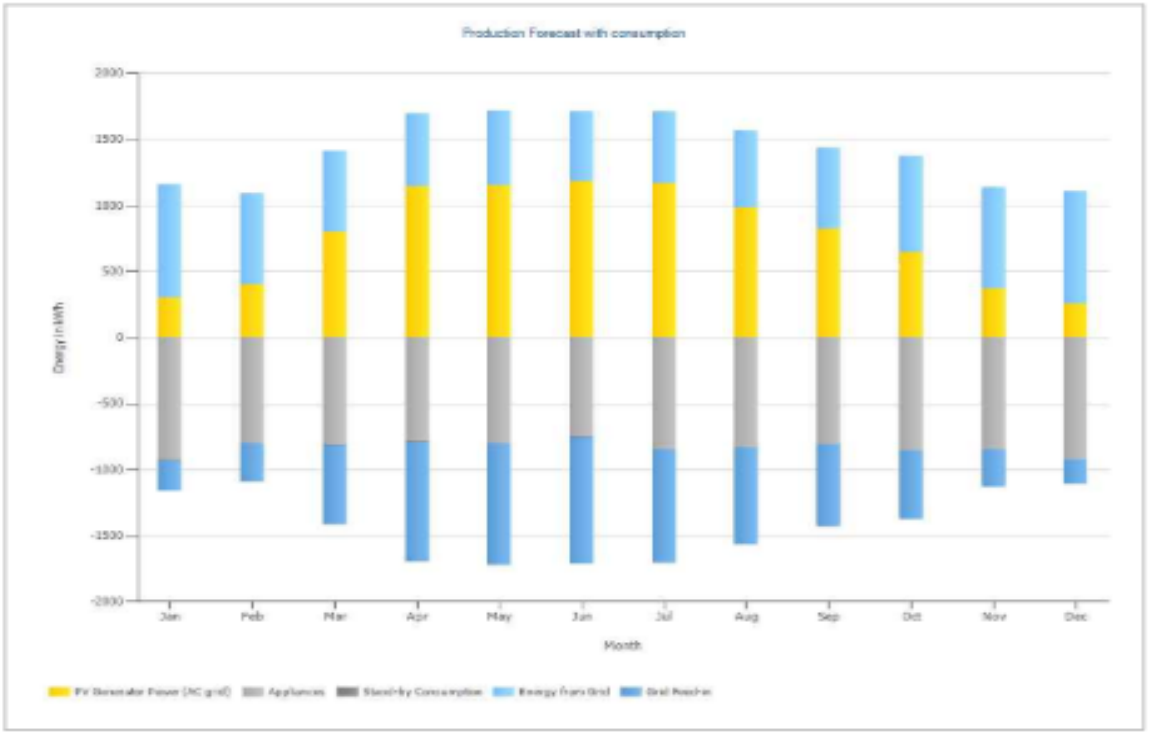


Figure: Production Forecast with consumption

PV System Energy Balance

Global radiation - horizontal	**1,078.5**	**kWh/m²**	
Deviation from standard spectrum	-10.78	kWh/m²	-1.00 %
Orientation and inclination of the module surface	137.17	kWh/m²	12.85 %
Shading of diffuse radiation by horizon	0.00	kWh/m²	0.00 %
Reflection on the Module Interface	-53.42	kWh/m²	-4.43 %
Global Radiation at the Module	**1,151.4**	**kWh/m²**	

	1,151.4	kWh/m²
x	58.92	m²
=	67,847.5	kWh

Global PV Radiation	**67,847.5**	**kWh**	
Soiling	0.00	kWh	0.00 %
STC Conversion (Rated Efficiency of Module 15.28 %)	-57,480.51	kWh	-84.72 %
Rated PV Energy	**10,367.0**	**kWh**	
Module-specific Partial Shading	-14.32	kWh	-0.14 %
Low-light performance	-422.87	kWh	-4.08 %
Deviation from the nominal module temperature	-171.20	kWh	-1.72 %
Diodes	-9.32	kWh	-0.10 %
Mismatch (Manufacturer Information)	-194.99	kWh	-2.00 %
Mismatch (Configuration/Shading)	-1.49	kWh	-0.02 %
PV Energy (DC) without inverter regulation	**9,552.8**	**kWh**	
Regulation on account of the MPP Voltage Range	-0.14	kWh	0.00 %
Regulation on account of the max. DC Current	0.00	kWh	0.00 %
Regulation on account of the max. DC Power	0.00	kWh	0.00 %
Regulation on account of the max. AC Power/cos phi	-0.31	kWh	0.00 %
MPP Matching	-22.44	kWh	-0.23 %
PV energy (DC)	**9,529.9**	**kWh**	

Energy at the Inverter Input	**9,529.9**	**kWh**	
Input voltage deviates from rated voltage	-33.90	kWh	-0.36 %
DC/AC Conversion	-283.47	kWh	-2.99 %
Stand-by Consumption	-25.63	kWh	-0.28 %
Total Cable Losses	-18.37	kWh	-0.20 %
PV energy (AC) minus standby use	**9,168.5**	**kWh**	
PV Generator Power (AC grid)	**9,194.1**	**kWh**	

Financial Analysis

System Data

Grid Feed-in in the first year (incl. module degradation)	7,065 kWh
PV Generator Output	9 kWp
Start of Operation of the System	01/05/2015
Assessment Period	20 Years

Economic Parameters

Return on Assets	12.45 %
Accrued Cash Flow (Cash Balance)	16,813.87 £
Amortization Period	8.8 Years

Payment Overview

Total investment costs	13,903.00 £
Total investment costs	1,544.78 £/kWp
Incoming Subsidies	0.00 £
One-off Payments	0.00 £
Annual Costs	0.00 £/year
Other Revenue or Savings	0.00 £/year

Remuneration and Savings

Total Payment from Utility in First Year	1,348.94 £
First year savings	311.87 £
FIT 2015 (April - June) Higher Rate - Generation tariff only - Building Attached	
Validity	01/05/2015 - 30/04/2035
Specific generation remuneration	0.1213 £/kWh
Generation Tariff	1,124.19 £/year
Inflation Rate for Generation Tariff	3 %/year
FIT 2015 (April - June) Higher Rate - Export tariff with 50% deeming - Building Attached	
Validity	01/05/2015 - 30/04/2035
Specific generation remuneration	0.0485 £/kWh
Generation Tariff	224.75 £/year
Inflation Rate for Generation Tariff	3 %/year

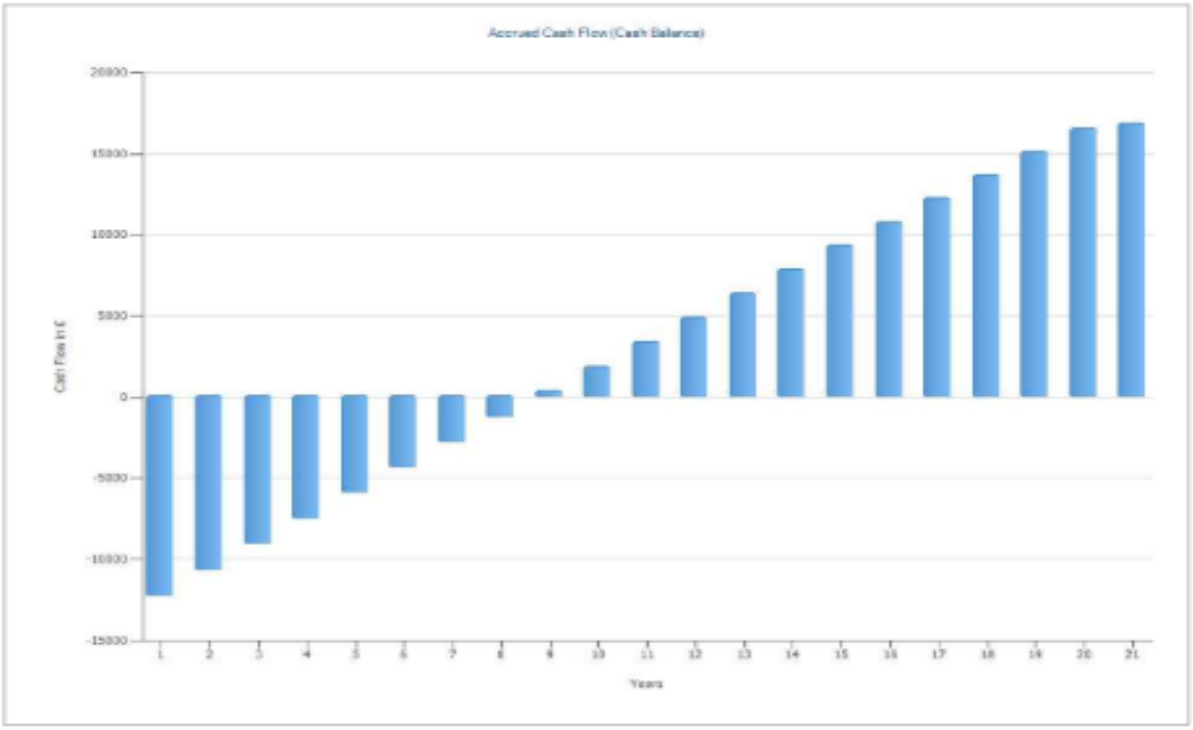


Figure: Accrued Cash Flow (Cash Balance)

Project Number: 00668
Date of Offer: 04/05/2015
Project Designer: David Lewis
Company: SunSmart Energy Ltd
Church House Hall - No Planning - £13,903 ex. VAT

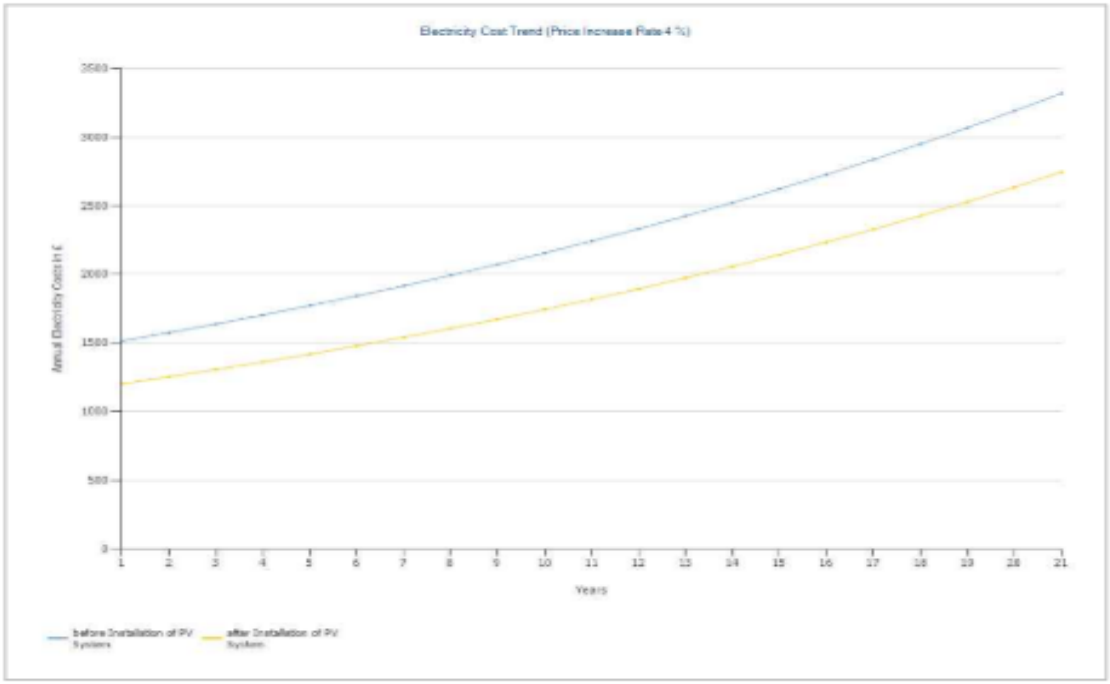


Figure: Electricity Cost Trend (Price Increase Rate 4 %)

Cashflow Table

Position	year 1	year 2	year 3	year 4	year 5
Investments	-£13,903.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£1,309.65	£1,299.66	£1,289.66	£1,279.65	£1,269.63
Electricity Savings	£302.79	£303.27	£303.74	£304.18	£304.61
Annual Cash Flow	**-£12,290.56**	**£1,602.93**	**£1,593.39**	**£1,583.83**	**£1,574.24**
Accrued Cash Flow (Cash Balance)	-£12,290.56	-£10,687.63	-£9,094.24	-£7,510.41	-£5,936.17

Position	year 6	year 7	year 8	year 9	year 10
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£1,259.60	£1,249.57	£1,239.53	£1,229.48	£1,219.42
Electricity Savings	£305.01	£305.39	£305.76	£306.10	£306.41
Annual Cash Flow	**£1,564.61**	**£1,554.96**	**£1,545.28**	**£1,535.57**	**£1,525.83**
Accrued Cash Flow (Cash Balance)	-£4,371.56	-£2,816.60	-£1,271.32	£264.26	£1,790.09

Position	year 11	year 12	year 13	year 14	year 15
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£1,209.35	£1,199.27	£1,189.19	£1,179.10	£1,168.99
Electricity Savings	£306.71	£306.98	£307.23	£307.46	£307.66
Annual Cash Flow	**£1,516.06**	**£1,506.25**	**£1,496.42**	**£1,486.55**	**£1,476.65**
Accrued Cash Flow (Cash Balance)	£3,306.14	£4,812.40	£6,308.82	£7,795.37	£9,272.02

Position	year 16	year 17	year 18	year 19	year 20
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£1,158.88	£1,148.77	£1,138.64	£1,128.51	£1,118.36
Electricity Savings	£307.83	£307.98	£308.10	£308.20	£308.27
Annual Cash Flow	**£1,466.72**	**£1,456.75**	**£1,446.74**	**£1,436.71**	**£1,426.63**
Accrued Cash Flow (Cash Balance)	£10,738.73	£12,195.48	£13,642.22	£15,078.93	£16,505.56

Position	year 21
Investments	£0.00
Feed-in / Export Tariff	£0.00
Electricity Savings	£308.31
Annual Cash Flow	**£308.31**
Accrued Cash Flow (Cash Balance)	£16,813.87

Depreciation and inflation rates are applied on a monthly basis over the entire observation period.

PV Module: PLM-250M-60

Manufacturer	Perlight Solar Co.,Ltd.
Available	Yes

Electrical Data

Cell Type	Si monocrystalline
Only Transformer Inverters suitable	No
Number of Cells	60
Number of Bypass Diodes	6

Mechanical Data

Width	992 mm
Height	1650 mm
Depth	40 mm
Frame Width	10 mm
Weight	18.5 kg
Framed	Yes

I/V Characteristics at STC

MPP Voltage	30.5 V
MPP Current	8.2 A
Power Rating	250 W
Open Circuit Voltage	38 V
Short-Circuit Current	8.78 A
Increase open circuit voltage before stabilisation	0 %

I/V Part Load Characteristics (calculated)	
Values source	Standard (Two-diode Model)
Series resistance Rs	5.682e-03 U
Parallel Resistance Rp	2.895 U
Saturation Current Parameters Cs1	66.2 A/K³
Saturation Current Parameters Cs2	-8.873e-14 A/K^(2,5)
Photocurrent Parameters C1	7.995e-03 m²/V
Photocurrent Parameters C2	2.691e-06 m²/V
Photocurrent	8.797 A

Further	
Voltage Coefficient	-115.01 mV/K
Electricity Coefficient	2.69 mA/K
Output Coefficient	-0.37 %/K
Incident Angle Modifier	95 %
Maximum System Voltage	1000 V
Spec. Heat Capacity	920 J/(kg*K)
Absorption Coefficient	70 %
Emissions Coefficient	85 %

Inverter: TRIO-8.5-TL-OUTD

Manufacturer	Power-One
Available	Yes

Electrical Data	
DC Power Rating	8.7 kW
AC Power Rating	8.5 kW
Max. DC Power	8.7 kW
Max. AC Power	8.5 kW
Stand-by Consumption	15 W
Night Consumption	3.5 W
Feed-in from	36 W
Max. Input Current	30 A
Max. Input Voltage	1000 V
Nom. DC Voltage	620 V
Number of Feed-in Phases	3
Number of DC Inlets	4
With Transformer	No
Change in Efficiency when Input Voltage deviates from Rated Voltage	0.4 %/100V

MPP Tracker	
Output Range < 20% of Power Rating	99.5 %
Output Range > 20% of Power Rating	99.8 %
No. of MPP Trackers	2
Max. Input Current per MPP Tracker	15 A
Max. recommended Input Power per MPP Tracker	4.8 kW
Min. MPP Voltage	200 V
Max. MPP Voltage	950 V

Module Areas

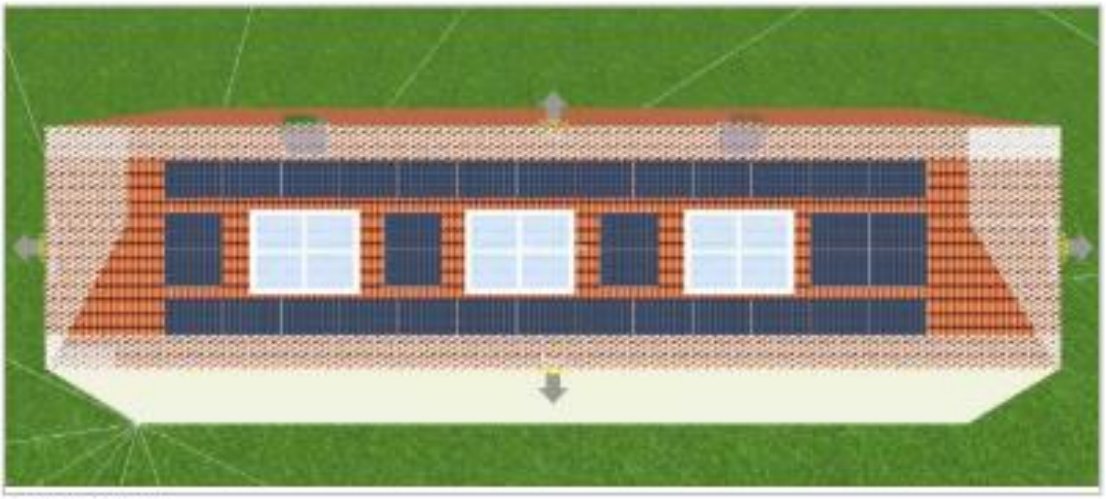


Figure: Panel Layout

Shading

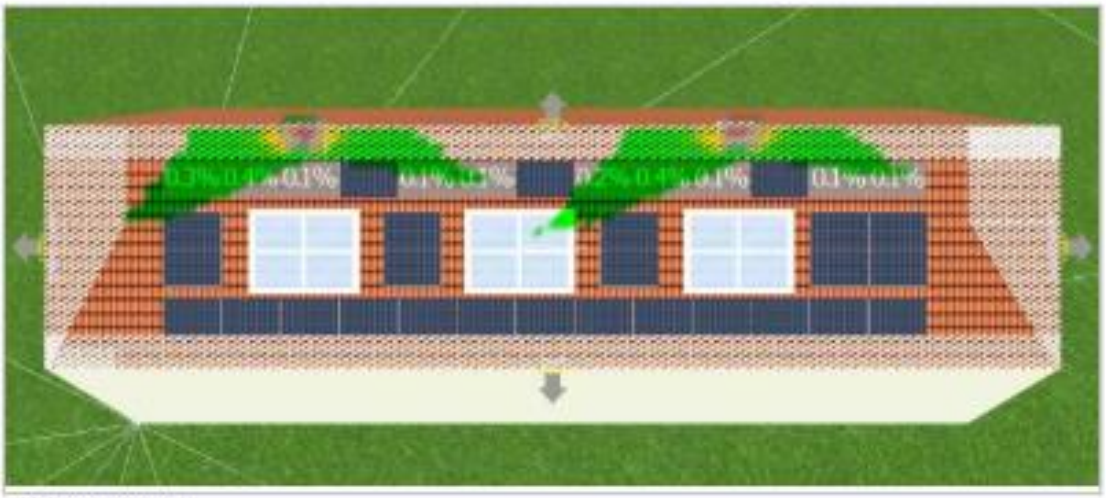


Figure: Shading Analysis

Planning permission would not normally be required – above diagram shows minimal shading

9 kWp Solar PV System

• 36 x Perlight 250W mono-crystalline panels

• 1 x ABB Power-One TRIO-8.5TL S 3-phase inverter
• Renusol mounting equipment
• OFGEM-approved 3-phase generation meter
• DC and AC isolators
• DC and AC cabling
• MCBs
• Cable containment
• Scaffolding and edge protection
• All labour (roofers and electricians)
• Grid connection notification to the DNO (Southern Electric)
• Assistance with your feed-in tariff application
• 5-year insured workmanship warranty
• MCS certificate

Total cost: £13,903 ex. VAT

• Predicted annual generation: 9,194 kWh
• Predicted Feed-in tariff income, first-year: £1,348
• Predicted Electricity savings, first-year: £311
• Total predicted return, first year: £1,659
• Return on investment, first year: 11.9%

Assumptions

In these calculations I have assumed:

- You pay 15p per kWh (unit) for your electricity;
- Your annual electricity demand is 10,000 kWh per year;
- RPI inflation is 3%;
- Energy price inflation is 4%.

If you would like any of these assumptions amending, please let me know, and we will generate a new report.

The software calculates you will use 22.9% of the solar electricity generated. If you end up using more of the electricity generated by the panels, then your electricity bill will go down by more than £311.

We have also allowed for the gradual degradation of the panels over time. They will lose some 20% of their potency over the next 25 years. In addition, there is a small loss due to the DC and AC cable runs. These losses of output are reflected in the figures above. We prefer to present likely, 'real world' numbers, rather than over-ambitious forecasts.

Panels, Inverters, and Mounting kit

We have chosen a high quality panel which offers very good value for money, but which is also the most aesthetically pleasing panel on the market. It is a 250W mono-crystalline panel made by Perlight. It has a 10-year product warranty and a 25-year linear performance warranty. It is an 'all black' panel and is often chosen where a solar system is installed in a heritage setting.

The inverter we recommend is made by a Tier 1 manufacturer, ABB Power-One, and provides very high efficiency. The inverter is made in Europe and comes with a 5-year warranty. Inverters are the key component of a PV system and do all the electrical heavy-lifting. It is important therefore that the inverter warranty has a big company behind it - as inverters do fail - and ABB is a massive, global conglomerate with $42 billion revenue in 2013.

To mount the panels on the roof, we recommend the German manufacturer, Renusol. The roof hook model would be the VarioSole Stainless Steel roof hook for Pantiles (see page 10 of the attached brochure). The rail, mid / end clamps, and end caps required to complete the mounting would all be from the same Renusol VarioSole system.

Energy Performance Certificate (EPC) Requirement

The highest feed-in tariff rate for your system size of 12.13p is paid as long as the installation falls into one of the following two categories:

1. The array is wired to provide electricity to a 'relevant' building and the building achieves an EPC rating of level D or above; or

2. There are no 'relevant' buildings connected to the array, in which case an EPC certificate is not required, though an assessor must still demonstrate that the energy efficiency requirement does not apply.

A relevant building is basically one that is either heated or cooled, and so, assuming the Church House Hall is heated, the EPC requirement does apply.

Do you know if the building has an EPC certificate? If not, you will need to instruct an EPC assessor to carry out a survey. We can recommend a company if required.

Structural Survey

MCS obliges us to ensure the weight of the panels and mounting system will not impose too great a load on the roof. Normally the architect firm that was responsible for the building can provide the relevant data, though due to the age of the Church House Hall we assume the data will not be easy to get hold of. In which case, you will need to arrange for a structural engineer to carry out the necessary calculations.

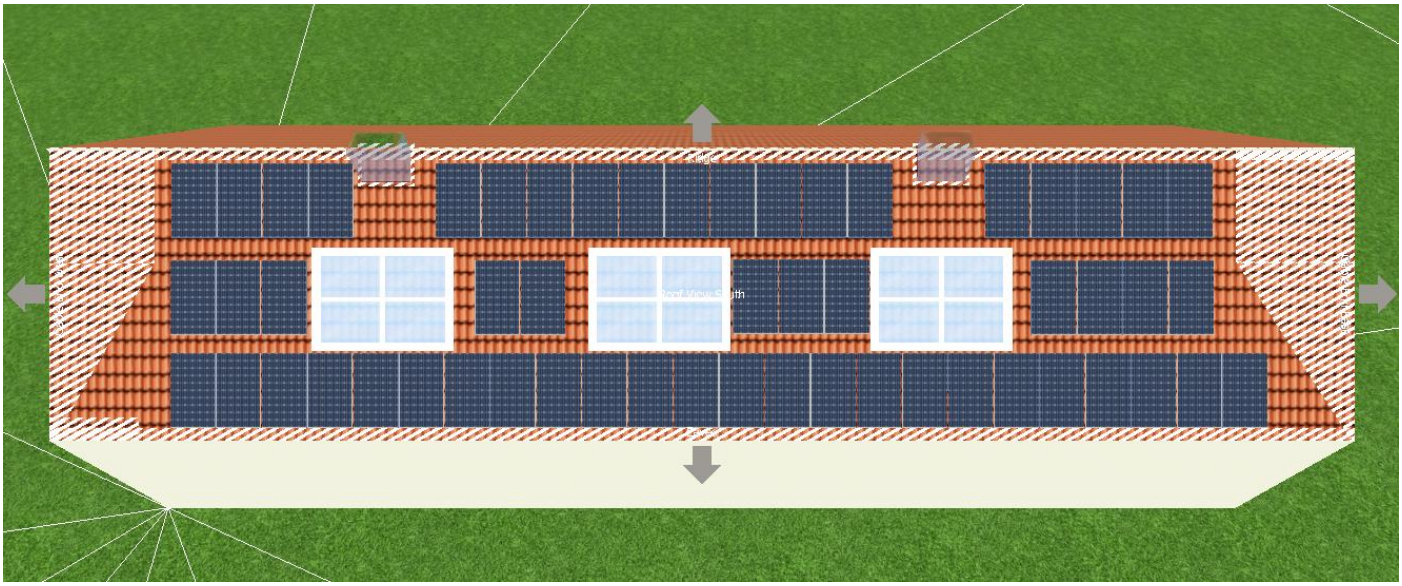
Larger systems requiring Planning Permission

The first design above prepared for the Church House Hall comprised 36 'all black' 250W panels made by Perlight, creating a 9 kWp system. This design kept the panels 1m away from the edges, thereby avoiding the need for planning (assuming the array is not deemed to be fronting a highway).

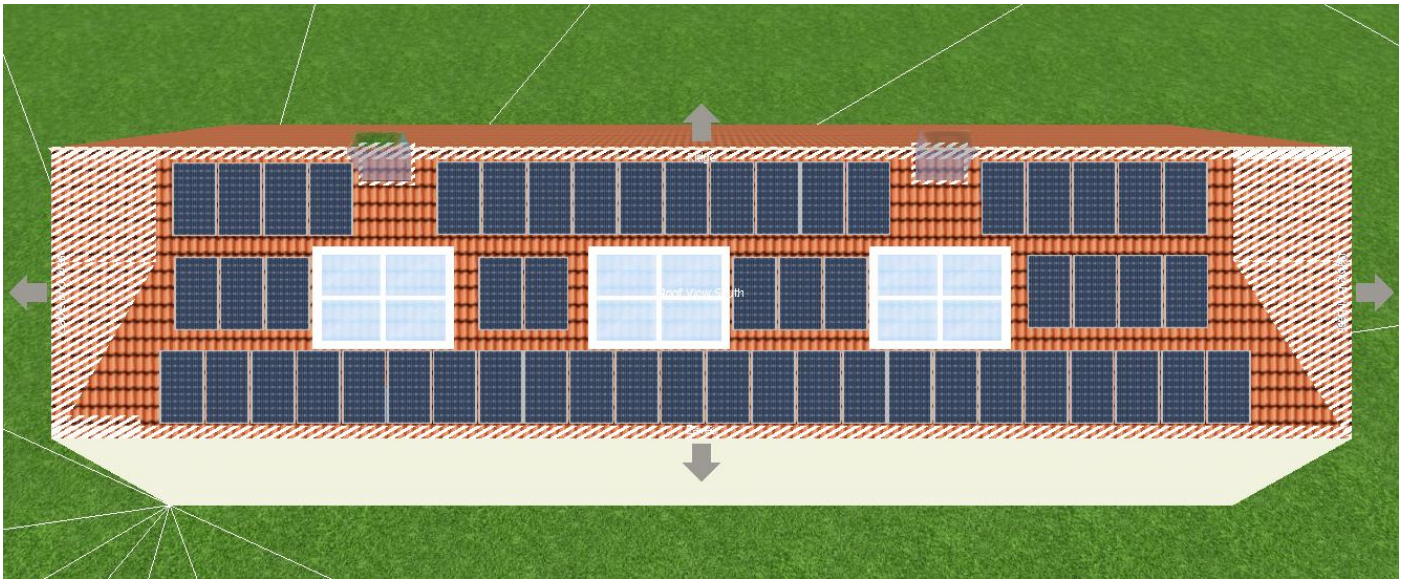
In order to increase the system size, we can use higher capacity panels, such as the JA Solar 275W panel, and would then reach 9.9 kWp. Still permitted development.

The only way to increase the system size more dramatically is to abandon the tactic to avoid planning. If we move to a 30cm gap from edge of panels to edge of roof, then we can create the following systems:

55 x 250W Perlight panels = 13.75 kWp
or
55 x 275W JA Solar panels = 15.13 kWp



Black Frame Solar PV Panels – Planning permission would be required
See graphic above showing the layout for both these new systems. Please note, however, that only the Perlight 250W is an all-black panel. The JA Solar 275W (similar to the Yingli 275W) has black cells, but a white backing sheet and a silver frame. These 275W panels do not look as nice when installed.



Silver Frame Solar PV Panels – Planning Permission would be required

I am a little unclear as to how many 275W panels Warm-Front think they can fit on. They write ’60 x 275W’. I think it would be challenge to fit 60 panels on. They then state the system size is 17.1 kWp. That equates to over 62 panels.

If you can let me know which system you prefer:

36 x 275W JA Solar panels = 9.9 kWp (no planning, silver frame)
55 x 250W Perlight panels = 13.75 kWp (planning, all black)
55 x 275W JA Solar panels = 15.13 kWp (planning, silver frame)

Church House Hall

3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	9 kWp
PV Generator Surface	58.9 m²
Number of PV Modules	36
Number of Inverters	1

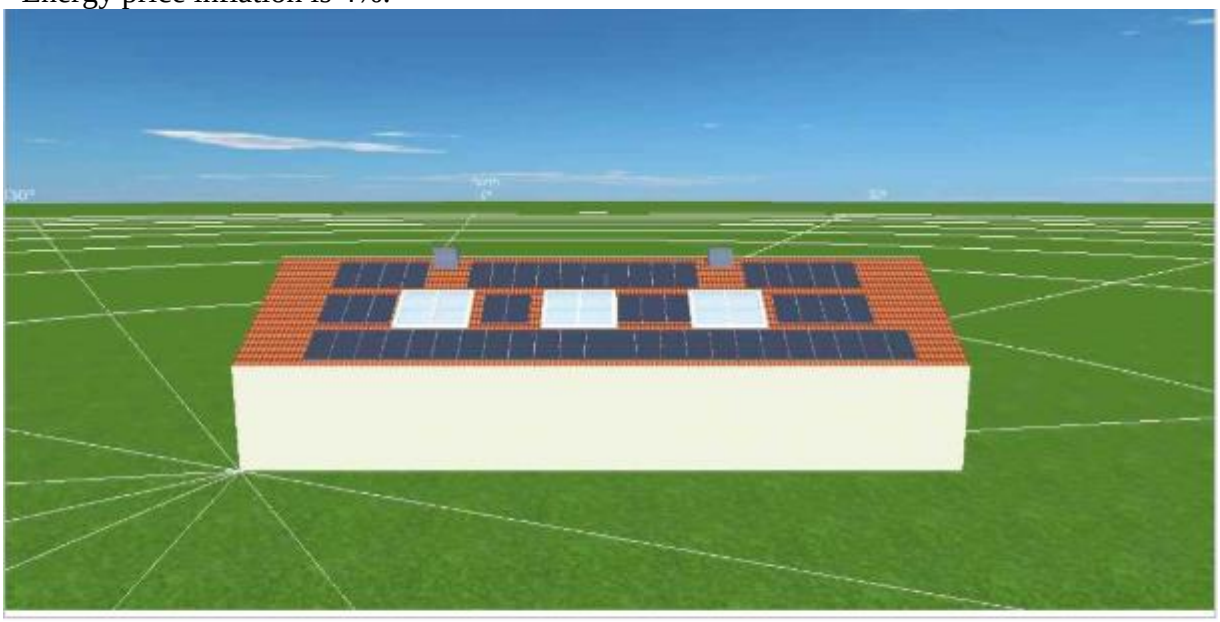
No Planning - £13,903 ex. VAT”. Towards the end of the design report, you will find visualisations of the panel layout and a shading analysis. Here is a summary:

9 kWp Solar PV System

• 36 x Perlight 250W mono-crystalline panels
• 1 x ABB Power-One TRIO-8.5TL S 3-phase inverter
• Renusol mounting equipment
• OFGEM-approved 3-phase generation meter
• DC and AC isolators
• DC and AC cabling
• MCBs
• Cable containment
• Scaffolding and edge protection
• All labour (roofers and electricians)
• Grid connection notification to the DNO (Southern Electric)
• Assistance with your feed-in tariff application
• 5-year insured workmanship warranty

• MCS certificate
Total cost: £13,903 ex. VAT
• Predicted annual generation: 9,194 kWh
• Predicted Feed-in tariff income, first-year: £1,348
• Predicted Electricity savings, first-year: £311
• Total predicted return, first year: £1,659
• Return on investment, first year: 11.9%

Assumptions
In these calculations I have assumed:- You pay 15p per kWh (unit) for your electricity;
- Your annual electricity demand is 10,000 kWh per year;- RPI inflation is 3%;
- Energy price inflation is 4%.



3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	13.75 kWp
PV Generator Surface	90.0 m²
Number of PV Modules	55
Number of Inverters	2

13.75 kWp system using all black 250W panels and requiring planning permission.

The key data are:

Total cost: £19,729 ex. VAT

• Predicted annual generation: 13,916 kWh

• Predicted Feed-in tariff income, first-year: £1,982

• Predicted Electricity savings, first-year: £372

• Total predicted return, first year: £2,354

• Return on investment, first year: 11.9%

3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	15.13 kWp
PV Generator Surface	89.9 m²
Number of PV Modules	55
Number of Inverters	2

a. 15.3 kWp system using JA Solar 275W panels and requiring planning permission.

The key data are:

Total cost: £20,572 ex. VAT

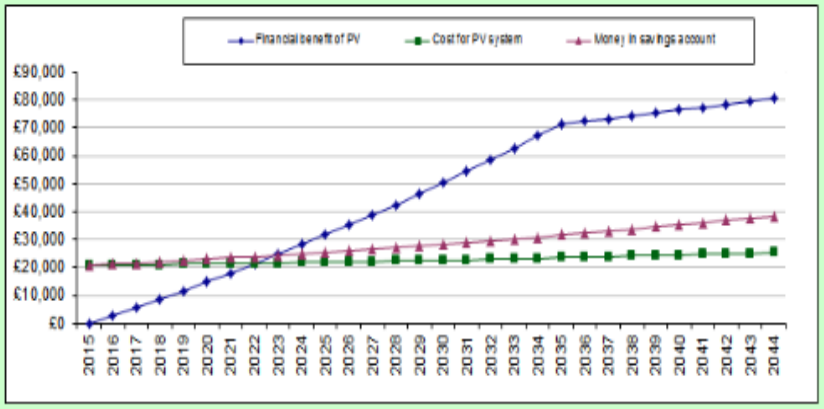
• Predicted annual generation: 16,014 kWh
• Predicted Feed-in tariff income, first-year: £2,281
• Predicted Electricity savings, first-year: £408
• Total predicted return, first year: £2,689
• Return on investment, first year: 13.1%

The calculator spreadsheet for the 15.13 kWp system for the Church House Hall is on the next page. The people who designed the spreadsheet, the SEAM Centre, described themselves as "an award winning training, information and research facility for Sustainable Energy And Micro-renewables", so I think we can trust the mathematics and formulae behind the scenes.

I have input the relevant data in the spreadsheet and the summary graph is very useful to show how the investment in solar PV compares with leaving your money in a savings account. All assumptions are stated clearly on the spreadsheet.

SEAM Centre Solar PV Payback Calculator
www.seamcentre.org.uk

Number of years for results calculation	30	years
From a start date of	13/05/2015	
The installation cost for the solar PV equipment is	20,572	pounds
Average annual maintenance etc. costs	100	pounds/year
The solar PV system will have a capacity of	15.13	kW peak
Would you like to use your own estimate of annual generation?	Yes	
Value to be used	15,417	kWh/year
Anticipated annual generation in first year (based on user's estimate)	15,417	kWh/year
Expected percentage of peak output after 25 years	80	%
Percentage of generated electricity used on-site	17.3	%
FIT generation tariff	11.71	pence/kWh
FIT export tariff	4.85	pence/kWh
Duration of FIT rates	20	years
Will the FIT income be invested in a savings account?	No	
Electricity price at start date	15	pence/kWh
Average annual electricity price inflation	4	%
Average annual retail Price Index (RPI)	3	%
Average annual savings interest rate (gross)	2	%
Tax rate	20	%



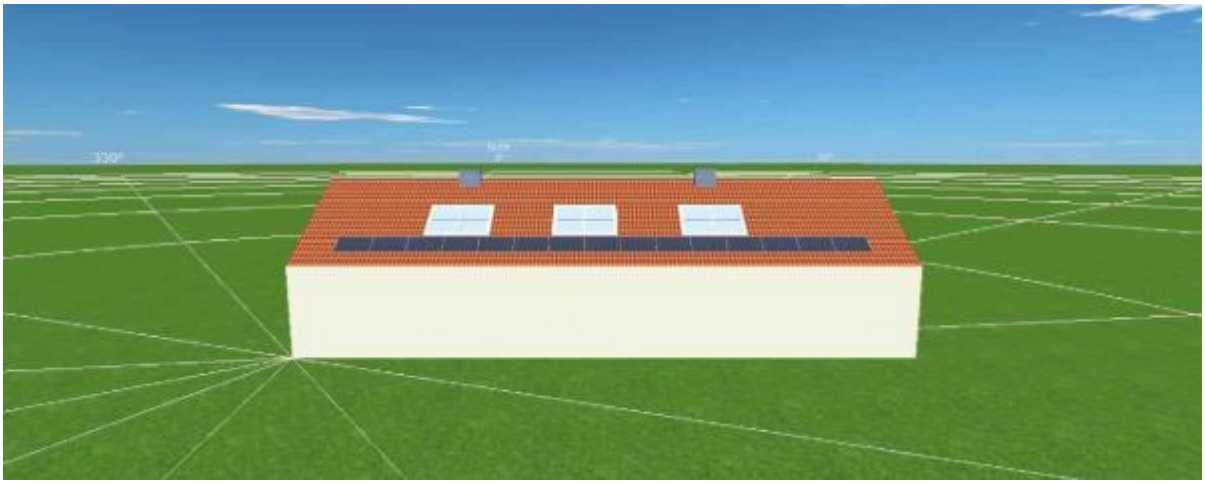
Payback comparison		
Payback after	9	years
Better than savings after	9	years

Equivalent interest rate after 30 years		
Net	3.94	%
Gross	4.93	%

Total energy generated by PV system in	30	years equals	######	kWhs representing	######	kgs of CO_2

Church House Hall - Smaller 3kWp system

Smaller 3.75KW – Normally No planning required – but in this case probably need the planning.



The yield	
PV Generator Power (AC grid)	3,764 kWh
Own Consumption	1,294 kWh
Grid Feed-in	2,469 kWh
Spec. Annual Yield	1,003.62 kWh/kWp
Performance Ratio (PR)	83.3 %
Own Power Consumption	34.4 %
Calculation of Shading Losses	0.5 %/year
CO_2 Emissions avoided	2,250 kg / year

Simulation Results

PV System

PV Generator Output	3.8 kWp
Spec. Annual Yield	1,003.62 kWh/kWp
Performance Ratio (PR)	83.3 %
Yield Reduction due to Shading	0.5 %/year
PV Generator Power (AC grid)	3,764 kWh/year
Own Consumption	1,294 kWh/year
Grid Feed-in	2,469 kWh/year
Regulation at Feed-in Point	0 kWh/year
Own Power Consumption	34.4 %
CO_2 Emissions avoided	2,250 kg / year

Appliances

Appliances	10,000 kWh/year
Stand-by Consumption	13 kWh/year
Total Consumption	10,013 kWh/year
covered by PV power	1,294 kWh/year
covered by grid	8,719 kWh/year
Solar Fraction	12.9 %

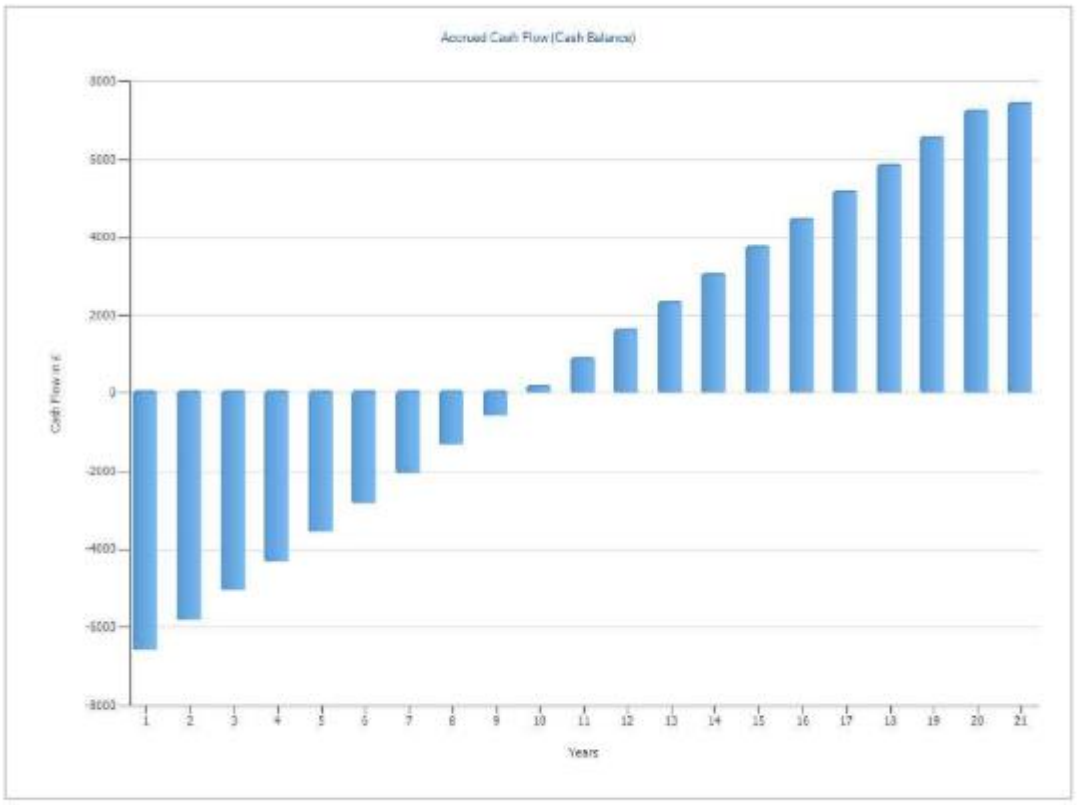


Figure: Accrued Cash Flow (Cash Balance)

Cashflow Table

Position	year 1	year 2	year 3	year 4	year 5
Investments	-£7,335.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£554.56	£578.06	£573.61	£569.16	£564.70
Electricity Savings	£186.81	£187.11	£187.40	£187.67	£187.93
Annual Cash Flow	**-£6,593.63**	**£765.17**	**£761.01**	**£756.83**	**£752.64**
Accrued Cash Flow (Cash Balance)	-£6,593.63	-£5,828.46	-£5,067.45	-£4,310.62	-£3,557.98

Position	year 6	year 7	year 8	year 9	year 10
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£560.24	£555.78	£551.31	£546.84	£542.37
Electricity Savings	£188.18	£188.42	£188.64	£188.85	£189.05
Annual Cash Flow	**£748.43**	**£744.20**	**£739.96**	**£735.70**	**£731.42**
Accrued Cash Flow (Cash Balance)	-£2,809.56	-£2,065.35	-£1,325.40	-£589.70	£141.72

Position	year 11	year 12	year 13	year 14	year 15
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£537.89	£533.41	£528.92	£524.44	£519.94
Electricity Savings	£189.23	£189.40	£189.55	£189.69	£189.82
Annual Cash Flow	**£727.12**	**£722.81**	**£718.48**	**£714.13**	**£709.76**
Accrued Cash Flow (Cash Balance)	£868.84	£1,591.65	£2,310.13	£3,024.26	£3,734.02

Position	year 16	year 17	year 18	year 19	year 20
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£515.45	£510.95	£506.44	£501.94	£497.42
Electricity Savings	£189.92	£190.02	£190.09	£190.15	£190.19
Annual Cash Flow	**£705.37**	**£700.96**	**£696.53**	**£692.09**	**£687.62**
Accrued Cash Flow (Cash Balance)	£4,439.39	£5,140.35	£5,836.88	£6,528.97	£7,216.59

Position	year 21
Investments	£0.00
Feed-in / Export Tariff	£0.00
Electricity Savings	£190.22
Annual Cash Flow	**£190.22**
Accrued Cash Flow (Cash Balance)	£7,406.81

Degradation and inflation rates are applied on a monthly basis over the entire observation period.
This is done in the first year.

Church Turret

Please find below and attached a proposal for the Church Tower.

This design is for a 6.84 kWp system. See the PDF "Church Tower - 6.84 kWp - JA Solar 285W - SolarEdge - Planning - £12,176 ex. VAT". Towards the end of the design report, you will find visualisations of the panel layout and a shading analysis. Here is a summary:

6.84 kWp Solar PV System

• 24 x JA Solar 285W mono-crystalline panels
• 1 x SolarEdge 7000W 3-phase inverter
• 24 x SolarEdge P300 power optimisers
• K2 mounting equipment
• Ballast
• OFGEM-approved 3-phase generation meter
• DC and AC isolators
• DC and AC cabling
• MCBs
• Cable containment
• Edge protection
• All labour (roofers and electricians)
• Grid connection notification to the DNO (Southern Electric)
• Assistance with your feed-in tariff application
• 5-year insured workmanship warranty
• MCS certificate

Total cost: £12,176 ex. VAT

• Predicted annual generation: 4,973 kWh
• Predicted Feed-in tariff income, first-year: £728
• Predicted Electricity savings, first-year: £239
• Total predicted return, first year: £967
• Return on investment, first year: 7.9%

Assumptions

In these calculations I have assumed:

- You pay 15p per kWh (unit) for your electricity;
- Your annual electricity demand is 10,000 kWh per year;
- RPI inflation is 3%;
- Energy price inflation is 4%.

If you would like any of these assumptions amending, please let me know, and we will generate a new report.

The software calculates you will use 32.1% of the solar electricity generated. If you end up using more of the electricity generated by the panels, then your electricity bill will go down by more than £239.

We have also allowed for the gradual degradation of the panels over time. They will lose some 20% of their potency over the next 25 years. In addition, there is a small loss due to the DC and AC cable runs.

Observations

- I have assumed the supply is 3-phase. If it is single phase, we will recommend a different inverter combination. If it is 3-phase, then prior permission from the DNO to connect the system to the grid will not be required.

- As there is a lot of shading - due mainly to the parapet walls and flag pole - we suggest using power optimisers so that each panel can control its own power independently of all the others. This technology makes the overall installation more expensive, but is justified from a technical perspective.

- I have allowed for edge protection to keep the installation team safe, but I have not included the cost of getting the panels and mounting system up onto the roof. We will need to discuss the optimal way of doing this. It's possible that a crane will be required, if the spiral staircase is too restrictive.

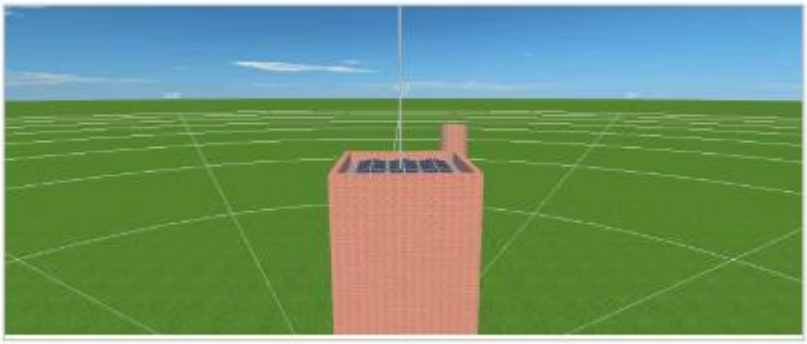
- As with the other quotations, costs associated with structural and EPC surveys are not included. The highest feed-in tariff rate will be paid if an EPC in the range of A-D can be achieved.

- The roof is very difficult to install on due to the different levels and slopes, the flag pole, and the walkways. If you look favourably upon our proposal, I would want to return with a technical adviser from one of the mounting companies to work out the most robust, safest method of mounting the panels on the roof.

Project Number: 00668
Date of Offer: 12/05/2015

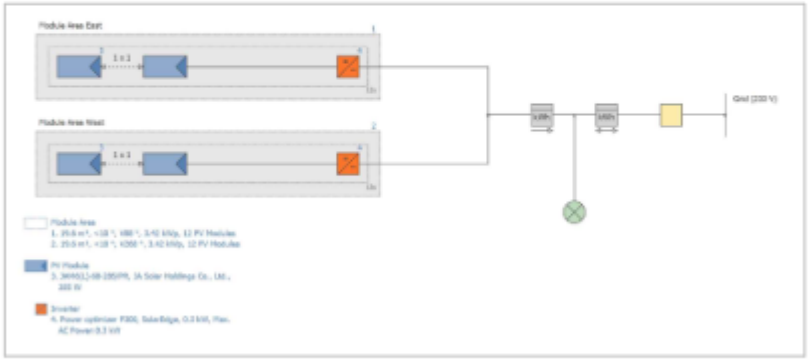
Project Designer: David Lewis
Company: SunSmart Energy Ltd

Church Tower - 6.84 kWp - JA Solar 285W - SolarEdge - Planning - £12,176 ex. VAT



3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	6.84 kWp
PV Generator Surface	39.2 m²
Number of PV Modules	24
Number of Inverters	24

3D, Grid-connected PV System with Electrical Appliances - Net Metering	
Climate Data	Havant (1986 - 2005)
PV Generator Output	6.84 kWp
PV Generator Surface	39.2 m²
Number of PV Modules	24
Number of Inverters	24



Project Number: 00668
Date of Offer: 12/05/2015

Project Designer: David Lewis
Company: SunSmart Energy Ltd

Church Tower - 6.84 kWp - JA Solar 285W - SolarEdge - Planning - £12,176 ex. VAT

The yield	
PV Generator Power (AC grid)	4,973 kWh
Own Consumption	1,594 kWh
Grid Feed-in	3,379 kWh
Spec. Annual Yield	727.05 kWh/kWp
Performance Ratio (PR)	70.9 %
Own Power Consumption	32.1 %
Calculation of Shading Losses	25.4 %/year
CO_2 Emissions avoided	2,984 kg / year

Your Gain	
Total investment costs	12,176.00 £
Return on Assets	7.11 %
Amortization Period	13.4 Years
Electricity Production Costs	£0.16

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the system

Climate Data	Havant
Type of System	3D, Grid-connected PV System with Electrical Appliances - Net Metering

Consumption	
Total Consumption	10000 kWh
Load Peak	23.1 kW

PV Generator 1. Module Area	
Name	Module Area East
PV Modules*	12 x JAM6(L)-60-285/PR
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	10 °
Orientation	East (88 °)
Installation Type	Mounted - Roof
PV Generator Surface	19.6 m²

Figure: 3D Design for Module Area East

Losses

Remaining power after 25 Years	80 %

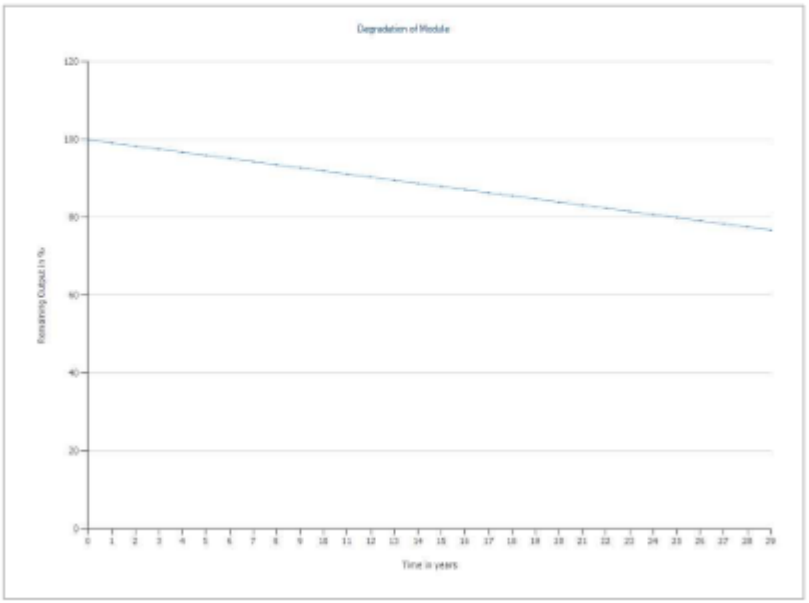


Figure: Degradation of Module for Module Area East

Project Number: 00668
Date of Offer: 12/05/2015

Project Designer: David Lewis
Company: SunSmart Energy Ltd

Church Tower - 6.84 kWp - JA Solar 285W - SolarEdge - Planning - £12,176 ex. VAT

Figure: 3D Design for Module Area West

PV Generator 2. Module Area	
Name	Module Area West
PV Modules*	12 x JAM6(L)-60-285/PR
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	10 °
Orientation	West (268 °)
Installation Type	Mounted - Roof
PV Generator Surface	19.6 m²

Inverter	
1. Module Area	**Module Area East**
Inverter 1*	12 x Power optimizer P300
Manufacturer	SolarEdge
Power Optimizer	existing
Configuration	MPP 1: 1 x 1
2. Module Area	**Module Area West**
Inverter 1*	12 x Power optimizer P300
Manufacturer	SolarEdge
Power Optimizer	existing
Configuration	MPP 1: 1 x 1

AC Mains	
Number of Phases	3
Mains Voltage (1-phase)	230 V
Displacement Power Factor (cos phi)	+/- 1

Cable	
Total Loss	0.63 %

* The guarantee provisions of the respective manufacturer apply

Losses
Remaining power after 25 Years 80 %

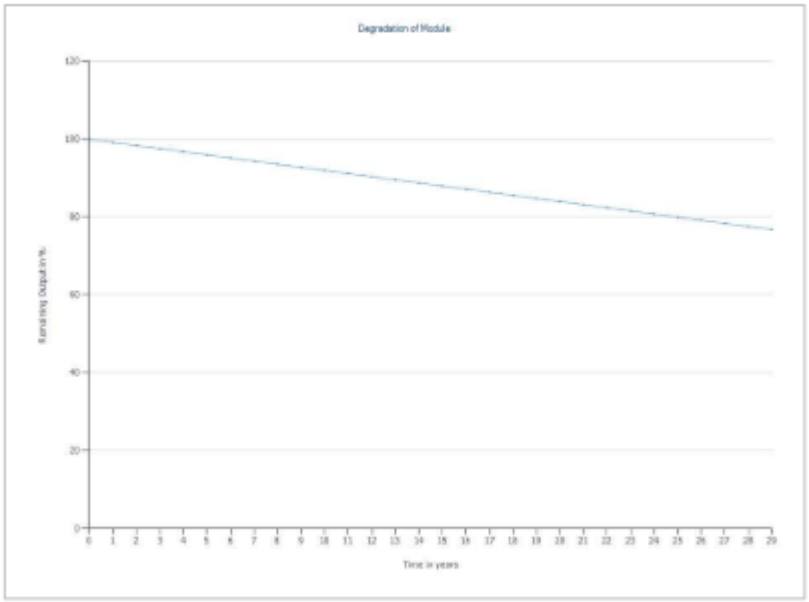


Figure: Degradation of Module for Module Area West

Simulation Results

PV System	
PV Generator Output	6.8 kWp
Spec. Annual Yield	727.05 kWh/kWp
Performance Ratio (PR)	70.9 %
Yield Reduction due to Shading	25.4 %/year
PV Generator Power (AC grid)	4,973 kWh/year
Own Consumption	1,594 kWh/year
Grid Feed-in	3,379 kWh/year
Regulation at Feed-in Point	0 kWh/year
Own Power Consumption	32.1 %
CO_2 Emissions avoided	2,984 kg / year

Appliances	
Appliances	10,000 kWh/year
Stand-by Consumption	0 kWh/year
Total Consumption	10,000 kWh/year
covered by PV power	1,594 kWh/year
covered by grid	8,406 kWh/year
Solar Fraction	15.9 %

Project Number: 00668
Date of Offer: 12/05/2015

Project Designer: David Lewis
Company: SunSmart Energy Ltd

Church Tower - 6.84 kWp - JA Solar 285W - SolarEdge - Planning - £12,176 ex. VAT

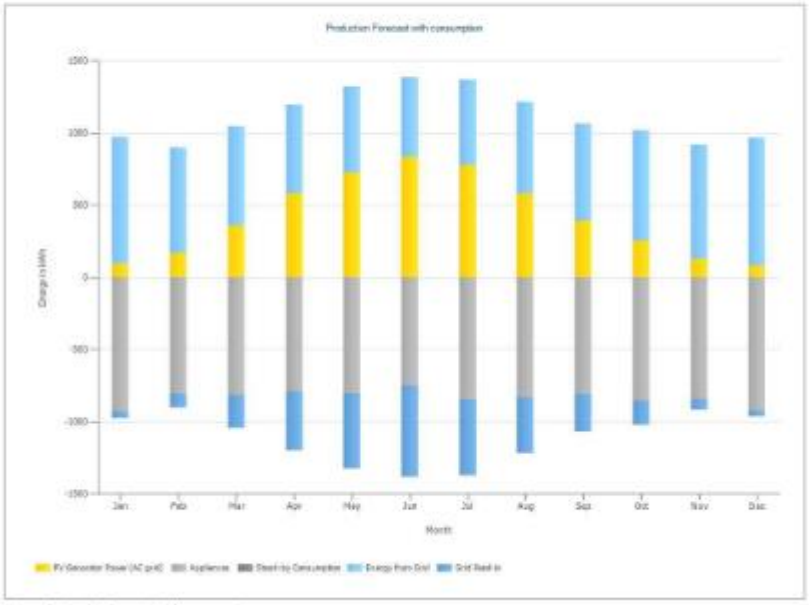


Figure: Production Forecast with consumption

PV System Energy Balance

Global radiation - horizontal	**1,078.5**	**kWh/m²**	
Deviation from standard spectrum	-10.78	kWh/m²	-1.00 %
Orientation and inclination of the module surface	-10.01	kWh/m²	-0.94 %
Shading of diffuse radiation by horizon	-34.08	kWh/m²	-3.22 %
Reflection on the Module Interface	-30.36	kWh/m²	-2.97 %
Global Radiation at the Module	**993.2**	**kWh/m²**	
	993.2	kWh/m²	
	x 39.24	m²	
	= 38,977.8	kWh	
Global PV Radiation	**38,977.8**	**kWh**	
Soiling	0.00	kWh	0.00 %
STC Conversion (Rated Efficiency of Module 17.47 %)	-32,167.54	kWh	-82.53 %
Rated PV Energy	**6,810.2**	**kWh**	
Module-specific Partial Shading	-645.89	kWh	-9.48 %
Low-light performance	-900.59	kWh	-14.61 %
Deviation from the nominal module temperature	-44.70	kWh	-0.85 %
Diodes	-36.22	kWh	-0.69 %
Mismatch (Manufacturer Information)	0.00	kWh	0.00 %
Mismatch (Configuration/Shading)	0.00	kWh	0.00 %
String Cable	-5.22	kWh	-0.10 %
PV Energy (DC) without inverter regulation	**5,177.6**	**kWh**	
Regulation on account of the MPP Voltage Range	0.00	kWh	0.00 %
Regulation on account of the max. DC Current	0.00	kWh	0.00 %
Regulation on account of the max. DC Power	0.00	kWh	0.00 %
Regulation on account of the max. AC Power/cos phi	0.00	kWh	0.00 %
MPP Matching	0.00	kWh	0.00 %
PV energy (DC)	**5,177.6**	**kWh**	
Energy at the Inverter Input	**5,177.6**	**kWh**	
Input voltage deviates from rated voltage	0.00	kWh	0.00 %
DC/AC Conversion	-204.57	kWh	-3.95 %
Stand-by Consumption	0.00	kWh	0.00 %
AC Cable	-0.03	kWh	0.00 %
PV energy (AC) minus standby use	**4,973.0**	**kWh**	
PV Generator Power (AC grid)	**4,973.0**	**kWh**	

System Data

Grid Feed-in in the first year (incl. module degradation)	3,368 kWh
PV Generator Output	6.8 kWp
Start of Operation of the System	12/05/2015
Assessment Period	20 Years

Economic Parameters

Return on Assets	7.11 %
Accrued Cash Flow (Cash Balance)	5,843.17 £
Amortization Period	13.4 Years

Payment Overview

Total investment costs	12,176.00 £
Total investment costs	1,780.12 £/kWp
Incoming Subsidies	0.00 £
One-off Payments	0.00 £
Annual Costs	0.00 £/year
Other Revenue or Savings	0.00 £/year

Remuneration and Savings

Total Payment from Utility in First Year	728.84 £
First year savings	239.23 £
FIT 2015 (April - June) Higher Rate - Generation tariff only - Building Attached	
Validity	12/05/2015 - 11/05/2035
Specific generation remuneration	0.1213 £/kWh
Generation Tariff	607.41 £/year
Inflation Rate for Generation Tariff	3 %/year
FIT 2015 (April - June) Higher Rate - Export tariff with 50% deeming - Building Attached	
Validity	12/05/2015 - 11/05/2035
Specific generation remuneration	0.0485 £/kWh
Generation Tariff	121.43 £/year
Inflation Rate for Generation Tariff	3 %/year

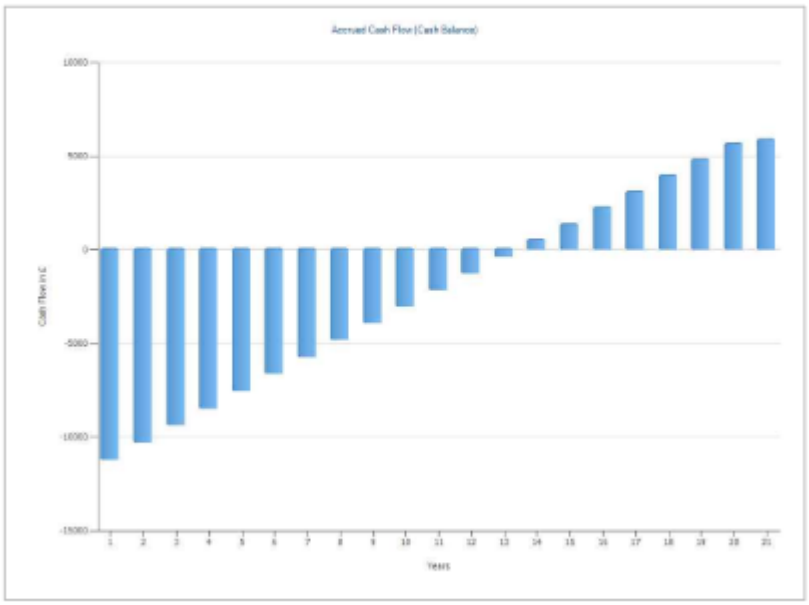


Figure: Accrued Cash Flow (Cash Balance)

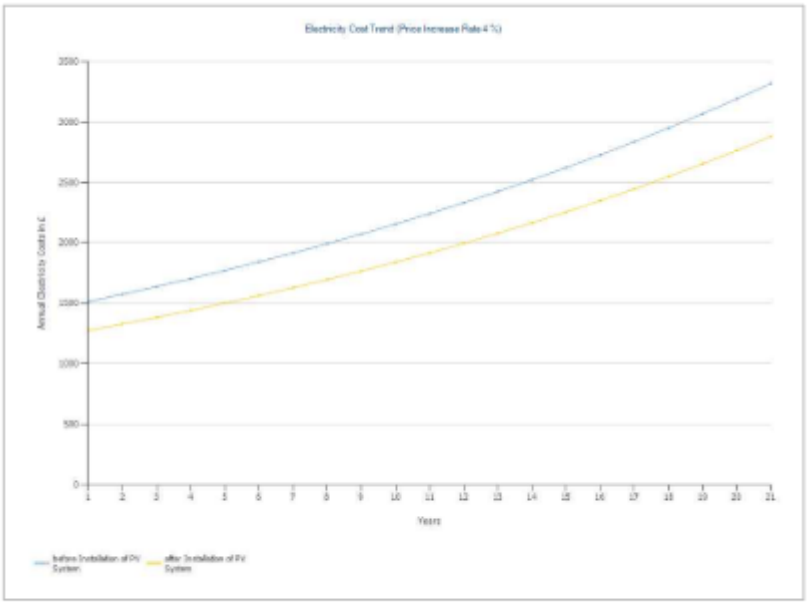


Figure: Electricity Cost Trend (Price Increase Rate 4 %)

Cashflow Table

Position	year 1	year 2	year 3	year 4	year 5
Investments	-£12,176.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£671.36	£702.21	£696.81	£691.40	£685.99
Electricity Savings	£232.26	£232.63	£232.99	£233.33	£233.65
Annual Cash Flow	**-£11,272.38**	**£934.84**	**£929.80**	**£924.73**	**£919.65**
Accrued Cash Flow (Cash Balance)	-£11,272.38	-£10,337.53	-£9,407.74	-£8,483.00	-£7,563.36

Position	year 6	year 7	year 8	year 9	year 10
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£680.58	£675.16	£669.74	£664.31	£658.87
Electricity Savings	£233.96	£234.26	£234.54	£234.80	£235.04
Annual Cash Flow	**£914.54**	**£909.42**	**£904.27**	**£899.10**	**£893.92**
Accrued Cash Flow (Cash Balance)	-£6,648.81	-£5,739.40	-£4,835.12	-£3,936.02	-£3,042.10

Position	year 11	year 12	year 13	year 14	year 15
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£653.44	£647.99	£642.55	£637.10	£631.64
Electricity Savings	£235.27	£235.48	£235.67	£235.84	£235.99
Annual Cash Flow	**£888.71**	**£883.47**	**£878.22**	**£872.94**	**£867.64**
Accrued Cash Flow (Cash Balance)	-£2,153.40	-£1,269.93	-£391.71	£481.23	£1,348.87

Position	year 16	year 17	year 18	year 19	year 20
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Feed-in / Export Tariff	£626.18	£620.72	£615.25	£609.78	£604.30
Electricity Savings	£236.13	£236.24	£236.34	£236.41	£236.46
Annual Cash Flow	**£862.31**	**£856.96**	**£851.59**	**£846.19**	**£840.76**
Accrued Cash Flow (Cash Balance)	£2,211.18	£3,068.14	£3,919.72	£4,765.91	£5,606.68

Position	year 21
Investments	£0.00
Feed-in / Export Tariff	£0.00
Electricity Savings	£236.50
Annual Cash Flow	**£236.50**
Accrued Cash Flow (Cash Balance)	£5,843.17

Degradation and Inflation rates are applied on a monthly basis over the entire observation period.
This is done in the first year.

Inverter: Power optimizer P300

Manufacturer	SolarEdge
Available	Yes

Electrical Data

DC Power Rating	0.3 kW
AC Power Rating	0.3 kW
Max. DC Power	0.3 kW
Max. AC Power	0.3 kW
Stand-by Consumption	0 W
Night Consumption	0 W
Feed-in from	0 W
Max. Input Current	10 A
Max. Input Voltage	48 V
Nom. DC Voltage	48 V
Number of Feed-in Phases	1
Number of DC Inlets	4
With Transformer	No
Change in Efficiency when Input Voltage deviates from Rated Voltage	1 %/100V

MPP Tracker

Output Range < 20% of Power Rating	100 %
Output Range > 20% of Power Rating	100 %
No. of MPP Trackers	1
Max. Input Current per MPP Tracker	10 A
Max. recommended Input Power per MPP Tracker	0.31 kW
Min. MPP Voltage	8 V
Max. MPP Voltage	48 V

PV Module: JAM6(L)-60-285/PR

Manufacturer	JA Solar Holdings Co., Ltd.
Available	Yes

Electrical Data

Cell Type	Si monocrystalline
Only Transformer Inverters suitable	No
Number of Cells	60
Number of Bypass Diodes	3

Mechanical Data

Width	991 mm
Height	1650 mm
Depth	5 mm
Frame Width	40 mm
Weight	18.2 kg
Framed	No

I/V Characteristics at STC

MPP Voltage	31.85 V
MPP Current	8.97 A
Power Rating	285 W
Open Circuit Voltage	39.25 V
Short-Circuit Current	9.45 A
Increase open circuit voltage before stabilisation	0 %

I/V Part Load Characteristics

Values source	Manufacturer/user-created
Irradiance	200 W/m²
Voltage in MPP at Part Load	31.02 V
Current in MPP at Part Load	1.82 A
Open Circuit Voltage (Part Load)	36.63 V
Short Circuit Current at Part Load	1.923 A

Further

Voltage Coefficient	-117.8 mV/K
Electricity Coefficient	5.67 mA/K
Output Coefficient	-0.39 %/K
Incident Angle Modifier	98 %
Maximum System Voltage	1000 V
Spec. Heat Capacity	920 J/(kg*K)
Absorption Coefficient	70 %
Emissions Coefficient	85 %

Environment

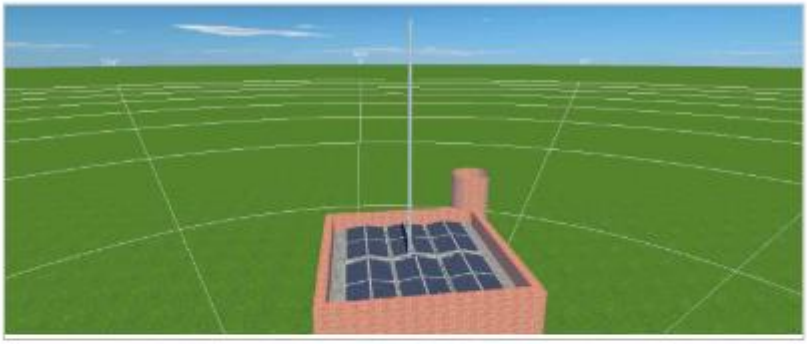


Figure: South

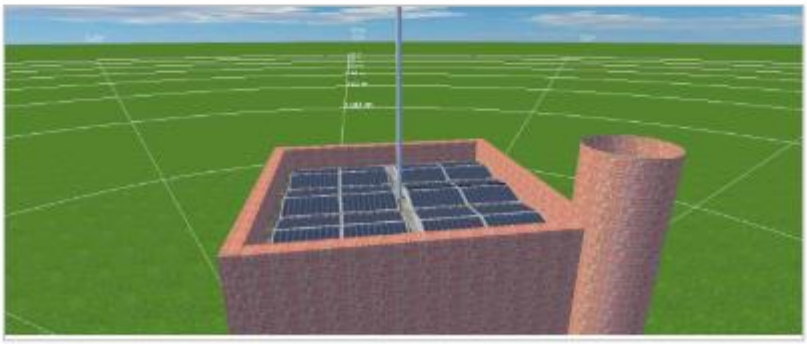


Figure: East

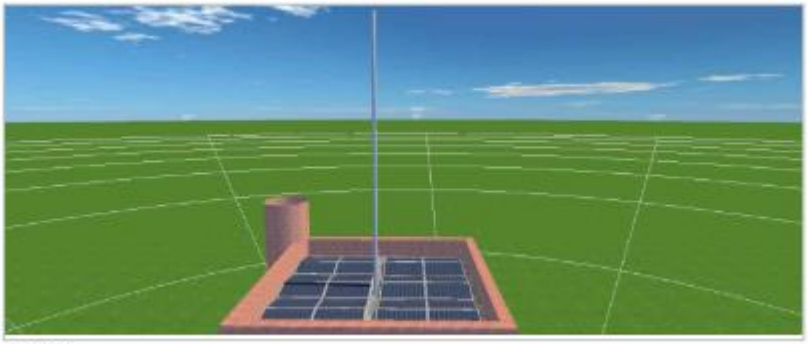


Figure: West

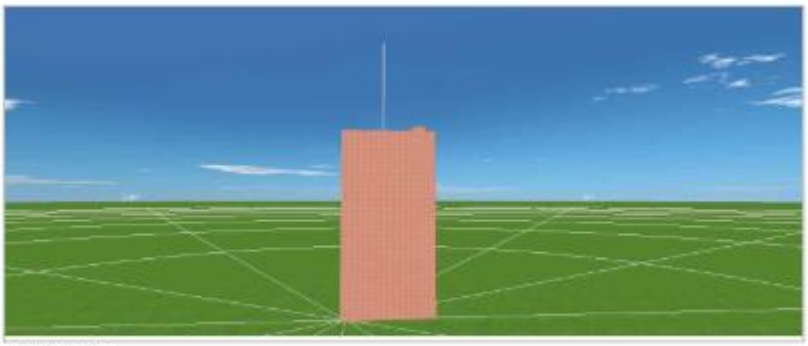


Figure: Ground view

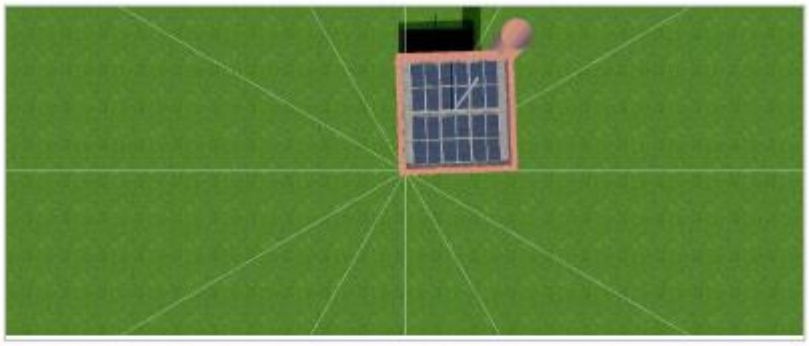


Figure: Overhead

Module Areas

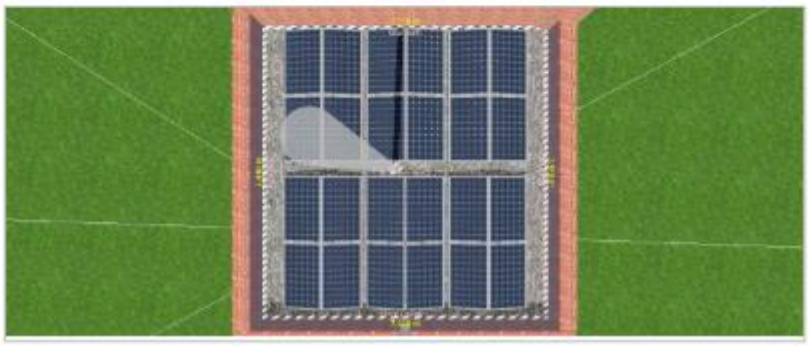
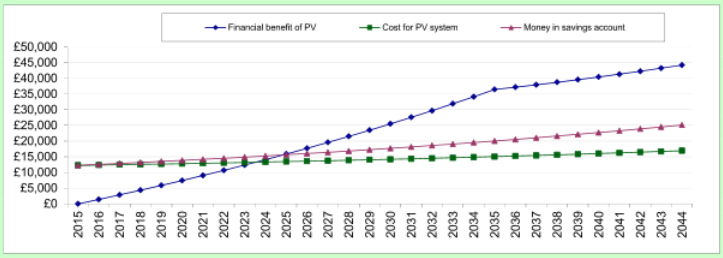


Figure: Shading Analysis

SEAM Centre Solar PV Payback Calculator
www.seamcentre.org.uk

Number of years for results calculation	30	years
From a start date of	13/05/2015	
The installation cost for the solar PV equipment is	12,176	pounds
Average annual maintenance etc. costs	100	pounds/year
The solar PV system will have a capacity of	6.84	kW peak
Would you like to use your own estimate of annual generation?	Yes	
Value to be used	6,969	kWh/year
Anticipated annual generation in first year (based on user's estimate)	6,969	kWh/year
Expected percentage of peak output after 25 years	80	%
Percentage of generated electricity used on-site	32.1	%
FIT generation tariff	12.13	pence/kWh
FIT export tariff	4.85	pence/kWh
Duration of FIT rates	20	years
Will the FIT income be invested in a savings account?	No	
Electricity price at start date	15	pence/kWh
Average annual electricity price inflation	4	%
Average annual retail Price Index (RPI)	3	%
Average annual savings interest rate (gross)	2	%
Tax rate	20	%



Payback comparison		
Payback after	10	years
Better than savings after	11	years

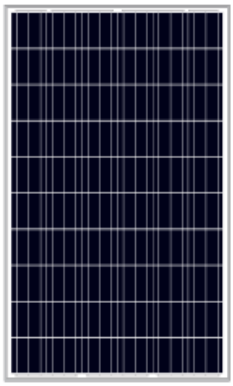
Equivalent interest rate after 30 years		
Net	3.25	%
Gross	4.07	%

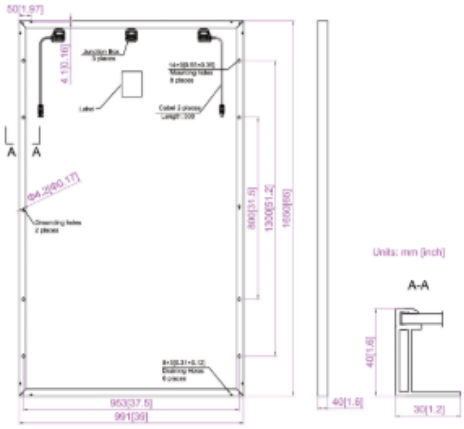
Total energy generated by PV system in	30	years equals	184,818	kWhs representing	97,769	kgs of CO_2

JAM6(R) 60/255-275

JA SOLAR

Engineering Drawings





PERLIGHT

PLM-250MB-60 SERIES

Monocrystalline Silicon Solar Module

DELTA BLACK

The Delta Black Series from Perlight

- Monocrystalline

Fully compliant with worldwide standards

- MCS Certified

- Monocrystalline
- Positive output tolerance
- Over 30 years manufacturing experience

Sleek and unobtrusive design

- Specially designed for the UK
- Blends-in instead of taking attention away from existing building attributes.
- No Silver lines

- MCS Certified
- Ammonia corrosion certified
- Salt Mist corrosion certified
- Fire Safety Certified
- PID Free

25 Year output performance warranty

- +90% output for 12 years
- +80% output over 25 years

10 Year workmanship warranty

Cell type	Monocrystalline
Cell Size (mm)	156 x 156
No. of cells per module	60
Module size (mm)	1650 x 992 x 40
Module weight	18.5 kg
Front Glass	3.2mm Tempered glass
Frame	Anodised Alu Alloy
Connector type	MC4

MANUFACTURING BASE
Perlight Solar Co.,Ltd
Muyu Administration District
Wenling
Zhejiang, 317521, China
Tel: +86 576 8647 7290
E: Jenny.uk@perlight.com

GLOBAL MARKETING CENTRE
Perlight Solar Co.,Ltd
E# 14th floor, 58 Xinjinqiao Rd
PuDong District
Shanghai, 200129, China
Tel: +86 21 6105 2372
E: enquiry@perlight.com

EU SALES AND CUSTOMER CENTRE
Westech Solar (UK) Ltd
Unit 1, Bobby Fryer Close,
Garsington Rd
Oxford, OX4 6ZN, UK
Tel: +44 (0)1865 682 584
E: info@westech-solar.co.uk

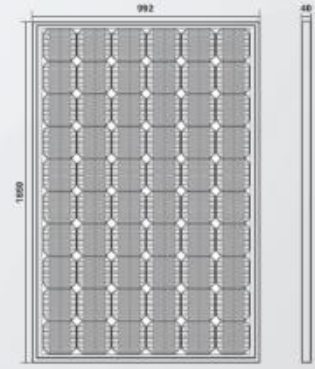
PERLIGHT westech

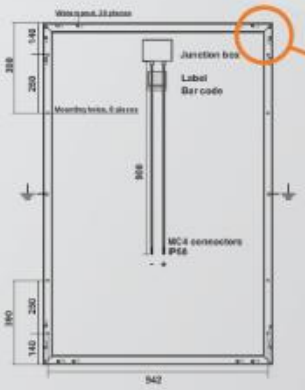
PERLIGHT

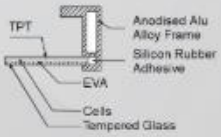
PLM-250MB-60 SERIES

Monocrystalline Silicon Solar Module

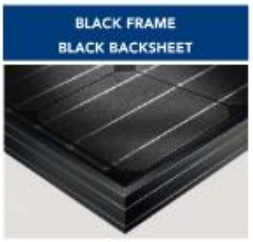
DELTA BLACK

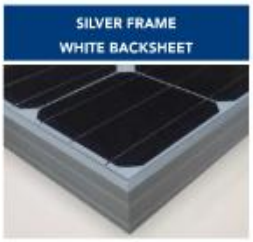






- Extremely reliable screw-less, interconnected frame for long-term flexibility and strength.
- 20 In-built drainage waterspouts.
- 8 mounting holes for direct mounting option.
- 2 Earth (Ground) points.





Solar inverters

ABB string inverters
TRIO-5.8/7.5/8.5-TL-OUTD
5.8 to 8.5 kW

The all-in-one, residential, three-phase TRIO-5.8, 7.5 and 8.5 kW inverters deliver performance, ease of use and installation, monitoring and control. With their 98% peak efficiency and wide input voltage range, these new residential TRIO inverters mean flexible installations and powerful output.

Commercial grade engineering at residential scale

These new additions to the TRIO family are small, light and built smart. The topology of the larger, commercial TRIO inverters has been redesigned to ensure that the TRIO-5.8/7.5/8.5 models also enjoy high conversion efficiency across a wide range of input voltages. Optional integrated Dataloggers and smart grid functionality, remote firmware updating and elegantly simple sliding front covers make these all-in-one devices easy to install and maintain. In short, they are commercial grade engineering at residential scale.

Inverters packed with powerful features

The double maximum power point tracker (MPPT) gives maximum installation flexibility for an optimal energy production (TRIO-7.5/8.5 models). The new generation inverters can integrate power control, monitoring functionalities, and environmental sensor inputs, all without requiring external components.

A compact Ethernet expansion card provides data logging functionality for monitoring the main parameters of the plant as well as advanced O&M operations both locally (with the integrated webserver) and remotely (with the AV Plant Portfolio Manager portal), via a LAN connection.

The outer cover with its natural cooling mechanism qualifies at IP65 environmental protection level for external use. It provides for maximum reliability and ease of installation, with a sliding front panel giving access to the connection and configuration area without requiring the complete removal of the cover.

Highlights

- True three-phase bridge topology for DC/AC output converter
- Transformerless topology
- Two independent MPPT channels for TRIO-7.5/8.5 allows optimal energy harvesting from two sub-arrays oriented in different directions (one MPPT channel for TRIO-5.8)
- Flat efficiency curves ensure high efficiency at all output levels ensuring consistent and stable performance across the entire input voltage and output power range
- Wide input voltage range
- Remote inverter upgrade
- Reactive power management

Power and productivity
for a better world™

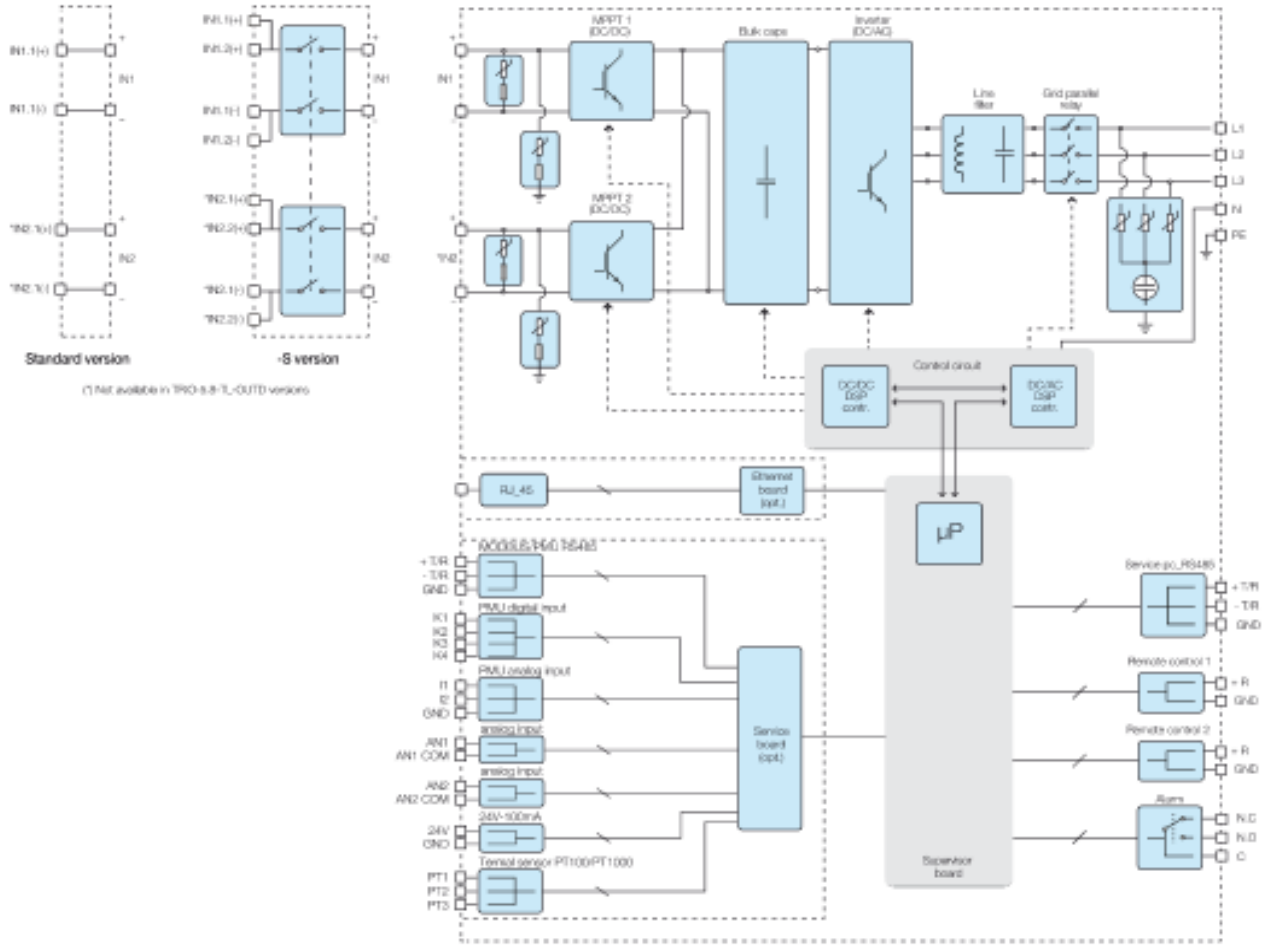
Additional highlights

- DC switch version option (-S)
- Natural convection cooling for maximum reliability
- Outdoor enclosure for unrestricted use under any environmental conditions (IP65)
- Sliding cover for the easiest installation and maintenance
- Datalogger and smart grid functionalities integrated on expansion cards:
- PMU expansion card option, with external sensor inputs for monitoring environmental conditions and additional RS-485 for Modbus protocol
- Ethernet expansion card option with integrated web server and remote monitoring capability via web portal (Modbus/TCP supported)
- Availability of auxiliary DC output voltage (24V, 100mA)

Technical data and types

Type code	TRIO-5.8-TL-OUTD	TRIO-7.5-TL-OUTD	TRIO-8.5-TL-OUTD
Input side			
Absolute maximum DC input voltage ($V_{max,abs}$)		1000 V	
Start-up DC input voltage (V_{start})		350 V (adj. 200...500 V)	
Operating DC input voltage range (V_{dcmin}...V_{dcmax})		0.7 x V_{start}...950 V	
Rated DC input voltage (V_{dcr})		620 V	
Rated DC input power (P_{dcr})	5950 W	7650 W	8700 W
Number of independent MPPT	1	2	2
Maximum DC input power for each MPPT ($P_{MPPTmax}$)	6050 W Linear derating from max to null [800V≤V_{MPPT}≤950V]	4800 W	4800 W
MPPT input DC voltage range ($V_{MPPTmin}$ ... $V_{MPPTmax}$) at P_{acr}	320...800 V	-	-
DC input voltage range with parallel configuration of MPPT at P_{acr}	-	320...800 V	320...800 V
DC power limitation with parallel configuration of MPPT	-	Linear derating from max to null [800V≤V_{MPPT}≤950V]	
DC power limitation for each MPPT with independent configuration of MPPT at P_{acr}, max unbalance example	-	4800 W [320V≤V_{MPPT}≤800V] the other channel: P_{dcr}-4800W [215V≤V_{MPPT}≤800V]	4800 W [320V≤V_{MPPT}≤800V] the other channel: P_{dcr}-4800W [290V≤V_{MPPT}≤800V]
Maximum DC input current (I_{dcmax}) / for each MPPT ($I_{MPPTmax}$)	18.9 A	30.0 A / 15.0 A	30.0 A / 15.0 A
Maximum input short circuit current for each MPPT	24.0 A	20.0 A	20.0 A
Number of DC inputs pairs for each MPPT		2 (-S version)	
DC connection type		Tool Free PV connector WM / MC4 (Screw terminal block on standard version)	
Input protection			
Reverse polarity protection		Yes, from limited current source	
Input over voltage protection for each MPPT - varistor		2	
Photovoltaic array isolation control		According to local standard	
DC switch rating for each MPPT (version with DC switch)		16 A /1000 V, 25 A / 800 V	
Output side			
AC grid connection type		Three phase 3W or 4W+PE	
Rated AC power (P_{acr} @cosϕ=1)	5800 W	7500 W	8500 W
Maximum apparent power (S_{max})	5800 VA	7500 VA	8500 VA
Rated AC grid voltage ($V_{ac,r}$)		400 V	
AC voltage range		320...480 V [1]	
Maximum AC output current ($I_{ac,max}$)	10.0 A	12.5 A	14.5 A
Contributory fault current	12.0 A	14.5 A	16.5 A
Rated output frequency (f_r)		50 Hz / 60 Hz	
Output frequency range (f_{min}...f_{max})		47...53 Hz / 57...63 Hz [2]	
Nominal power factor and adjustable range	> 0.995, adj. ± 0.9 with P_{acr}=5.22 kW, ± 0.8 with max 5.8 kVA	> 0.995, adj. ± 0.9 with P_{acr}=6.75 kW, ± 0.8 with max 7.5 kVA	> 0.995, adj. ± 0.9 with P_{acr}=7.65 kW, ± 0.8 with max 8.5 kVA
Total current harmonic distortion		< 2%	
AC connection type		Screw terminal block, cable gland M32	
Output protection			
Anti-islanding protection		According to local standard	
Maximum AC overcurrent protection	10.5 A	13.0 A	15.0 A
Output overvoltage protection - varistor		4 plus gas arrester	
Operating performance			
Maximum efficiency (η_{max})		98.0%	
Weighted efficiency (EURO/CEC)	97.4% / -	97.5% / -	97.5% / -
Feed in power threshold	32 W	36 W	36 W
Stand-by consumption	< 15W	< 15W	< 15W

Block diagram of TRIO-5.8/7.5/8.5-TL-OUTD



Technical data and types

Type code	TRIO-5.8-TL-OUTD	TRIO-7.5-TL-OUTD	TRIO-8.5-TL-OUTD
Communication			
Wired local monitoring	Ethernet card with webserver (opt.), PVI-USB-RS232_485 (opt.)		
Remote monitoring	Ethernet card (opt.), VSN300 Wifi Logger Card[2] (opt.), PVI-AEC-EVO (opt.), VSN700 Data Logger (opt.)		
Wireless local monitoring	VSN300 Wifi Logger Card[2] (opt.)		
User interface	Graphic display		
Environmental			
Ambient temperature range	-25...+60°C /-13...140°F with derating above 50°C/122°F		
Relative humidity	0...100% condensing		
Noise emission	< 45 dB(A) @ 1 m		
Maximum operating altitude without derating	2000 m / 6560 ft		
Physical			
Environmental protection rating	IP 65		
Cooling	Natural		
Dimension (H x W x D)	641mm x 429mm x 220mm/ 25.2" x 16.9" x 8.7" (855mm x 429mm x 237mm/ 33.7" x 16.9" x 9.3"with open front cover)		
Weight	25.0 kg / 55.1 lb	28.0 kg / 61.7 lb	28.0 kg / 61.7 lb
Mounting system	Wall bracket		
Safety			
Isolation level	Transformerless		
Marking	CE (50 Hz only)		
Safety and EMC standard	EN62109-1, EN62109-2, AS/NZS3100, AS/NZS 60950, EN61000-6-2, EN61000-6-3, EN61000-3-2, EN61000-3-3		
Grid standard (check your sales channel for availability)	CEI 0-21, CEI 0-16, VDE 0126-1-1, VDE-AR-N 4105, G83/2, C10/11, EN 50438 (not for all national appendices), RD1699, RD 1565, ABNT NBR 16149, NRS-097-2-1, CLC/FprTS 50549		
Available products variants			
Standard	TRIO-5.8-TL-OUTD-400	TRIO-7.5-TL-OUTD-400	TRIO-8.5-TL-OUTD-400
With DC switch	TRIO-5.8-TL-OUTD-S-400	TRIO-7.5-TL-OUTD-S-400	TRIO-8.5-TL-OUTD-S-400

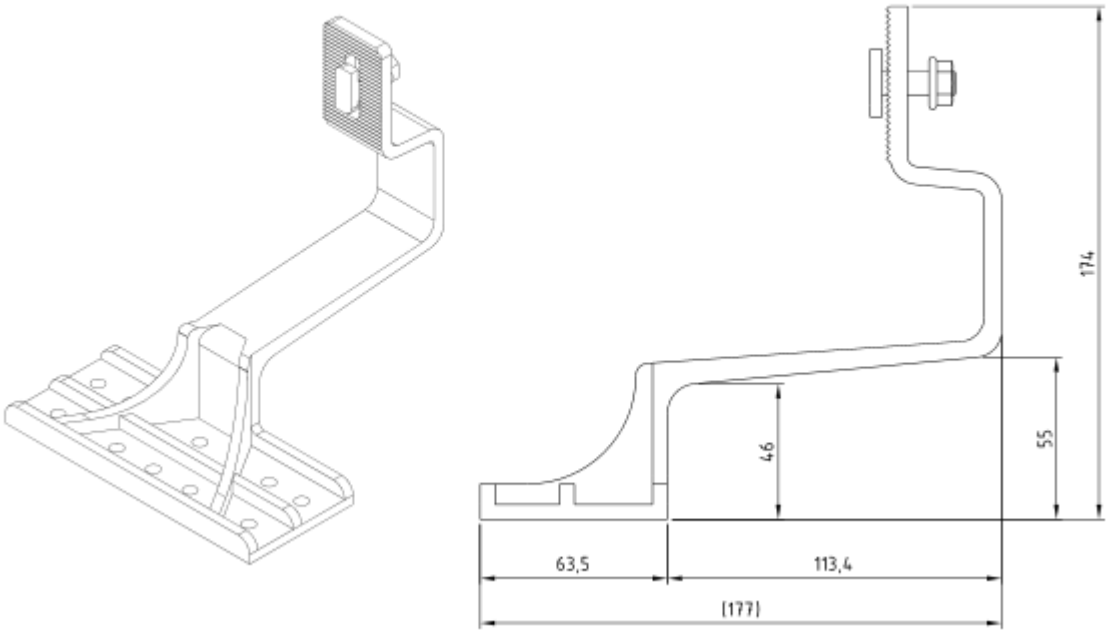
1. The AC voltage range may vary depending on specific country grid standard
2. The Frequency range may vary depending on specific country grid standard
3. Check availability before to order

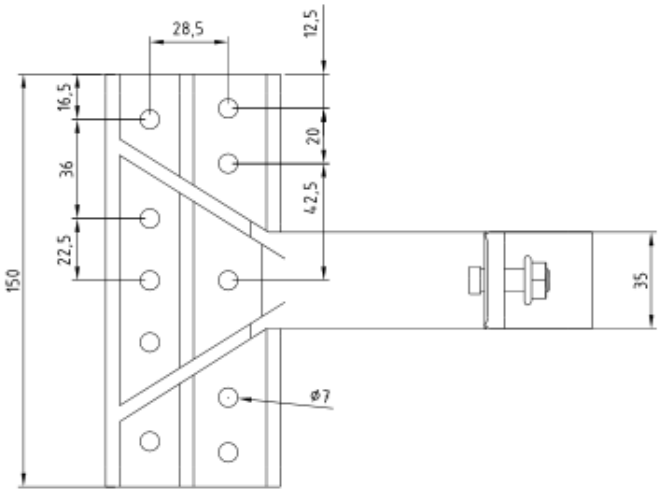
Remark. Features not specifically listed in the present data sheet are not included in the product

Renusol
Solar Mounting Systems

Roof Hook Aluminium

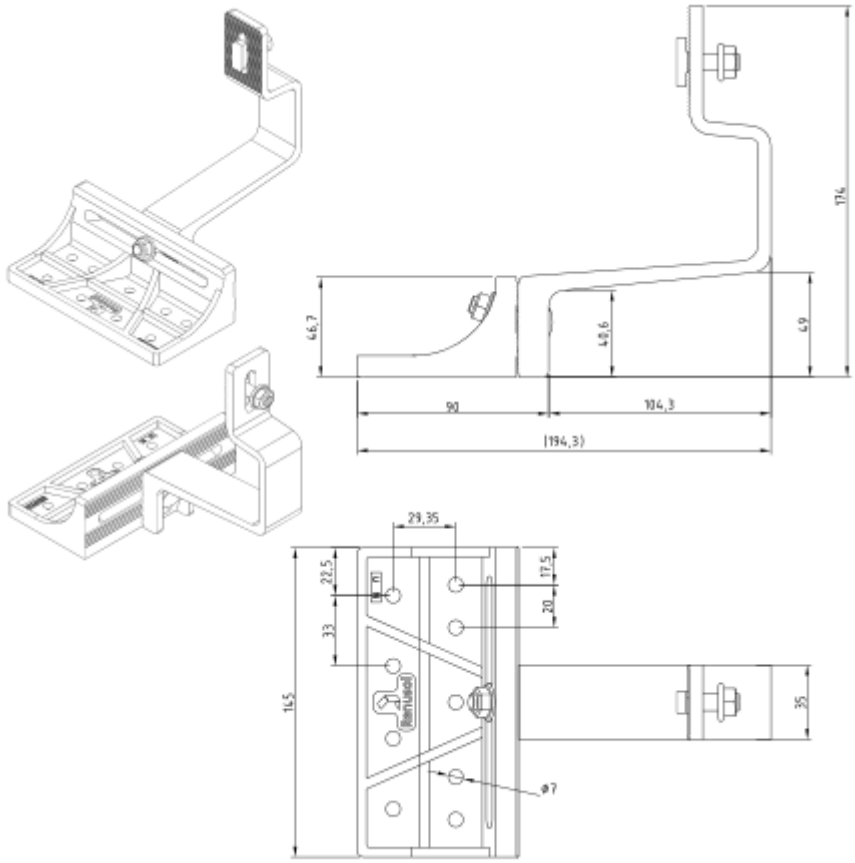
Item Number	Article description	PU
860005	VarioSole Roof Hook Alu	1 pc
860001	VarioSole Roof Hook Alu	20 pcs





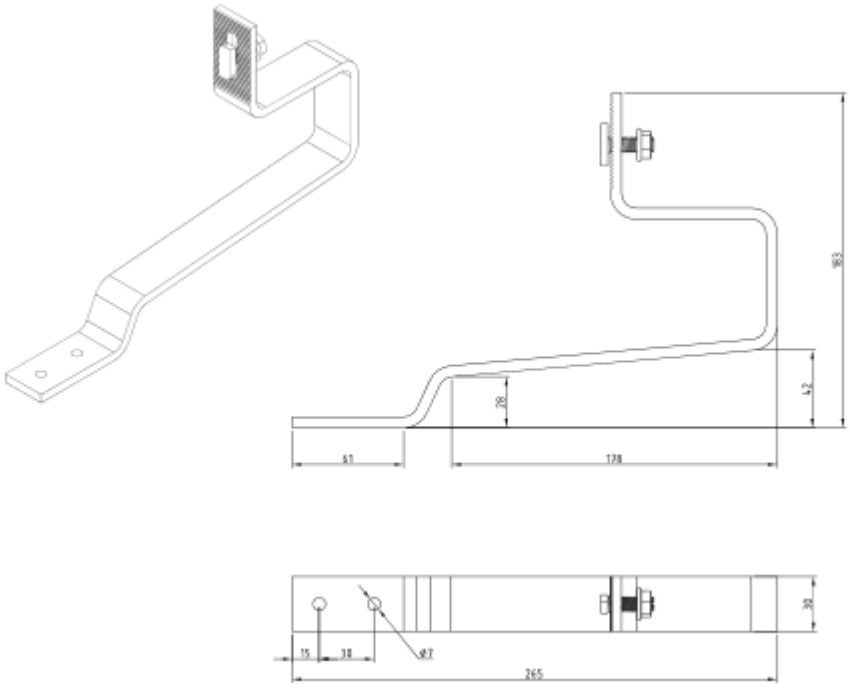
Roof Hook Aluminium adjustable

Item Number	Article description	PU
420102	VarioSole Roof Hook Alu adjustable	1 pc
460174	VarioSole Roof Hook Alu adjustable	20 pcs



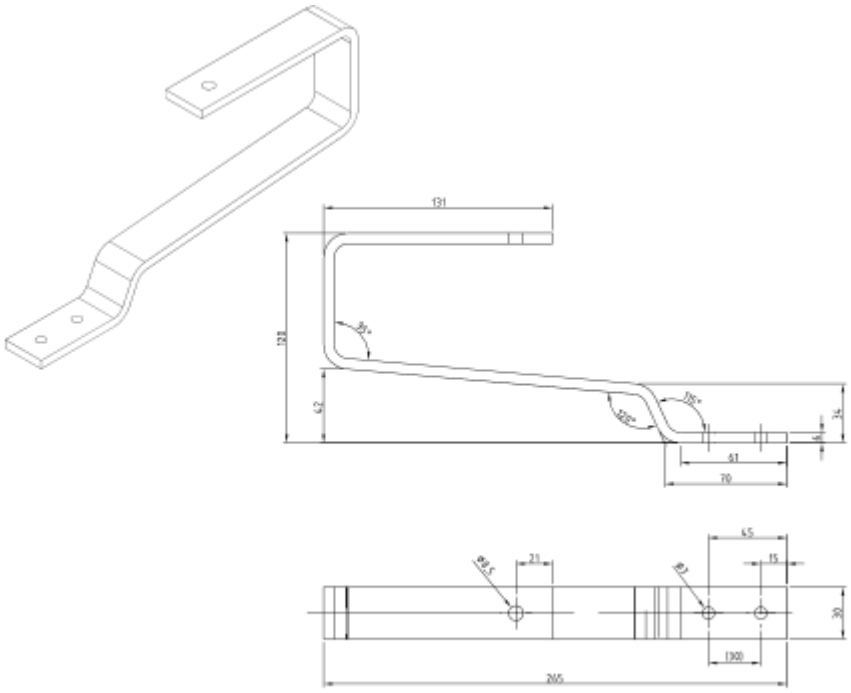
Roof Hook Plain tile Standard

Item Number	Article description	PU
920062	VarioSole Roof Hook Plain tile Standard	1 pc
960062	VarioSole Roof Hook Plain tile Standard	20 pcs



Roof Hook Plain tile 90°

Item Number	Article description	PU
920116	VarioSole Roof Hook Plain tile 90°	1 pc
960116	VarioSole Roof Hook Plain tile 90°	20 pcs



Please see accompanying brochure

b. Warm Space Quote - (Ref: Warm Space proposal – please go to Recommendations page)

Church House Hall – Very Large maximum sized system of 17.1KW.

Warm-Space Photovoltaic Quotation

Customer Name:	Mr Brewer. (Hall)
Address:	2 North Street, Havant.
Postcode:	PO9 1EH
Telephone/Mob:	07763 977634
Staff Name:	Robert Smith
Quote Ref:	190796
Date:	28-Apr-15

This quotation is valid for 14 days. Outside this period the price may vary

Description		Total
System Size kWp	17.1	
	System Description	
Panels	60 x 275w Yingli Solar Panels (Anti Corrosive).	
Inverters	1 x 17000 Solar Edge Inverter with 30 Optimisers.	
Mounting system	All Stainless Steal Frames plus Alluminiun Rails.	
Monitoring option	Full Broadband Monitoring.	
Switchgear	N/A	
DC Cabling	Included	
AC Cabling	Included	
G59 Relay	Included	
Scaffold	Included	
Witness test	N/A	
MCS Certification	Included plus all guarantees and Warrantees	
	Total Ex. Vat	**£22,494.26**
	Total inc. Vat @ 20%	**£26,993.11**
	Deposit 25%	£6,748.00
	Final payment on completion	£20,245.11

Energy Production estimate kWh per Year		**MCS**			
		17,391			
SAP Calculation details:	Annual energy kWh/yr	Postcode region	Kk (from table)	SF (shade factor)	System size kWp
	17,391	3	1,017	1	17.10

"The performance of solar photovoltaic systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. The estimate is based upon the governments standard assessment procedure for the energy rating of buildings (SAP) and is given as guidance only. It should not be considered as a guarantee of performance."

Only where data has been collected remotely for the quotation to be produced (with no physical survey) "This sytem performance has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values."

"This shade assessment has been undertaken using the standard MCS procedure - it is estimated that this method will yield results within 10% of the actual annual energy yield for most systems

Estimated Payback Period (Years)	MCS	Workmanship warranty
	5	**10 Years**

"The payback period estimations are based on assumptions shown on the attached Payback Calculator sheets. You should review the assumptions used and change them as required to reach your own conclusion as to the likely payback period achievable".

I Accept the quotation stated and confirm that, if required, any necessary permissions (such as planning) will be in place before the work commences on site. I understand that the final system design and cost is dependent on the connection capacity allowed by the National Grid at my property.

Customer name:	Mr Brewer. (Hall)	Date:	28-Apr-15
Customer Signature:		Quote reference:	190796

S.A.P. Based Solar PV Payback Calculation

This estimation tool is provided to assist potential Photovoltaic customers to evaluate photovoltaic systems financial returns.
Warm-Space ltd makes no assertions as to the accuracy of the calculations or of the assumptions used.

WARM-SP
INSULATION L

Average Cost per kW Installed (£)	1,315
Estimated Installed Cost (£)	22,494
Size of the Array (kWp)	17.1
Postcode region	3
Kk	1,017
Shading Factor	1

Estimated Output (kWh/annum) 17391

Enter your own figures in ORANGE boxes
PAYBACK reached in year where cells turn GREEN in Cumulative Total
Notes:
> Calculations ignore the time value of money
> Assumes inverter lasts 25 years

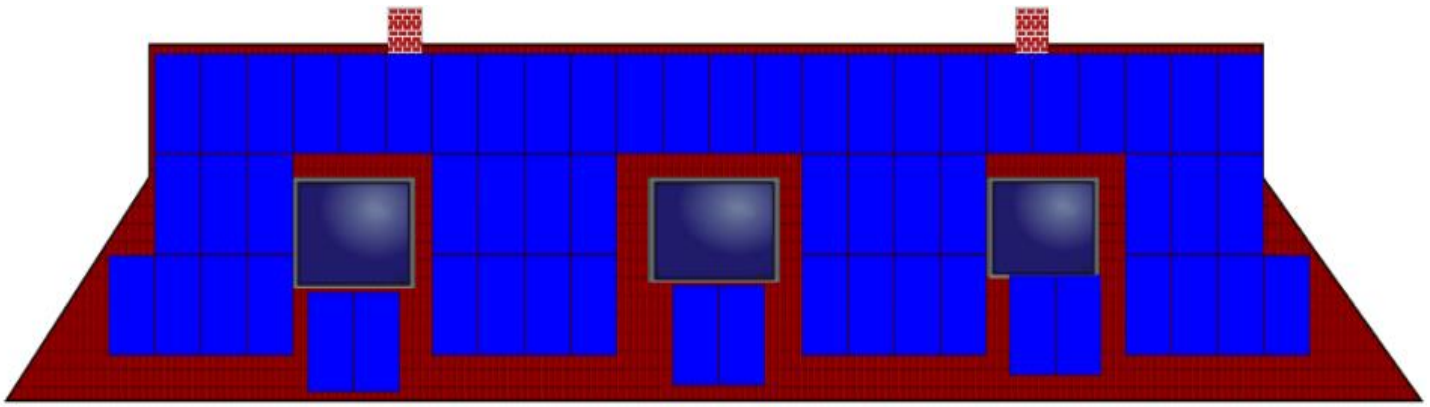
Higher Fit rates from 1st April 2014
upto 4 kWp 13.38
10 to 50kWp 11.71
50 to 100kWp
100 to 150kWp
150 to 250kWp

104% Assumed Annual Rate of Inflation	% of Energy Used on Site	Annual Increase in Energy Cost	Annual Maintenance Cost (£)
4%	75%	10%	-

Year	Estimated Output Taking Degradation at 1% loss/year into Account (kWh/annum)	Efficiency of Cells	10 to 50 kW FIT (p/kWh)	10-50 kW FIT (p/kWh)	inflation compound factor	FIT including inflation (p/kWh)	export payment at total - energy used on site x 4.77p	Total Generation annual income (£)	Energy Used on Site (kWh)	Energy Cost (p)	Savings from Energy Used (£)	Total Income & Saving per year (£)	Cumulative Total (£)	Year
1	17391	100%	11.71	11.71	1.00	11.71	403.5	2,440	13043	14.00	1826	4,266	4,266	1
2	17391	100%	11.71	11.71	1.04	12.18	419.6	2,538	13043	15	2009	4,546	8,812	2
3	17391	100%	11.71	11.71	1.08	12.67	436.4	2,639	13043	17	2210	4,849	13,661	3
4	17217	99%	11.71	11.71	1.12	13.17	449.3	2,717	12913	19	2406	5,123	18,784	4
5	17045	98%	11.71	11.71	1.17	13.70	462.6	2,798	12784	20	2620	5,418	24,202	5
6	16874	97%	11.71	11.71	1.22	14.25	476.3	2,880	12656	23	2854	5,734	29,936	6
7	16706	96%	11.71	11.71	1.27	14.82	490.4	2,966	12529	25	3107	6,073	36,009	7
8	16539	95%	11.71	11.71	1.32	15.41	504.9	3,053	12404	27	3384	6,438	42,447	8
9	16373	94%	11.71	11.71	1.37	16.03	519.9	3,144	12280	30	3685	6,829	49,276	9
10	16210	93%	11.71	11.71	1.42	16.67	535.3	3,237	12157	33	4013	7,250	56,526	10
11	16047	92%	11.71	11.71	1.48	17.33	551.1	3,333	12036	36	4370	7,703	64,229	11
12	15887	91%	11.71	11.71	1.54	18.03	567.4	3,431	11915	40	4759	8,191	72,420	12
13	15728	90%	11.71	11.71	1.60	18.75	584.2	3,533	11796	44	5183	8,716	81,136	13
14	15571	90%	11.71	11.71	1.67	19.50	601.5	3,637	11678	48	5644	9,282	90,417	14
15	15415	89%	11.71	11.71	1.73	20.28	619.3	3,745	11561	53	6147	9,892	100,309	15
16	15261	88%	11.71	11.71	1.80	21.09	637.6	3,856	11446	58	6694	10,550	110,859	16
17	15108	87%	11.71	11.71	1.87	21.93	656.5	3,970	11331	64	7289	11,260	122,118	17
18	14957	86%	11.71	11.71	1.95	22.81	675.9	4,088	11218	71	7938	12,026	134,144	18
19	14808	85%	11.71	11.71	2.03	23.72	695.9	4,209	11106	78	8645	12,853	146,997	19
20	14660	84%	11.71	11.71	2.11	24.67	716.5	4,333	10995	86	9414	13,747	160,745	20
21	14513	83%	11.71	11.71				-	10885	94	10252	10,252	170,996	21
22	14368	83%	11.71	11.71				-	10776	104	11164	11,164	182,161	22
23	14224	82%	11.71	11.71				-	10668	114	12158	12,158	194,319	23
24	14082	81%	11.71	11.71				-	10561	125	13240	13,240	207,558	24
25	13941	80%	11.71					-	10456	138	14418	14,418	221,977	25
26	13802	79%	11.71					-	10351	152	15701	15,701	237,678	26
27	13664	79%	11.71					-	10248	167	17099	17,099	254,777	27
28	13527	78%	11.71					-	10145	184	18621	18,621	273,398	28
29	13392	77%	11.71					-	10044	202	20278	20,278	293,676	29
30	13258	76%	11.71					-	9943	222	22083	22,083	315,758	30

Exaggerated revenues

The latest signs of distress are coming from Yingli Green Energy (NYSE: YGE), one of China's largest Solar PV Manufacturers , which has just announced it has the necessary funds to pay off a bond that will mature next week. Some may see such an announcement as a sign of strength; but the fact that Yingli is taking the unusual step of making an announcement seems aimed at allaying market concerns that it might not make the payment. May 2nd 2015. Warm Space should use another panel manufacturer if possible to avoid any issues of future panel replacements. (source 11)



www.youtube.com/watch?v=Jr8h51M8sW8 **Pitched roof fixing of panels onto Church House Hall**


LANDSCAPE
Mounting landscape profile

Church House Hall – Smaller 3.575KW system - 13 panels along the front edge of pitched roof.

Warm-Space Quotation

Customer Name:	Church House (alan Brewer)
Address:	Havant
Postcode:	PO9 1EH
Telephone/Mob:	07763 977634
Staff Name:	Robert Smith
Quote Ref:	190796
Date:	11-May-2015

WARM-SPACE INSULATION LIMITED

This quotation is valid for 14 days. Outside this period the price may vary

Description	Total
System Size kWp 3.575	
3.575KW System, 13 x 275 Yingli Solar Panels.	
Solar Edge Inverter with 13 Optimizers for increase power output.	
a generation meter, A/C & D/C Isolation Switches, Grid Connection.	
All Cables & Wiring, All Fixtures & Fittings. Full Commissioning on completion.	
Total Ex. Vat	**£5,795.14**
Total inc. Vat @ 5%	**£6,084.89**
Deposit 25%	£1,521.00
Remainder on Completion (before MCS certificate)	£4,563.89

Whole system Energy Production estimate - kWh per Year	SAP
	3,586

SAP Calculation details:	Annual energy kWh/yr	Area	(S) kWh/m sq	(Zpv) overshading	System size kWp
Array 1	3,586	3	1,003	0	3575
Array 2	0	1	0	1	
Array 3	0	1	0	1	0
Array 4	0	1	0	0	0
Array 5	0	1	0	0	0

"The performance of solar photovoltaic systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. The estimate is based upon the governments standard assessment procedure for the energy rating of buildings (SAP) and is given as guidance only. It should not be considered as a guarantee of performance."

Estimated Payback Period (Yea	SAP	Installation workmanship Warranty(years
	6	10

"The payback period estimations are based on assumptions shown on the attached Payback Calculator sheets. You should review the assumptions used and change them as required to reach your own conclusion as to the likely payback period achievable".

[illegible] before the work commences on site. I understand the requirement for a band D or better EPC for my property to be able to claim FIT payments

Customer name:	Church House (alan Brewer)	Date of quote	11-May-15
Customer Signature:		Date:	Quote reference: 190796

Tel: 01793 877333 . 07737 516635 Please make Cheques Warm-Space Ltd

Bank Transfer Information: Nat-West Sort Code 60-21-40

Warm-Space Ltd Account name: Warm-Space Ltd

Caen View Account no.: 57815135

MCS 6.02 Version 1.13 page 1

S.A.P. Based Solar PV Payback Calculation

This estimation tool is provided to assist potential Photovoltaic customers to evaluate photovoltaic systems financial returns. Warm-Space ltd makes no assertions as to the accuracy of the calculations or of the assumptions used.

WARM-SPACE INSULATION LIMITED

Average Cost per kW Installed (£)		1,702
Estimated Installed Cost (£)		6,085
	Size of the Array (kWp)	3.6
	Load Factor	0.8
Average	Solar Radiation Factor	1,003,000
Average	Overshading Factor	0

Estimated Output (kWh/annum) **3586**

Enter your own figures in ORANGE boxes
PAYBACK reached in year where cells turn GREEN in Cumulative Total
Notes:
> Calculations ignore the time value of money
> Assumes inverter lasts 25 years

104% Assumed Annual Rate of Inflation	% of Energy Used on Site	Annual Increase in Energy Cost	Annual Maintenance Cost (£)
4.00%	**75%**	**10%**	-

Year	Estimated Output Taking Degradation at 1% loss/year into Account (kWh/annum)	Efficiency of Cells	Up to 4kW FIT (p/kWh)	4-10 kW FIT (p/kWh)	inflation compound factor	FIT including inflation (p/kWh)	Deemed export payment at 50% of total generation x 4.5p	**Total Generation annual income (£)**	Energy Used on Site (kWh)	Energy Cost (p)	**Savings from Energy Used (£)**	**Total Income & Saving per year (£)**	**Cumulative Total (£)**	Year
1	3586	100%	13.4	12.1	1.00	13.4	80.7	**561**	2690	**14.00**	**377**	**937**	**937**	1
2	3586	100%	13.4	12.1	1.04	13.9	80.7	**580**	2690	15	**414**	**994**	**1,932**	2
3	3586	100%	13.4	12.1	1.08	14.5	80.7	**600**	2690	17	**456**	**1,056**	**2,987**	3
4	3550	99%	13.4	12.1	1.12	15.1	79.9	**615**	2663	19	**496**	**1,111**	**4,098**	4
5	3515	98%	13.4	12.1	1.17	15.7	79.1	**630**	2636	20	**540**	**1,170**	**5,268**	5
6	3479	97%	13.4	12.1	1.22	16.3	78.3	**645**	2610	23	**588**	**1,234**	**6,501**	6
7	3445	96%	13.4	12.1	1.27	16.9	77.5	**661**	2584	25	**641**	**1,302**	**7,803**	7
8	3410	95%	13.4	12.1	1.32	17.6	76.7	**678**	2558	27	**698**	**1,375**	**9,179**	8
9	3376	94%	13.4	12.1	1.37	18.3	76.0	**695**	2532	30	**760**	**1,455**	**10,633**	9
10	3342	93%	13.4	12.1	1.42	19.1	75.2	**712**	2507	33	**828**	**1,540**	**12,173**	10
11	3309	92%	13.4	12.1	1.48	19.8	74.5	**730**	2482	36	**901**	**1,631**	**13,805**	11
12	3276	91%	13.4	12.1	1.54	20.6	73.7	**749**	2457	40	**981**	**1,730**	**15,535**	12
13	3243	90%	13.4	12.1	1.60	21.4	73.0	**768**	2432	44	**1069**	**1,837**	**17,372**	13
14	3211	90%	13.4	12.1	1.67	22.3	72.2	**788**	2408	48	**1164**	**1,952**	**19,324**	14
15	3179	89%	13.4	12.1	1.73	23.2	71.5	**809**	2384	53	**1267**	**2,076**	**21,400**	15
16	3147	88%	13.4	12.1	1.80	24.1	70.8	**830**	2360	58	**1380**	**2,210**	**23,610**	16
17	3115	87%	13.4	12.1	1.87	25.1	70.1	**851**	2336	64	**1503**	**2,354**	**25,964**	17
18	3084	86%	13.4	12.1	1.95	26.1	69.4	**874**	2313	71	**1637**	**2,511**	**28,475**	18
19	3053	85%	13.4	12.1	2.03	27.1	68.7	**897**	2290	78	**1783**	**2,679**	**31,154**	19
20	3023	84%	13.4	12.1	2.11	28.2	68.0	**921**	2267	86	**1941**	**2,862**	**34,016**	20
21	2993	83%						-	2244	94	**2114**	**2,114**	**36,130**	21
22	2963	83%						-	2222	104	**2302**	**2,302**	**38,432**	22
23	2933	82%						-	2200	114	**2507**	**2,507**	**40,939**	23
24	2904	81%						-	2178	125	**2730**	**2,730**	**43,669**	24
25	2875	80%						-	2156	138	**2973**	**2,973**	**46,642**	25
26	2846	79%						-	2134	152	**3238**	**3,238**	**49,880**	26
27	2817	79%						-	2113	167	**3526**	**3,526**	**53,405**	27
28	2789	78%						-	2092	184	**3840**	**3,840**	**57,245**	28
29	2761	77%						-	2071	202	**4181**	**4,181**	**61,426**	29
30	2734	76%						-	2050	222	**4553**	**4,553**	**65,980**	30

Exaggerated revenues

Church Turret

Warm-Space Photovoltaic Quotation

Customer Name:	Mr Brewer (Church)
Address:	2 North Street, Havant.
Postcode:	PO9 1EH
Telephone/Mob:	07763 977634
Staff Name:	Robert Smith
Quote Ref:	190796
Date:	28-Apr-15

This quotation is valid for 14 days. Outside this period the price may vary

Description		Total
System Size kWp	5.5	
	System Description	
Panels	20 x 275w Yingli Solar Panels (Anti Corrosive).	
Inverters	1 x 5000 Solar Edge Inverter with 90 Optimisers.	
Mounting system	All Stainless Steal Frames plus Alluminiun Rails.	
Monitoring option	Full Broadband Monitoring.	
Switchgear	N/A	
DC Cabling	Included	
AC Cabling	Included	
G59 Relay	Included	
Scaffold	Included	
Witness test	N/A	
MCS Certification	Included plus all guarantees and Warrantees	
	Total Ex. Vat	**£8,300.00**
	Total inc. Vat @ 20%	**£9,960.00**
	Deposit 25%	£1,992.00
	Final payment on completion	£7,968.00

Energy Production estimate kWh per Year		**MCS**			
		5,594			
SAP Calculation details:	Annual energy kWh/yr	Postcode region	Kk (from table)	SF (shade factor)	System size kWp
	5,594	3	1,017	1	5.50

"The performance of solar photovoltaic systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. The estimate is based upon the governments standard assessment procedure for the energy rating of buildings (SAP) and is given as guidance only. It should not be considered as a guarantee of performance."

Only where data has been collected remotely for the quotation to be produced (with no physical survey) "This sytem performance has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values."

"This shade assessment has been undertaken using the standard MCS procedure - it is estimated that this method will yield results within 10% of the actual annual energy yield for most systems

Estimated Payback Period (Years)	MCS	Workmanship warranty
	5	**10 Years**

"The payback period estimations are based on assumptions shown on the attached Payback Calculator sheets. You should review the assumptions used and change them as required to reach your own conclusion as to the likely payback period achievable".

I Accept the quotation stated and confirm that, if required, any necessary permissions (such as planning) will be in place before the work commences on site. I understand that the final system design and cost is dependent on the connection capacity allowed by the National Grid at my property.

Customer name:	Mr Brewer (Church)	Date:	28-Apr-15
Customer Signature:		Quote reference:	190796

Please return this form to:
Warm-Space Insulation Ltd
Caen View
Rushy Platt
Swindon
SN5 8WQ
Tel: 01793 877333

Bank Transfer Information:
HSBC Sort Code
Account no.:
Account no.:

Please make Cheques Payable to Warm-Space

S.A.P. Based Solar PV Payback Calculation

This estimation tool is provided to assist potential Photovoltaic customers to evaluate photovoltaic systems financial returns.
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WARM-SI INSULATION L

Average Cost per kW Installed (£)		1,509
Estimated Installed Cost (£)		8,300
	Size of the Array (kWp)	5.5
	Postcode region	3
	Kk	1,017
	Shading Factor	1

Estimated Output (kWh/annum) **5594**

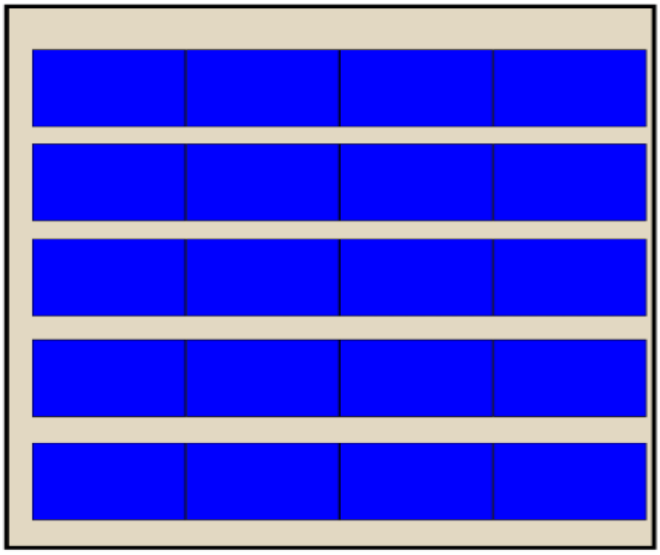
Enter your own figures in ORANGE boxes
PAYBACK reached in year where cells turn GREEN in Cumulative Total
Notes:
> Calculations ignore the time value of money
> Assumes inverter lasts 25 years

Higher Fit rates from 1st April 2014
upto 4 kWp 13.38
10 to 50kWp 12.13
50 to 100kWp 10.34
100 to 150kWp
150 to 250kWp

104% Assumed Annual Rate of Inflation	% of Energy Used on Site	Annual Increase in Energy Cost	Annual Maintenance Cost (£)
4%	75%	10%	-

Year	Estimated Output Taking Degradation at 1% loss/year into Account (kWh/annum)	Efficiency of Cells	10 to 50 kW FIT (p/kWh)	10-50 kW FIT (p/kWh)	inflation compound factor	FIT including inflation (p/wKh)	export payment at total - energy used on site x 4.77p	**Total Generation annual income (£)**	Energy Used on Site (kWh)	Energy Cost (p)	**Savings from Energy Used (£)**	**Total Income & Saving per year (£)**	**Cumulative Total (£)**	Year
1	5594	100%	**12.13**	**11.71**	1.00	11.71	129.8	**785**	4196	**14.00**	**587**	**1,372**	**1,372**	1
2	5594	100%	**12.13**	**11.71**	1.04	12.62	135.0	**841**	4196	15	**646**	**1,487**	**2,859**	2
3	5594	100%	**12.13**	**11.71**	1.08	13.12	140.4	**874**	4196	17	**711**	**1,585**	**4,444**	3
4	5538	99%	**12.13**	**11.71**	1.12	13.64	144.5	**900**	4154	19	**774**	**1,674**	**6,118**	4
5	5483	98%	**12.13**	**11.71**	1.17	14.19	148.8	**927**	4112	20	**843**	**1,770**	**7,888**	5
6	5428	97%	**12.13**	**11.71**	1.22	14.76	153.2	**954**	4071	23	**918**	**1,872**	**9,760**	6
7	5374	96%	**12.13**	**11.71**	1.27	15.35	157.7	**982**	4030	25	**1000**	**1,982**	**11,742**	7
8	5320	95%	**12.13**	**11.71**	1.32	15.96	162.4	**1,012**	3990	27	**1089**	**2,100**	**13,842**	8
9	5267	94%	**12.13**	**11.71**	1.37	16.60	167.2	**1,042**	3950	30	**1185**	**2,227**	**16,069**	9
10	5214	93%	**12.13**	**11.71**	1.42	17.26	172.2	**1,072**	3910	33	**1291**	**2,363**	**18,432**	10
11	5162	92%	**12.13**	**11.71**	1.48	17.96	177.3	**1,104**	3871	36	**1406**	**2,510**	**20,942**	11
12	5110	91%	**12.13**	**11.71**	1.54	18.67	182.5	**1,137**	3833	40	**1531**	**2,668**	**23,610**	12
13	5059	90%	**12.13**	**11.71**	1.60	19.42	187.9	**1,170**	3794	44	**1667**	**2,838**	**26,447**	13
14	5009	90%	**12.13**	**11.71**	1.67	20.20	193.5	**1,205**	3756	48	**1816**	**3,021**	**29,468**	14
15	4958	89%	**12.13**	**11.71**	1.73	21.01	199.2	**1,241**	3719	53	**1977**	**3,218**	**32,686**	15
16	4909	88%	**12.13**	**11.71**	1.80	21.85	205.1	**1,277**	3682	58	**2153**	**3,431**	**36,116**	16
17	4860	87%	**12.13**	**11.71**	1.87	22.72	211.2	**1,315**	3645	64	**2345**	**3,660**	**39,776**	17
18	4811	86%	**12.13**	**11.71**	1.95	23.63	217.4	**1,354**	3608	71	**2553**	**3,908**	**43,684**	18
19	4763	85%	**12.13**	**11.71**	2.03	24.57	223.9	**1,394**	3572	78	**2781**	**4,175**	**47,859**	19
20	4715	84%	**12.13**	**11.71**	2.11	25.56	230.5	**1,436**	3537	86	**3028**	**4,464**	**52,323**	20
21	4668	83%	**12.13**	**11.71**				-	3501	94	**3298**	**3,298**	**55,620**	21
22	4622	83%	**12.13**	**11.71**				-	3466	104	**3591**	**3,591**	**59,211**	22
23	4575	82%	**12.13**	**11.71**				-	3432	114	**3911**	**3,911**	**63,122**	23
24	4530	81%	**12.13**	**11.71**				-	3397	125	**4259**	**4,259**	**67,381**	24
25	4484	80%	**12.13**					-	3363	138	**4638**	**4,638**	**72,018**	25
26	4439	79%	**12.13**					-	3330	152	**5051**	**5,051**	**77,069**	26
27	4395	79%	**12.13**					-	3296	167	**5500**	**5,500**	**82,569**	27
28	4351	78%	**12.13**					-	3263	184	**5990**	**5,990**	**88,559**	28
29	4308	77%	**12.13**					-	3231	202	**6523**	**6,523**	**95,081**	29
30	4265	76%	**12.13**					-	3198	222	**7103**	**7,103**	**102,184**	30

Exaggerated revenues



www.youtube.com/watch?v=bI8DB0L0mm8&feature=youtu.be **Church Turret flat roof fixing**

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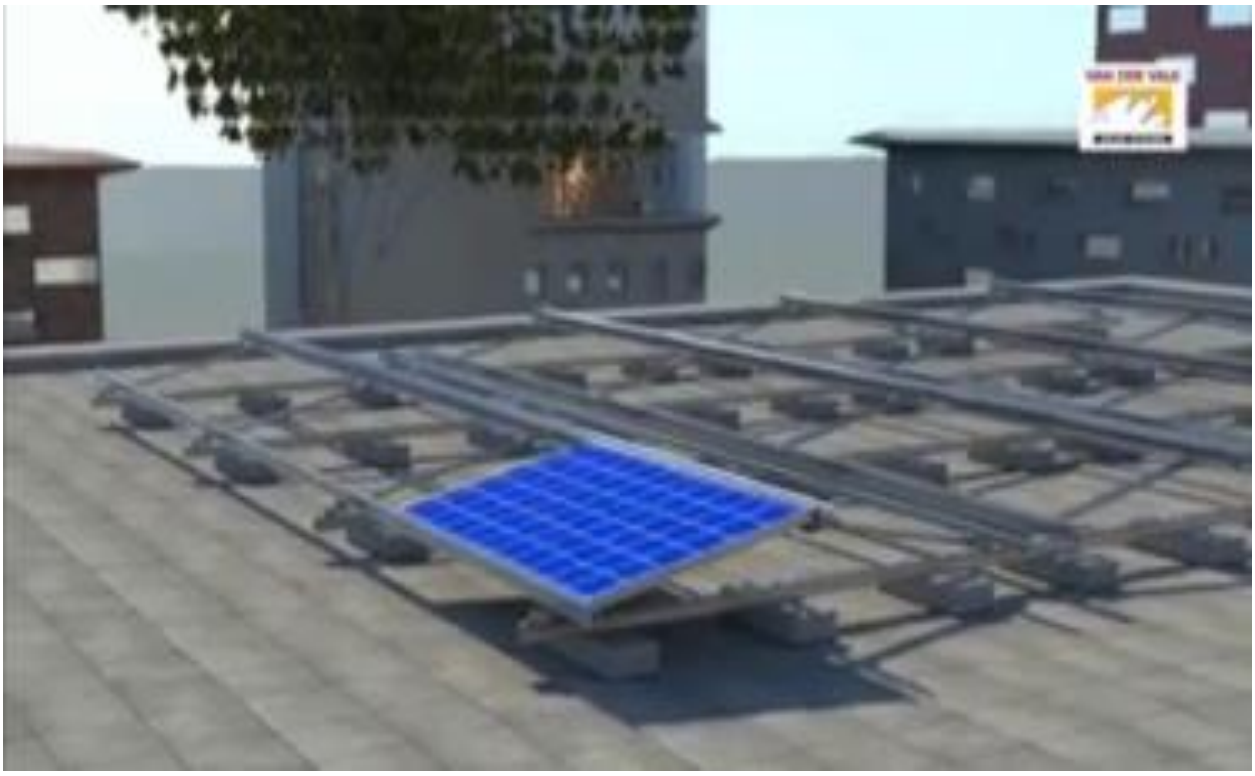


PANDA 60 Cell 40mm SERIES

YL280C-30b
YL275C-30b
YL270C-30b
YL265C-30b
YL260C-30b

panda Powered by YINGLI

ABOUT YINGLI GREEN ENERGY

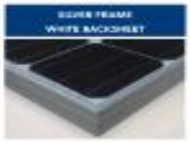
Yingli Green Energy Holding Company Limited (NYSE: YGE) is one of the world's largest fully vertically integrated PV manufacturers, which markets its products under the brand "Yingli Solar". With over 7.0GW of modules installed globally, we are a leading solar energy company built upon proven product reliability and sustainable performance. We are the first renewable energy company and the first Chinese company to sponsor the FIFA World Cup™.

PERFORMANCE

- Yingli Solar PANDA is a new monocrystalline silicon module technology with n-type solar cells that have average efficiencies higher than 19.5%. Combined with high transmission glass, module efficiencies are up to 17.1%.
- Compared to traditional modules with p-type solar cells, PANDA modules have lower initial degradation and higher performance under both high temperature and low irradiation conditions.
- Tight positive power tolerance of 0W to +5W ensures you receive modules at or above nameplate power and contributes to minimizing module mismatch losses leading to improved system yield.
- Top ranking in the "TÜV Rheinland Energy Yield Test" demonstrates high performance and annual energy production.

RELIABILITY

- Tests by independent laboratories prove that Yingli Solar modules:
  - Fully conform with certification and regulatory standards.
  - Withstand wind loads of up to 2.4kPa and snow loads of up to 5.4kPa, confirming mechanical stability.
  - Successfully endure ammonia and salt-mist exposure at the highest severity level, ensuring their performance in adverse conditions.
- Manufacturing facility certified by TÜV Rheinland to ISO 9001:2008, ISO 14001:2004 and BS OHSAS 18001:2007.



WARRANTIES

- 10-year limited product warranty'.
- Limited power warranty': 1 year at 98% of the minimal rated power output, 10 years at 92% of the minimal rated power output, 25 years at 82% of the minimal rated power output.

'In compliance with our Warranty Terms and Conditions.

QUALIFICATIONS & CERTIFICATES

IEC 61215, IEC 61730, MCS, CE, ISO 9001:2008, ISO 14001:2004, BS OHSAS 18001:2007, PV Cycle, SA 8000

CE PV CYCLE

solaredge

SolarEdge Three Phase Inverters

SE4K - SE17K

INVERTERS

Specifically designed to work with power optimizers

- Superior efficiency (98%)
- Small, lightest in its class, and easy to install
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- IP65 – Outdoor and indoor installation
- Fixed voltage inverter, DC/AC conversion only

C.

Church House Hall Roof - fitting around the existing skylights

58 panels = 14.5KW system
Generation Tariff = £1,876 per year
Export Tariff = £388 per year
Savings on Units = £1,281 per year (assumes 50% of the electricity is used on site)
Total Return = £3,545 per year
Fully Installed Cost = £22,950 + VAT
Return on Investment = 15.44% per year

Church Tower

15 panels = 3.75KW System
Generation Tariff = £554 per year
Export Tariff = £100 per year
Savings on Units = £331 per year (assumes 50% of the electricity is used on site)
Total Return = £985 per year
Fully Installed Cost = £8,770 including VAT
Return on Investment = 11.23% per year

Why choose My Planet?

- We are the largest residential installers of Solar PV in the country.
- We use the market leading top quality black German Solar world panels.
- We only also use top quality brackets, cabling, inverters - we do not cut any corners at any stage.
- We back up our and the manufacturer guarantees with a H.I.E.S. warranty on every installation.
- We fit a sophisticated monitoring system with each installation.
- Our aftercare service is second to none with our 10 year installation and workmanship guarantee.

Typical installation

d.

Church House Hall

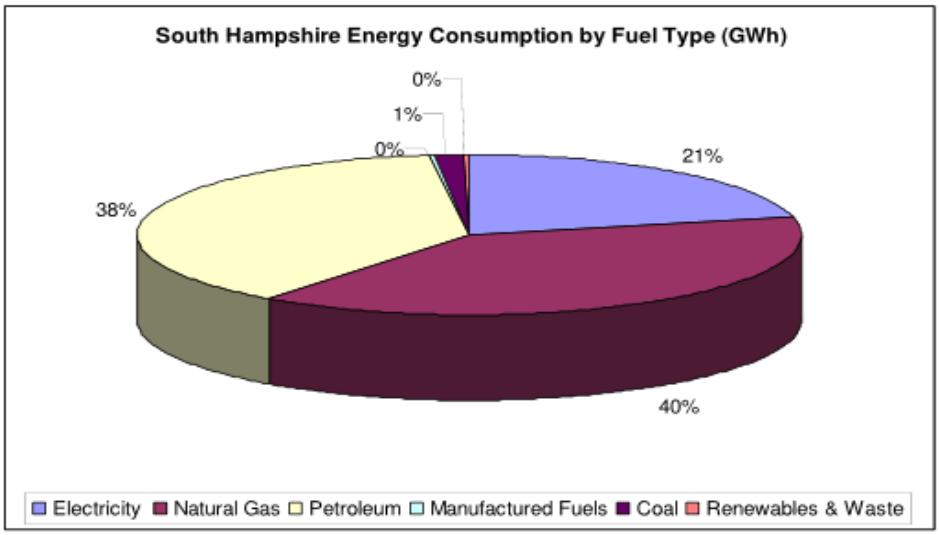
After careful consideration the company decline to quote due to complexities over and above their normal residential market place, this commercial installation was too much for them.

Situation with Energy in South East

Havant Borough Council

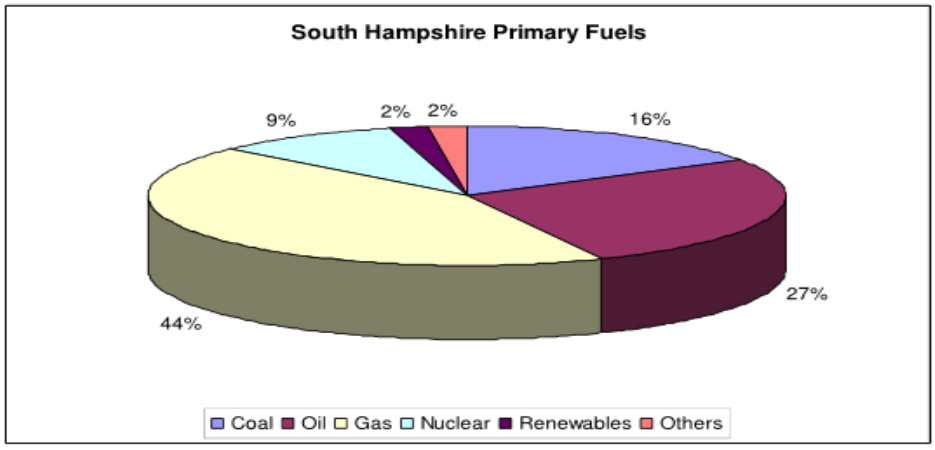
Feasibility of an Energy and Climate Change Strategy for Urban South Hampshire

Figure (1): South Hampshire's Energy Consumption by Fuel Type



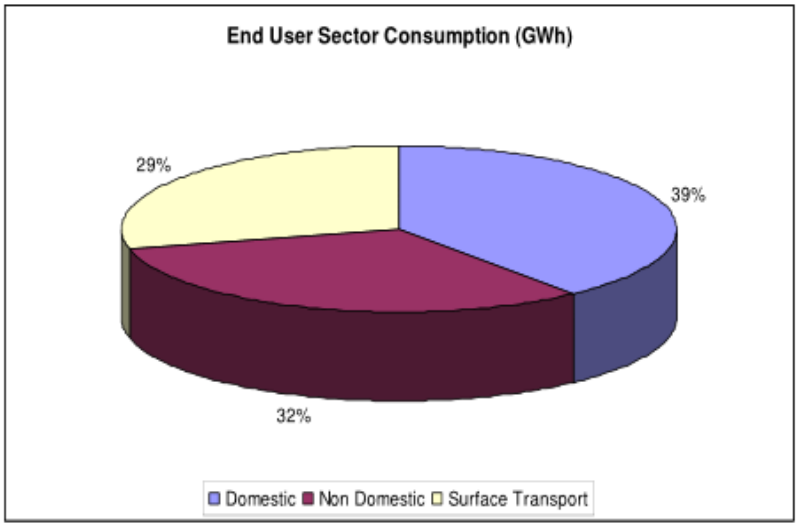
Currently, energy from renewables amounts to less than 1% whilst the majority of final consumption is accounted for by the consumption of fossil fuels. Just over a third of all energy consumption is accounted for by electricity.

(source 12)



The implication for the sub region is that substituting grid based electricity with a renewable source of power production saves on the transmission efficiencies but also the extensive loss of thermal energy associated with a centralised power generation. Localised power generation also offers an opportunity to use heat generated in the process to supply space and domestic water heating. The efficiencies for power generation alone are, however, slightly lower.

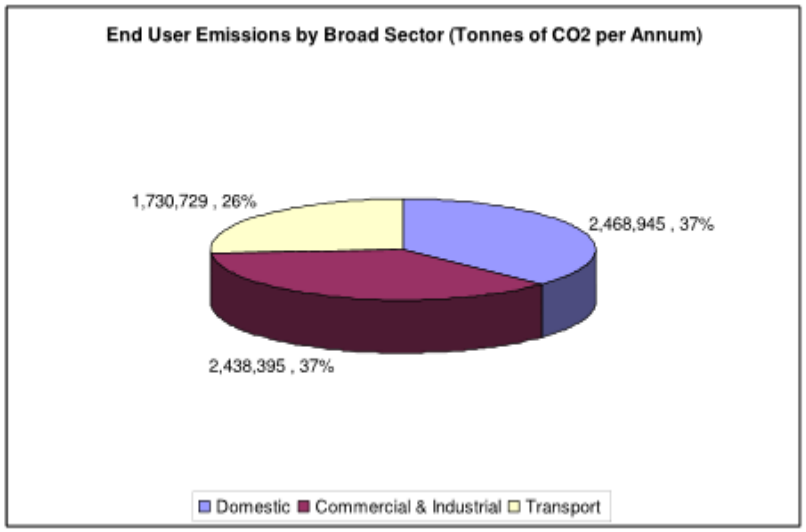
Figure 3: End User Sector Energy Consumption



South Hampshire has lost many of its carbon intensive industries so domestic use of energy accounts for the highest share of energy consumption followed by commercial/ industrial and surface transport.

South Hampshire is responsible for 6.6 Million Tonnes of Emissions. For emissions, the higher carbon intensity of the commercial/ industrial sector result in an even split on emissions between domestic and commercial/ industrial. Based on this analysis, emissions per capita have been calculated at 6.7 tonnes of carbon dioxide.

Figure 4: End User Carbon Dioxide Emissions by Broad Sector



(source 12)

2010

Small scale solar electric (photovoltaics) energy and traditional buildings

ENGLISH HERITAGE

The information in this publication is based on current knowledge. Whilst every effort has been made to ensure the accuracy of the advice given, English Heritage does not accept liability for loss or damage arising from the use of this information. This publication is intended only as a guide. It has no statutory authority, and should not be used as a substitute for professional advice. The guidance provided here deals only with the practical aspects of installing the equipment. The acceptability of the installation will depend on the historic significance of the building or site being adapted. You are strongly advised to discuss the proposals informally with historic environment staff from your local council.

The inclusion in this publication of any company, group or individual, or any product or service, should not be regarded as either a recommendation or an endorsement by English Heritage or its agents.

PLANNING AND HISTORIC BUILDING LEGISLATION

THE INSTALLATION OF A RENEWABLE TECHNOLOGY IMPLIES IN MOST CASES THE FIXING OF EQUIPMENT TO THE HISTORIC FABRIC OF A BUILDING. ENGLISH HERITAGE SEEKS TO ENSURE THAT ANY WORKS TO A HISTORIC BUILDING DO NOT UNNECESSARILY DISTURB OR DESTROY HISTORIC FABRIC.

In deciding how best to incorporate a renewable technology, the principle of minimum intervention and reversibility should be adopted whenever and wherever possible.

Installing a solar electric system will probably need planning permission. The local planning authority can grant permission under the Town and Country Planning Act 1990, and they will be looking for any issues about visual impact or proximity to land boundaries.

Installing a solar electric system on a Listed Building or a building in a Conservation Area will also need permission from the local planning authority under the Planning (Listed Buildings and Conservation Areas) Act 1990. Planning Policy Guidance PPG 15 'Planning and the Historic Environment' can help you with this: see **www.planningportal.gov.uk**. A New Planning Policy Statement (PPS) 15 will replace *Planning Policy Guidance 15: Planning and the Historic Environment* (PPG15) and *Planning Policy Guidance 16: Archaeology and Planning* (PPG16) from 2010. Work of any kind to a Scheduled Monument requires consent from English Heritage under the Ancient Monuments and Archaeological Areas Act 1979.

Your application will need to show clearly what you intend to do, with detailed drawings and photographs. It is useful to draw the panel on a photo of the site or building in order to help the planning officer visualise it in its proposed setting and determine its visual impact.

CONTENTS

Front cover image courtesy of Solar Century

INTRODUCTION

English Heritage is the UK government's adviser on the historic environment. Central to our role is the advice we give to local planning authorities and government departments on development proposals affecting listed and traditional buildings, conservation sites and areas, terrestrial and underwater archaeological sites, designed landscapes and historical aspects of the landscape as a whole. For our policy statements on climate change and energy, refer to English Heritage's Historic Environment, Local Management website, **www.helm.org.uk**.

The Department of Trade and Industry reports that domestic energy consumption has increased by 32 per cent since 1970 and by 19 per cent since 1990. Energy efficiency improvements, such as increased levels of insulation and the introduction of more efficient electrical appliances, have meant that domestic energy consumption has not increased at a greater rate. This rise has been attributed to the increased use of electrical appliances in our homes. Carbon dioxide is a by-product of the burning of fossil fuels to supply energy, and emissions have spiralled upwards as our demand for energy has increased.

The UK government, wishing to reduce the country's dependence on fossil-fuel stores and to cut carbon dioxide emissions, has made a commitment to find 10 per cent% of our energy from renewable sources by 2010, rising to 20 per cent% by 2025. Renewable energy may come from sources such as wood that are self-regenerating, or those such as the sun that are effectively infinite. The technologies associated with these sources are sometimes referred to as 'low-carbon', in that they emit much lower levels of carbon dioxide and related compounds into the atmosphere than do fossil-fuel technologies.

For more information on the UK government's position on climate change, contact the UK Climate Impacts Programme (see Useful contacts).

This guide is one of a series on small-scale renewable energy options. Separate guides look at generation, solar energy, bio-fuels, heat pumps and combined heat and power, explaining how each system works and what you need to consider if you wish to install it in or on a historic building. All the guides look at small-scale generation, or 'Microgeneration' as it is known. Microgeneration is defined by Government as 'The production of heat and/or electricity on a small-scale from a low carbon source'.

Cutting demand for energy is as important as finding alternative means of generating it. Before deciding whether to install a renewable energy technology in a building, all available energy-saving measures – including low-energy light bulbs, heating controls and improved insulation – should already have been taken. An English Heritage guidance document, *Energy Conservation in Traditional Buildings*, looks at methods of improving insulation and introduces other methods for saving energy.

PLANNING A SOLAR ELECTRIC SYSTEM

THERE ARE A NUMBER OF FACTORS TO CONSIDER BEFORE INSTALLING A PHOTOVOLTAIC SYSTEM ON A PROPERTY.

Have other energy saving measures been taken? Is planning permission or listed building consent needed and would it be forthcoming? Is a photovoltaic system the most suitable renewable technology for the occupants? Can this technology be installed easily on this property? The non-profit, government-funded and private-funded Energy Saving Trust (see Useful contacts) has fact sheets on a variety of small-scale renewable technologies.

A photovoltaic (PV) cell is a device that converts sunlight into electrical energy. The PV cell consists of one or two layers of a semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity. PVs will only produce electricity whilst there is daylight. So the energy must either be consumed as it is being generated, or stored for later use or exported to the National Grid.

The maximum power generated under ideal conditions in full sun by a PV cell is expressed as kilowatt peak (kWp) by manufactures. The kWp will vary according to time of day, month, year and location. It is more useful to find out from the installer what the estimated annual yield would be. This would give an average estimate for the year of how much electricity the array would generate, and is given in kilowatt-hours per year (kWh/yr). Thus, using the household electricity bill, also measured in kWh, the savings can be calculated.

The Solar Trade Association (see Useful contacts) has produced a map for the United Kingdom (Fig 1) of the average amount of solar energy falling on a south-facing 30° incline from the horizontal. A 30° incline is considered the optimum for maximising total solar radiation in the UK.

In the UK a PV array required to provide electricity for a typical home varies depending on a number of issues: how much power you need, the type of PV cell used, roof space available and the budget. The average UK household electricity usage is around 4,000 kWh/annum. The Energy Savings Trust says that a typical domestic installation is around 1.5-2.5 kWp. This could generate enough electricity to provide almost half of the average family's annual requirement, covering a roof area of between 10 and 40 m^2 (assuming gas is used for heating requirements and there are no energy-efficiency savings).

The annual yield of a domestic PV array in the UK on a south-facing, inclined plane, unshaded can be expected to generate on average 750 kWh per kWp installed per year. So for a 2-kWp installation you can expect to generate 1,500 kWh of electricity.

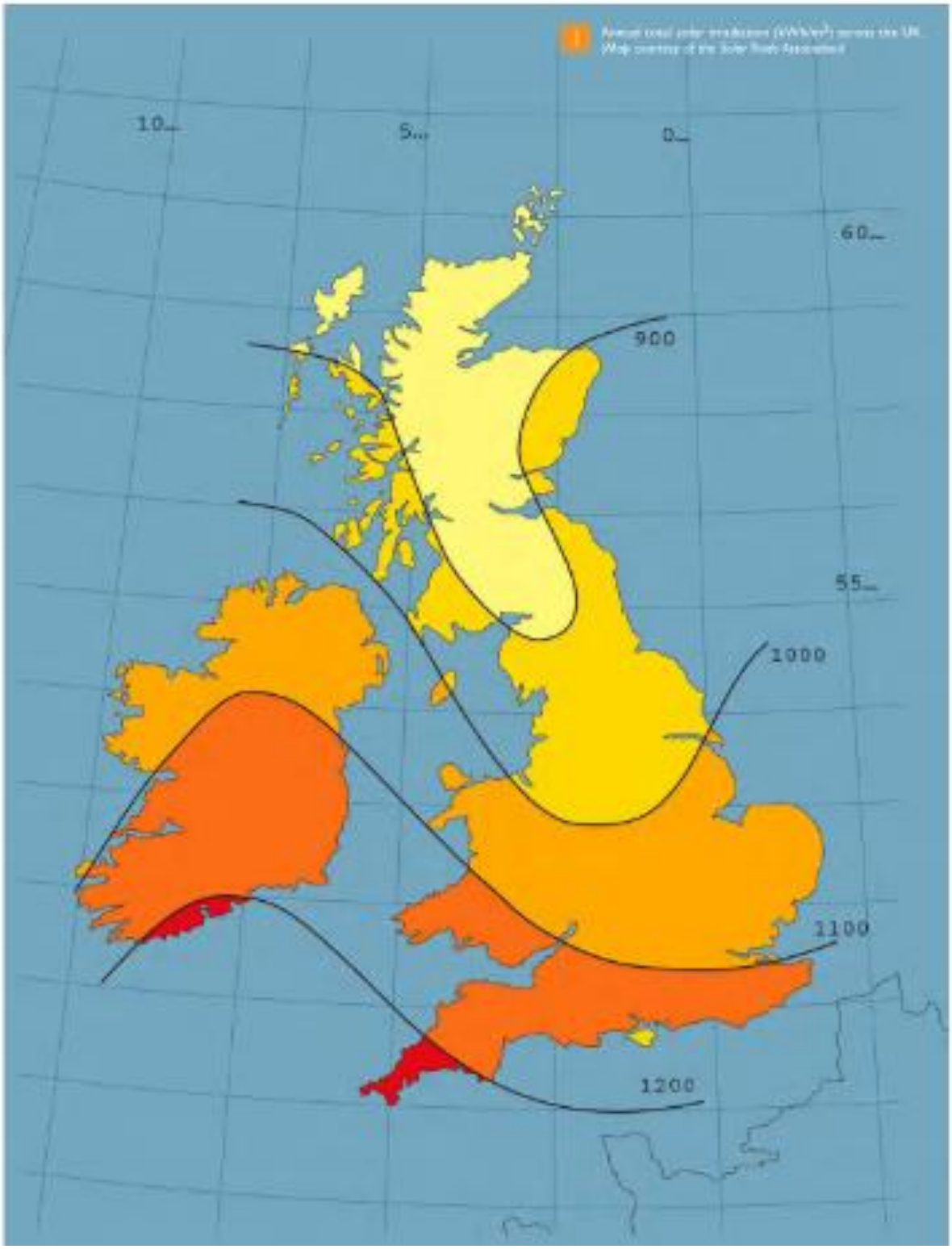
There are three types of PV cells to choose from: monocrystalline, polycrystalline and amorphous silicon (thin film).

Monocrystalline silicon is made using thin wafers of a single crystal of silicon all arranged in orderly patterns. Polycrystalline or multicrystalline are similar to monocrystalline but are made from less refined silicon. Amorphous silicon cells or thin film are made up of silicon atoms in a thin layer deposited on a wide range of substrates, such as glass or metals. Monocrystalline are the most efficient at converting the sun's energy into useable electrical energy. They also have the longer life span but will be more expensive than the other types. See table 1.

To help understand what the efficiencies could mean in terms of affecting the size of the array the British Photovoltaic Association (see Useful contacts) give the following general guidelines. An area of around 8 m^2 would be required to mount an array with a rated power output of 1kW if monocrystalline modules were used. If polycrystalline modules were used, an area of around 10 m^2 would be required; and if amorphous modules were used, an area of about 20 m^2 would be required.

Efficiency (%)	Module type	Durability (yrs)
12-15%	Monocrystalline	25-30
10-13%	Polycrystalline	20-25
3-6%	Amorphous	15-20

Table 1. Typical conversion efficiencies of silicon-based PV modules. *(Table courtesy of the Energy Savings Trust 'Energy efficiency best practice in housing renewable energy sources for homes in rural environments').*


10
5
0
60
55
900
1000
1100
1200

ORIENTATION

The array should be mounted on a southeast- to southwest-facing roof, receiving direct sunlight during the main part of the day, to generate a significant annual yield of energy.

It is generally not considered sympathetic to a building's appearance to have a solar panel or other equipment fixed to any of its main elevations, i.e. the face or faces seen from the principle viewpoint, towards which it is mainly viewed. Thus buildings with main elevations aligned in the direction of optimal solar radiation may present special installation problems with regards to visual impact.

Arrays can still be effective on the east and west faces but the annual yield would be lower and north faces should be avoided. Where a collector cannot be mounted on a building in an optimal direction for solar irradiation, it may be possible to mount it away from the building. In such cases it is advisable to speak to your local authority conservation or planning officer.

SHADING

It is important that no trees or other structures – or parts of the same building such as chimneys or dormer windows – should cast shadows on the array, as this would reduce its energy output. Shading can have a huge effect on the performance of a PV array. The arrays are configured in 'strings'. If one part of the string is in shade the rest of the string will not work, so will not produce electricity.

WILDLIFE

Bat and birds use buildings for roosting and nesting. Bats can roost under very small spaces in roof coverings or inside roof spaces. When planning an installation you would need to assess whether they are nesting or roosting in or on the roof, as all bats and some birds are legally protected. If they are using the building you will need to install equipment when they are not present. Subsequent maintenance will also need to avoid times when it a roost is being used, as bats tend to re-occupy the same site every year.

Natural England should always be consulted at an early stage when planning an installation with known wildlife interest or in areas known to be used by protected wildlife. The Royal Society for the Protection of Birds (RSPB) and The Bat Conservation Trust have guidance on their website (see Useful contacts).

INSTALLATION OPTIONS

ONCE THE ENVIRONMENTAL AND AESTHETIC CONSIDERATIONS HAVE BEEN CONSIDERED, THE NEXT STAGE IS TO PLAN THE INSTALLATION.

There are many options for installing a solar PV system; fixing the array over the roof finish, tiles integrated into the roof finish, building integrated photovoltaics (BIPV) or installation away from the building. Photovoltaics can also be fitted as an array to a conservatory or glass and provide shading.

When planning the installation it is important to think about the 'reversibility' and the 'physical impact' an installation can have on a building. This is to say that a PV array and its associated equipment can have a life of 25 years, so a building could have many installations over its life. By carefully planning the installation and how it can be removed at the end of its useful life damage to the building fabric can be limited.

PV ARRAY

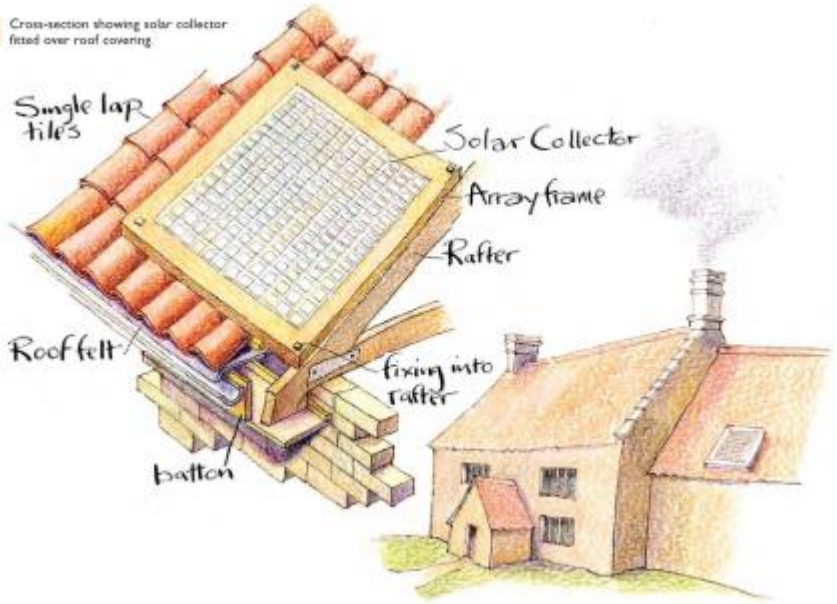
The PV array can be fixed over the roof covering, so it sits above the tiles or slates, or it can be integrated into the roof covering so it sits flush. With thatch roofs, where the material is organic, the thickness of the thatch decreases over time so we would not recommend fixing the collectors to thatch roofs.

The optimum angle for mounting the array is 30°, and as the angle varies from the optimum the efficiency of the collector reduces. Most pitched roofs have angles of between 30° and 50°. The angle of the roof or 'pitch' is determined by the exposure of the site and local weather conditions. The pitch of tile and slate roofs depend on the size and overlap of the individual tiles or slates.

With all the following installation options, where the PV array is going to be mounted on the roof it is necessary for a structural survey to be carried out. The PV array and fixing framework will be attached to the roof rafters, which will need to be capable of supporting them. It is advisable to speak to the installer and find the weight of the array and the weight of the supporting framework so an assessment can be made.

During the installation it is normal for tiles and slates to get broken, however careful the installer, so it is advisable to have replacements available.

2 Cross-section showing solar collector fitted over roof covering



PV array fitted over roof covering

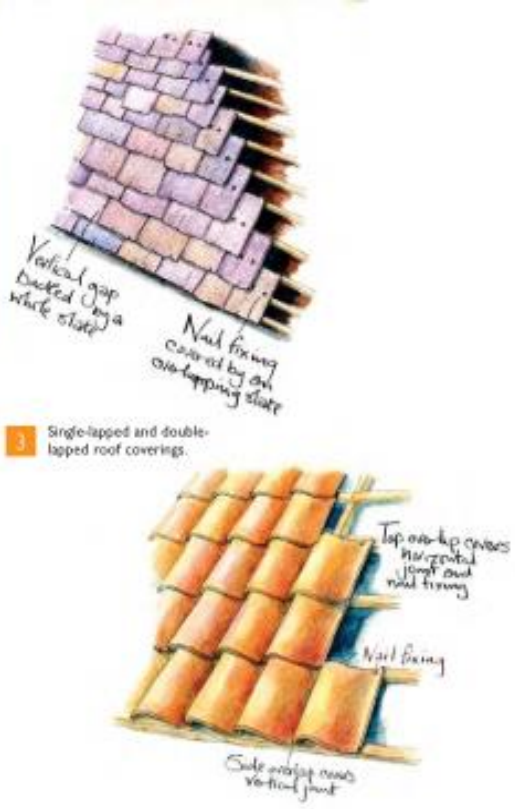
In this type of mounting the array is fixed to the roof structure by drilling through the roof covering (tile or slate, and roof felt) directly into the rafters (Fig 2).

For roofs with stone or old handmade tiles, replacements can be expensive and difficult to find and drilling through them will render them unusable. It is therefore advisable to investigate what type of roof covering you have and how to get replacements before undertaking any work.

Careful planning is required, both in the locating the rafters and in drilling through the roof covering. To locate the rafters it is best to chalk a line up the roof rather than remove tiles. If the rafters don't coincide with where the frame needs to be, existing noggins can be used, or noggins can be attached to the rafters.

Slates or tiles are laid in a variety of ways. Plain tiles and slates are normally double-lapped, profiled tiles single-lapped (Fig 3). It is important to know the difference, because with double-lapped tiles you will be drilling through several tiles at once.

The holes must also be made into the loft space for cabling to and from the PV array to the inverters. These holes should be weather-sealed with roofing sealant and with lead flashing on a non-profiled tiled roof.



3 Single-lapped and double-lapped roof coverings.

Roof-integrated PV array

To integrate an array into the roof finish, PV tiles are used that replace individual ordinary roofing tiles or slates, or several, with larger single PV tiles (Fig 4). In some installations part of the original roof covering is replaced with PV tiles or the whole covering is replaced, depending on the energy need.

They PV tiles are anchored onto the roofing battens and are screwed in place (Fig 5). The tiles overlay like single-lap roof tiles and are connected electrically together with the cabling taken back to the electrical inverter.

Many of these systems will only be compatible with certain makes of roof tiles and slates so it is necessary to check with the manufacturer for the type of covering of the roof unless the whole covering is being replaced.

PVs can also be integrated into glazing (Fig 6). They can be used on the roof glass of conservatories where there is still a good inline to the sun.

5

PV roof tile being drilled to timber roof batten. *(Photograph courtesy of Solar Century)*

4

Top left: Close up of PV slate installation. Top right: Individual PV slate. Bottom: Roof covered with PV slates. *(Top left and bottom: Photographs courtesy of Sunslates Limited. Top right: Photograph courtesy of Solar Century.)*

6

PVs integrated into glass *(Photograph courtesy of Solar Century)*

PV installation on a flat roof at Crichton Castle, which is now in the care of Historic Scotland (Photograph courtesy of Historic Scotland)

PV arrays on flat roofs

On a flat roof a frame can be constructed to hold the collector at the optimum 30° angle (Fig 7). The frame can be held in place with ballast or more permanently fixed with screws through the roof structure. Where the roof covering must be penetrated it is important to ensure that it is sealed against the weather.

Where a tilted PV array might have an undesirable visual impact it may be mounted horizontally, allowing the array to be hidden from ground-level view behind a parapet wall.

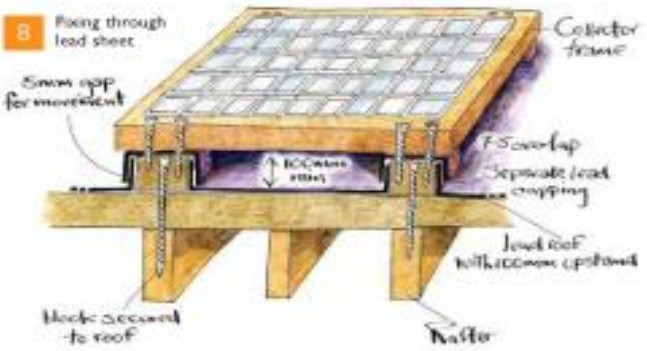
Flat roof coverings tend to have a life of 10 to 15 years before the felt must be replaced. As a PV array has a useful life of around 25 years (according to the British Photovoltaic Association), it is sensible to plan its installation at the same time as re-covering of the roof.

This is not an issue with lead roofs, which can last well over 100 years and require little maintenance. Lead sheet, with its high coefficient of linear expansion, undergoes considerable expansion and contraction as the temperature changes, so joints in lead roofs are designed to allow the material to shift. As a rule of thumb, lead sheet is only fixed at the top third of the sheet to allow contraction and expansion of the two-thirds below, therefore any fixings should come within this top third.

Rolled lead sheet works in partnership with most building materials. However, additional precautions may be required when using some types of materials, as they will most probably have different coefficients of expansion and contraction.

Before designing the installation it would be advisable to consult an experienced lead contractor because of the positioning of fixings and cabling that go through the roof is critical to the longevity of the lead. (Fig 8) shows a detail of a fixing through lead sheet into the roof rafter.

Anyone contemplating putting PV panels on a lead roof should refer to the Lead Sheet Association (see Useful contacts) manual for guidance (ref: Rolled Lead Sheet – The Complete Manual. A guide to good practice in the specification and use of rolled lead sheet to BSEN 12588:1999. Lead Sheet Association 2003) on detailing.



PV arrays: free-standing away from building

If it not desirable to have arrays fixed to the roof, or if the roof is not suitable, an alternative is to locate them off the building on the ground or on an outbuilding (Fig 9). From the PV array a cable must run back to the building's electrical fuse board. The cable size is determined by the load it must carry as well as its length: the further the array is from the building, the larger (and more expensive) the required cable. It is usually necessary to bury it, to a depth of no less than 0.5 m to avoid damage from general gardening.

Ground-mounted PV array (Photographs courtesy of Wind and Sun Ltd)

Before excavating, both for foundations and for cabling, it is important to assess the possibility of buried archaeology on the site. If the building or grounds are listed or scheduled, the statutory description may cover this aspect of the site. Where the archaeology prevents a cable being buried at a reasonable depth, an alternative route should be found where it could be buried more deeply. Where this is not possible, the cable duct should be encased in concrete.

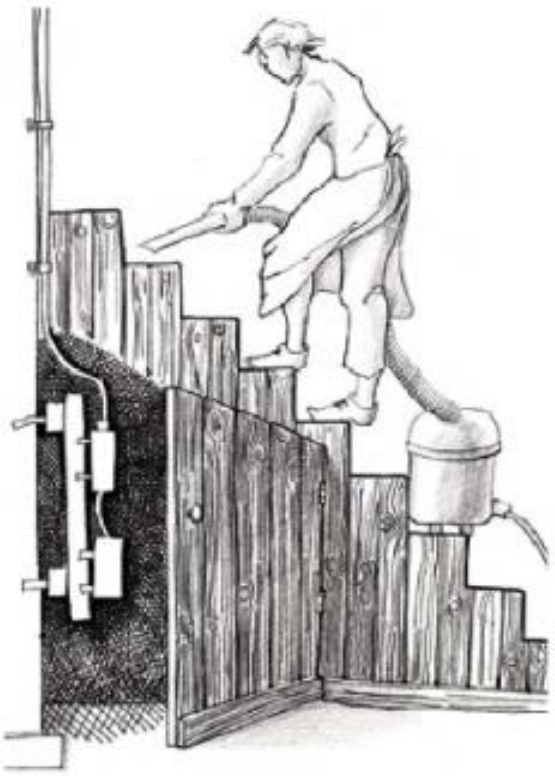
The access point of the cable into the building should be properly sealed to prevent water ingress, and to keep pests out.

ELECTRICAL SYSTEM

Equipment should be located to permit easy access for maintenance and repair. All parts of the installation should be indicated on a working drawing. Where equipment is to be fixed to building walls, the number of fixing points should be minimised by the use of a wooden pattress or frame system (fig 10).

The PV system is made up of the roof top array and the electrical distribution system and equipment. The electricity generated by the PV cell is direct current (dc). An inverter is needed to convert this to alternating current (ac) so that it can be used for electrical appliances or fed back to the grid. Other essential elements of the system are an isolation switch, allowing the panel to be disconnected for safe maintenance or repair and a meter to measure the energy generated (fig 11).

10 Electrical equipment mounted on a pattress



ELECTRICAL SYSTEM

There are three options for connecting a PV to the electrical system: direct, off-grid and grid.

Direct connection

In a direct connection, the PV is connected directly to the load it is supplying. An example of this is with modern street lighting (Fig 12), where the panels are fixed to the street lighting column and only supply the individual street light.

Off-grid connection

Where no mains electricity is available, a PV can be used to replace or supplement the existing local electricity supply (a diesel generator, for example). The PV is connected via the controller and inverter to the fuse board or dedicated load.

11

An installation, showing the inverter, solacor. (Photograph courtesy of Solar Century.)

If there is no generator or other electricity supply, batteries can be used to store energy as it is generated by the PV, for use later when it is needed. (Fig 13).

The number and size of the batteries depend on how long they would be expected to continue supplying electricity without the PV; this is known as the 'autonomy' or how long the batteries need to operate. The batteries should be of a 'deep-cycle' type, which can be discharged deeply without damage. The storage space must be well ventilated, as batteries give off a gas in their operation, and preferably cool: warmer temperatures reduce battery life.

Grid connection

A PV can also be used to supplement mains electricity, offering the security of a continuous electrical supply. In this case there are two inputs to the fuse board, one from the PV and one from the mains (Fig 14). When the PV is not generating enough energy, mains electricity is used (Fig 15). If more electricity is generated by the PV than is needed, the excess can be exported to the national grid.

12

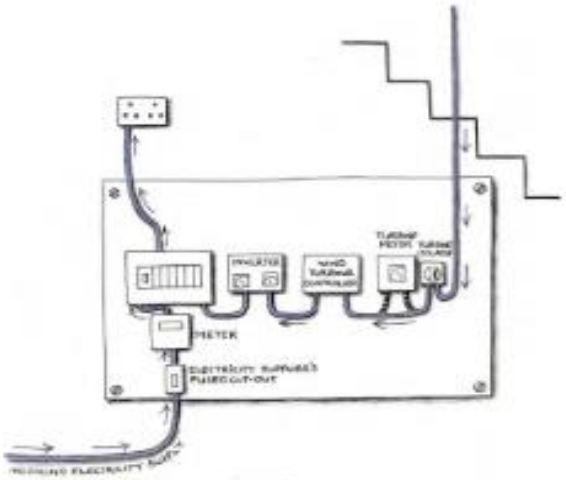
A street light with PV mounted on the column. (Photograph courtesy of Roger Smart.)

13

Deep-cycle battery installation. (Photograph courtesy of Wind and Sun Limited.)

Two meters are required, one to measure the amount of imported electricity and the other to measure the generated electricity by the PV system to be exported. This is done because the value of the units for exported units is lower than that of those imported. In addition, the electricity supplier levies a charge for the metering facility.

14 Electrical connection options



15 Electrical connection options

MAINTENANCE AND WORKING LIFE

All renewable installations require maintenance to ensure they remain reliable and efficient. When maintenance is carried out there is the potential for damage to be caused to the fabric of the building. When planning the installation it is important to talk to the installer about how often equipment would need routine maintenance and how the equipment would be accessed. Regular inspection of cables and equipment conditions will also be necessary.

As mentioned earlier it is important to remember that, because the maximum working life of a PV is around 20 years and that of many of its electrical parts far less, a building could have more than one installation. Damage to the building's fabric can be minimised with careful planning not only of the installation but also of the PV's removal at the end of its useful life. Batteries have a life of around 6-10 years, depending on the type of battery and on environmental conditions. Once the batteries have come to the end of their useful life they must be disposed of carefully.

GRANTS

Feed in Tariffs were introduced by the Government from the 1st April 2010. They were introduced to increase the level of renewable energy in the UK to a target of 15% of total energy from renewables by 2020.

The scheme gives a fixed payment for all the electricity produced by the PV array called the 'generation tariff'. This tariff is paid whether it is used or exported to the grid. If the array generates a surplus you can export to the electricity grid where an additional bonus called an 'export tariff' is paid.

The amount paid from the 'generation tariff' is dependent on the type of renewable and its size. The export tariff is dependant on how much excess electricity is sent back to the grid and is paid at a flat rate of 3p/kilowatt hour regardless of what technology is used. The tariffs are paid for 20 or 25 years - so will cover the life time of the array.

The Energy Savings Trust say that for 'a typical 2.5kW, well-sited solar pv installation could save you around £140 per year on your electricity bill and you could earn around £900 a year through the cash back scheme'.

Once the installation is complete your chosen energy supplier will enter the installation on the Central FIT Register. The energy supplier will then start paying you the 'generation tariff' and if you export the 'export tariff. It is necessary to have an Ofgem approved Total Generation Meter which should be installed with your system to measure the energy generated. If you choose to export an additional meter is required. It varies as to whether the energy company will pay for this meter or not.

Grants are also available from some local Governments for renewables and energy efficiency measures.

USEFUL CONTACTS

RENEWABLE ENERGY AND CLIMATE CHANGE

Historic Environment, Local Management (HELM)
English Heritage
1 Waterhouse Square
138-142 Holborn
London EC1N 2ST
Tel: 020 7973 3000
www.helm.org.uk

UK Climate Impacts Programme (UKCIP)
Oxford University Centre for the Environment
Dyson Perrins Building
South Parks Road
Oxford OX1 3QY
Tel: 01865 285717
www.ukcip.org.uk

ENERGY CONSERVATION AND FEED IN TARIFFS

Energy Saving Trust
21 Dartmouth Street
London SW1H 9BP
Tel: 020 7222 0101
www.energysavingtrust.org.uk

SOLAR POWER

British Photovoltaic Association Renewable Energy Association,
17 Waterloo Place,
London SW1Y 4AR
Tel: 020 7747 1830
www.greenenergy.org.uk

Centre for Alternative Technology
Machynlleth
Powys SY20 9AZ
Tel: 01654 705950
www.cat.org.uk

PVS AND WILDLIFE

The Royal Society for the Protection of Birds
The Lodge
Sandy
Bedfordshire SG19 2DL
Tel: 01767 680551
www.rspb.org.uk

Bat Conservation Trust
Unit 2, 15 Cloisters House
8 Battersea Park Road
London SW8 4BG
Tel: 020 7627 2629
www.bats.org.uk

Natural England
Northminster House
Peterborough PE1 1UA
Tel: 0845 600 3078
www.naturalengland.org.uk

PLANNING GUIDANCE

Department for Communities and Local Government
Eland House
Bressenden Place
London SW1E 5DU
Tel: 020 7944 4400
www.communities.gov.uk

English Heritage
1 Waterhouse Square
138-142 Holborn
London EC1N 2ST
Tel: 020 7973 3000
www.english-heritage.org.uk

RENEWABLE ENERGY GRANTS

Department of Energy and Climate Change
3 Whitehall Place
London SW1A 2AW
http://www.decc.gov.uk

LEAD ROOFS

Lead Sheet Association
Hawkwell Business Centre
Maidstone Road
Pembury, Tunbridge Wells
Kent TN2 4AH
Tel 01892 822773
www.leadsheetassociation.org.uk

HISTORIC PROPERTIES WITH RENEWABLE-ENERGY INSTALLATIONS

Historic Scotland
Longmore House
Salisbury Place
Edinburgh EH9 1SH
Tel 0131 668 8600
www.historic-scotland.gov.uk

The National Trust
PO Box 39
Warrington WA5 7WD
Tel 0870 458 4000
www.nationaltrust.org.uk

ACKNOWLEDGEMENTS

English Heritage would like to acknowledge the help of the following people in the production of this guide:

Adam Williams, Sunslates Ltd

Peter Ranson, Historic Scotland

Sophie Duncan, Wind and Sun Ltd

Text by Caroline Cattini, English Heritage Building services Engineering and Safety Team (BsEST)

All Illustrations by Judith Dobie, Centre for Archaeology, English Heritage

Edited by Sara Peacock

Design and Production by Evolve

Product Code 51370

Building services
Engineering and Safety Team
English Heritage
1 Waterhouse Square
138-142 Holborn
London EC1N 2ST

ENGLISH HERITAGE

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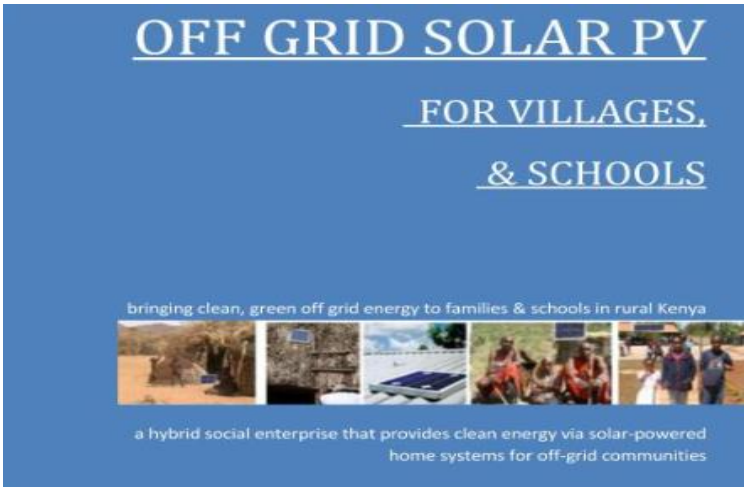
Fax: 01793 414926
Textphone: 01793 414878
E-mail: customers@english-heritage.org.uk

Personal References & CV - Founder of PSECC & Kenyalight-Projects Ltd – Alan Brewer MSc.

Kenyalight – Project Ltd CV's (Founder from PSECC)

Solar Farm at Nakuru 25MW and also possibly in our development programme will be off grid at a later date -



Certificate of Attendance

breglobal

This is to certify that

Alan Brewer

of

PSECC

attended the

BRE Global Assessor Training Course on the BREEAM Education Scheme

On

Tuesday 14th-Thursday 16th October 2008

Date: Thursday 16th October 2008

Pauline Traetto
Training and Events Manager
BRE Global

BRE Global Limited (incorporating LPCB) is an independent third party approvals body offering certification of fire, security and sustainability products and services to an international market

Portsmouth
City Council

PORTSMOUTH
THE FLAGSHIP CITY

Contact Mr Johnston
Our reference DJ/GAS/LA21
Your reference
Telephone 01705 834247

Fax
DX

19 October 1995

TO WHOM IT MAY CONCERN

RE: ALAN BREWER, MSc CANDIDATE, PORTSMOUTH UNIVERSITY 94-95
161 SYDENHAM COURT, BERKSHIRE CLOSE, FRATTON, PO1 1RQ

I confirm that Alan Brewer has been engaged on his MSc project "Sustainable Development in Local Authorities", full-time from early May 1995, until 13 October 1995.

Whilst engaged on this project he has also been assisting a City Council Team engaged on developing an Energy Policy and Strategy which forms an essential part of a Sustainable Development Strategy in Terms of Local Agenda 21. Alan has attended all meetings of this internal team which started on 12 April 1995 and has provided a positive knowledgeable contribution.

Furthermore, during this period he has also assisted me with other workgroups and Local Agenda 21 issues.

The City Council has benefitted from Alan's voluntary assistance and I, personally, have benefitted not only by his ready assistance but also from his expert knowledge of the full range of environmental issues embraced by Local Agenda 21.

I would have no hesitation in recommending Alan for any post in the sphere of environmental management and control.

Yours faithfully

D M R Johnston
Environmental Co-ordinator

Environmental Health Service
Civic Offices
Guildhall Square
Portsmouth
PO1 2AZ

Hampshire
County Council

Environment
The Castle, Winchester, Hampshire SO23 8UD
Telephone 01962 841841
Fax 01962 847055
Fax (abnormal loads) 01962 854045

Mr A Brewer
IMG Ltd & International Agenda 21 Ltd
Suite F9
Venture Tower,
Fratton Road, Portsmouth
PO1 5DL

Enquiries to: Heidi Hack
My reference:
Direct Line: (01962) 847732
Your reference:
Date: 25 June 2002
E-mail: heidi.hack@hants.gov.uk

Dear Mr Brewer

INITIAL COORDINATOR FOR ENERGY NETWORK FOR NRI PROJECT

Thank you for your time in coming to Winchester and meeting with us on 6 June. As requested, I am confirming the outcome of that meeting in writing.

As you recall, we discussed the natural resources initiative which is currently being undertaken by Hampshire County Council. The NRI project aims to develop business practices and individual lifestyle changes that achieve the efficient use and conservation of natural resources. It aims to facilitate the development of a virtuous circle of production and consumption of goods being reused, recycled and reprocessed, minimising overall energy use.

An integral part of this process will be to work with existing networks and to develop new opportunities. At the meeting we discussed whether you would like to act as initial co-ordinator for the NRI energy network, pulling in the key players in the field under the NRI project.

If you have any further queries please do not hesitate to contact me on the above details.

Yours sincerely

Hack

for County Surveyor

County Surveyor
John Ekins OBE FREng FICE
ALAN BREWER - 11 JUNE 2002

BMC

Hampshire
County Council

Property, Business and Regulatory Services
Three Minsters House
76 High Street, Winchester
Hampshire SO23 8UL
Telephone 01962 841841
Fax 01962 841326

Alan J. Brewer
PSECC, Unit 1.2 Central Point
Kirpal Road
Portsmouth
PO3 6FH

Enquiries to Mike Fitch
Direct line 01962 847846
Date Friday 16th May 2008

My reference
Your reference
E-mail Mike.fitch@hants.gov.uk

Dear Alan

Re Sustainable School's Opportunities

Firstly, I would like to record my thanks to you and Kevin Ellis for the meeting yesterday to tell us about the work of PSECC.

I think it fair to say you raised with us considerable interest in the work that you are doing through PSECC and we would like to explore further how we might be able to work with your organisation and how PSECC can help Hampshire County Council with it's plans for reducing carbon emissions and contributing to the climate change agenda.

I agreed to let you have some background information about Hampshire County Council's property portfolio to assist you with your thinking about how our respective organisations might be able to connect.

In broad terms the County Council's property portfolio is comprised of some 7,000 buildings across 1,000 sites in Hampshire. The attached chart gives you an idea of the range of buildings that we manage, nearly 75% being schools. We are currently undertaking a major Strategic Property Review particularly around our office accommodation portfolio and new ways of working.

Hampshire County Council will become a CRC organisation from 2010 and I attach a report that I presented to Cabinet recently in this connection. The report provides detailed information about energy use and carbon dioxide emissions in respect of the County Council's property portfolio and street lighting obligations. You will see from the report that we have identified three Corporate work streams and these are now at development stage.

Once you have had an opportunity to consider the attached information I would appreciate receiving your comments about how you feel you can help with our Corporate work streams and Carbon Reduction Commitment (CRC).

Acting Director of Property, Business and Regulatory
Karen Murray

The areas that seemed to us to be of most interest include;

- Sustainable energy in schools.
- Strategic energy company partnership
- Large scale biomass energy generation.

Alan, in covering the above issues it would be particularly helpful if you could explain how the funding arrangements for these strategic initiatives operate. This will be important for me to understand in relation to the impact on the County Council borrowing authority. Also, if you could share with us information of live projects that you have implemented elsewhere, I know that would be helpful in explaining to my colleagues how these initiatives might work in the County Council.

I look forward to hearing from you.

Yours sincerely

Mike Fitch
Head of Property Management

Enc.

cc. Steve Hall
Andrew Spencer

To whom it may concern

Reference Mr Alan Brewer

I was the Director of the Hampshire Natural Resources Initiative (HNRI) until I left the county in 2005. The HNRI was a public /private sector network of organisations that were working in the field on conservation of natural resources; materials, water, natural environment and the development of renewable energy.

Mr Brewer approached the HNRI representing a network of organisations that were interested in providing renewable solutions and with the potential to realise funding that would promote the development of renewable energy projects. At the time what was needed was someone to pull together those interested in this area and Mr Brewer was given this task.

Mr Brewer did present the HNRI with a report on ideas and opportunities for future development.

Whilst not involved as a Director or trustee of HNRI MR Brewer was active in this area and attended a number of meetings and offered a range of ideas.

The HNRI embedded into the county an approach to sustainability that has seen a number of results on all areas of its work.

Bob Lisney

Ex Director HNRI

18/11/11

Property Services

To whom it may concern

Enquiries to	Steve Hall	*My reference*	jsh211/dc
Direct Line	01962 847771	*Your reference*	-
Date	9 November 2011	*E-mail*	steve.hall@hants.gov.uk

Portsmouth Sustainable Energy and Climate Change Centre - PSECC

In 2008 the Property Services Department of Hampshire County Council met with Mr. Alan Brewer of PSECC to examine possible options for the development of sustainable energy sources in our school estate and our work on the Carbon Reduction Commitment.

PSECC produced a comprehensive report in September 2008 including setting out the national CO_2 reduction targets and potential technologies available, some of the initiatives already underway elsewhere in the country and citing a number of case studies for renewable energy as well as referencing existing projects in which the County Council was involved , such as the PUSH initiative.

The report also examined potential funding streams for the financing of renewable technologies and how the planning policies impacted on their deployment

Much of the information contained in the report was not specific to the County Council; however it did serve as a useful guide and did draw together many areas of work and initiatives running at that time.

More specifically, PSECC were involved with three Hampshire schools in obtaining funding for solar PV and wind turbine installations. However, as Property Services were involved only at 'arm's length' we cannot comment in detail as to the involvement PSECC had with the individual schools.

Yours faithfully

Steve Hall

Steve Hall
Senior Engineering Manager

HCC Property Services, Three Minsters House, 76 High Street, Winchester, Hampshire, SO23 8UL
t: 01962 847778 | f: 01962 841326 | www.hants.gov.uk/propertyservices

Hampshire County Council

WARWICKSHIRE MIDDLESEX ISLE OF WIGHT

SOVEREIGN C. S. LTD.

- SURVEYORS & ENVIRONMENTAL ENGINEERS -

39 CUCKOO HILL ROAD, PINNER, MIDDLESEX HA5 1AS, U.K.
Tel.: + 44 (0)20 8866 0713 Fax: + 44 (0)20 8429 0959
Email: sovereign@onetel.com

Contact: R. WERRY

Our Ref.: Alan Brewer Your Ref.: Date: 05.08.05

"FOR INTERESTED PARTIES"

Both, Alan Brewer and Sovereign C. S. Ltd., were some of the leaders and founder members of the Hampshire Natural Resources Initiative (HNRI) from over four years ago and Alan subsequently went on to co-ordinate the Energy Network and forming the "HNRI – Energy Consortium".

Over the years we have sought the expertise and knowledge of Alan to assist in the various "environmental projects" of Sovereign's activities, which primarily have been for projects in Asia and Africa. Some energy – as power focused, whilst the majority of our projects being in the reduction of energy by recycling and re-utilisation of waste including considering the energy content in the recycling process, thus "energy conscious" in the most holistic manner.

This has included searching for "environmental utilisation of waste" products and processes and when combined with new technology the application and integration of, and of particular note that in conjunction with SoilBind Ltd.'s polymers.

Alan has not only been a good team leader in our projects, but often with his knowledge and experience, over the period of February to June this year worked for us as "Environmental Consultant" taking charge of, leading and directing our various Energy and Waste projects.

Innovation and the ability to integrate new technologies in relation to the changing world (lifestyle, population demand trends and projections, climate etc.) the engineering challenge is like an insatiable desire and given the challenge from corn starck waste to contaminated animal bone waste he has come up trumps for us.

An enthusiastic, energetic, dedicated, committed Environmentalist" with an amiable, easy to work with reliable character sums up Alan, and his continued desire to "achieve" and apply environmental solutions is now seeking greater challenges in being able to see the results of his efforts, which due to political instability/finances some of the projects, which he was involved with us have been delayed and thus we are not able for him to stay with us.

We wish him well in his future career.

Roger Werry

Roger Werry
Managing Director

THE MOUNTBATTEN SCHOOL

DML/SWS

3 February 2010

To Whom it May Concern

Re: Alan Brewer PSECC

This is to confirm that The Mountbatten School now has a 9.72KW photo voltaic system installed, which cost a total of £53,304.39.

Alan Brewer of PSECC instigated the project for us, via the Ringwood sustainable schools cluster.

PSECC brought in Project delivery partners, namely SEi and British Gas – Solar Technologies, to install solar PV system. Alan advised on grants to provide total funding.

The system provides the school and wider community with a greater awareness of renewable energy. It lowers energy bills and reduces our CO_2 emissions by some 4 tonnes per year.

Alan Brewer of PSECC was critical in the success of this project – his knowledge and guidance proving invaluable.

Yours sincerely

Dana McDonnell

D McDonnell (Mrs)
Deputy Headteacher

Whitenap Lane Romsey Hampshire SO51 5SY
t: 01794 502 502 f: 01794 502 501 e: info@mountbatten.hants.sch.uk w: www.mountbatten.hants.sch.uk

RINGWOOD
SPECIALIST LANGUAGE COLLEGE
Headteacher: Miss C E Edwards BA(Hons)

Ringwood School
Parsonage Barn Lane
Ringwood
Hampshire
BH24 1SE

Tel: 01425 475000
Fax: 01425 473063

Email: office@ringwood.hants.sch.uk
www.ringwood.hants.sch.uk

26th May 2010

To whom it may concern

Alan Brewer

This is to confirm that Alan Brewer of Portsmouth Sustainable Energy & Climate Change Centre, was the facilitator and responsible for the technology, consultancy and commitment, and funding arrangements for the recently installed solar PV at Ringwood School. He worked on the project with energy and enthusiasm, and without his help it is doubtful whether we would have obtained our 50% matched funding from British Gas complementing the initial funding provided by the Low Carbon Buildings Programme, Phase 2.

He has a real and deep-rooted commitment to the development and promotion of sustainable energy solutions in energy-hungry public buildings such as schools.

Gill Hickman
Head of Biology
Sustainability Coordinator
Ringwood School

NIVERSITY of PORTSMOUTH

Alan John Brewer

has been awarded the degree of

Master of Science in

ENVIRONMENTAL ENGINEERING

having followed a programme of study approved by Academic Council

3 June 1997

Vice-Chancellor

Academic Registrar

015404

Centre for Alternative Technology
Canolfan y Dechnoleg Amgen
Machynlleth, Powys, SY20 9AZ ⊕ www.cat.org.uk

courses@cat.org.uk 01654 705981 www.cat.org.uk/courses

CERTIFICATE OF APPRECIATION & COURSE ATTENDANCE

This certificate is awarded to

Alan Brewer

COMMUNITY RENEWABLE ENERGY SCHEMES

INTERNATIONAL AGENDA 21 LTD

Sustainable Development Renewable Energy

May 12 _ 14 _ 2006

Recommendations:

1. PSECC recommend **Sun Smart Energy Ltd** for the Solar PV panel work on St Faiths Church and the Church House – the better professional service, installation & offer. If St Faiths are interested in Finance?, Solar electricity systems can either be bought outright by you when installed or financed is available over a number of years, either with or without an initial deposit.

2. Pay for system if possible as you will immediately benefit from Feed-In-Tariff (FIT) revenue, export tariffs together with Electricity Bill reduction. IF going a finance loan route you will have to pay off the loan before any benefit seen financially for about seven to eight years.

3. A detailed structural survey will be required before any installation work commences

4. The Council (HBC) does operate a pre-application advice service. This is designed to provide potential applicants with a feel for how a Renewable Energy Solar PV application would be considered and any particular factors to address. The more information given, the clearer and more definitive the informal guidance that can be provided. It is a chargeable service. For John Townsend to comment on such a proposal(s) would necessitate a site visit. The current fee is £100.

5. St Faiths Church Turret has a leaded flat roof ideal for the installation of Solar PV Panels in a ballasted arrangement requiring NO drilling of holes in the lead roof.

6. Planning Permission will not be required for the Sun Smart Energy systems quote of 9WK – 36 panels as it is a permitted installation under planning guidelines, however for the larger system sizes of 55 panels the Church House Hall planning permission will be required and consultation with English Heritage together with Conservation & Planning officers at HBC required due to Heritage status of Town and listed building status of main Church.

7. Historic England, the National Heritage Adviser, would need to be consulted with on any planning proposal for such Solar PV work on the Church Turret and possibly the Church House Hall in the Pallant.

8. Warm Space proposals – this solar company plan to use "Yingli" manufactured panels, we do not recommend their use due to possible Warranty issues and panel replacement problems - The latest signs of distress are coming from Yingli Green Energy (NYSE: YGE), one of China's largest solar pv panel manufacturers, which has just announced it has the necessary funds to pay off a bond that will mature next week. Some may see such an announcement as a sign of strength; but the fact that Yingli is taking the unusual step of making an announcement seems aimed at allaying market concerns that it might not make the payment. In view of this factor PSECC does not recommend this Warm Space proposal. (source 11)

9. Havant Borough Council should allow planning permission for both Church sites to have Solar PV in line with page 17 of the targets for South Hampshire - "Feasibility of an Energy and Climate Change for Urban South Hampshire" published – September 2008 ARUP.UK should provide renewable sources for 15% of its total energy use by 2020 (electricity, heat and transport) to comply with EU directive (UK Renewable Energy Strategy Consultation, June 20098).

10. A key aspect of Sustainable Development is Sustainable Energy use and Generation – for this reason PSECC suggest that the St Faiths exploration and possible installations of Solar PV at Church House Hall in the Pallant and also St Faiths Church Turret **comply** with the wishes of HBC and their desire in the **Core Strategy** to Reduce CO_2 emissions and adapt to climate change & the PUSH Economic Development Strategic Objective of ensuring Sustainable Development across the sub region of Havant.

11. Significant revenues of just over £400,000 over a 30 year period can be achieved by the adoption of Solar PV panels on both the Church House Hall in the Pallant and also the Turret of the main St Faiths Church, we recommend Solar PV.

12. The darker Black framed Solar PV panels aesthetically look better and could prevent any objections to installations.

Report References:

(Source 01) St Faiths Church Mission Development Plan, adoption of the Mission Development Plan for the Church was entered into in late April of 2015

(Source 02) English Heritage 2010 Guidelines to Small scale solar electric (photovoltaics) energy and Traditional buildings

(Source 03) Planning and the Historic Environment (PPG15)

(Source 04) Archaeology and Planning (PPG16) Planning Policy Guidance 16:from 2010

(Source 05) Work of any kind to a Scheduled Monument requires consent from English Heritage under the Ancient Monuments and Archaeological Areas Act 1979

(Source 06) The first World Earth Summit at Rio de Janeiro in 1992 resulted in the term Sustainable Development and the Agenda21 programme

(Source 07) Portsmouth City Council (PCC) Energy Policy 1995

(Source 08) Future Solent programme in 2014 by Fareham Borough Council with a main objective of encouraging Green Energy along the Solent and South Coats - **www.futuresolent.org.uk**

(source UK 1) UK Solar Photovoltaic Roadmap – a Strategy for 2020. Knowledge Transfer Network – November 2013

(Source 09) Manual for guidance (ref: Rolled Lead Sheet – The Complete Manual. A guide to good practice in the specification and use of rolled lead sheet to BSEN 12588:1999. Lead Sheet Association 2003)

(Source 10) Informal Comments made to Alan Brewer of PSECC by HBC Conservation Consultant John Townsend- 24 April 2015

(source 11) Warm Space proposals – this solar company plan to use "Yingli" manufactured panels - The latest signs of distress - **http://www.renewableenergyworld.com/rea/blog/post/2015/04/solar-distress-signs-at-yingli-in-europe?cmpid=SolarNL-Saturday-May2-2015 –** could be a Warranty issue later.

(source 12) "Feasibility of an Energy and Climate Change for Urban South Hampshire" published – September 2008 ARUP

(source 13) Havant Borough Core Strategy - "Reduce CO2 emissions and adapt to climate change; protect and enhance biodiversity and increase recycling" page17.

(source 14) Economic Development Strategy – PUSH – Partnership for Urban South Hampshire.

www.push.gov.uk/pdf/Official%20Documents/ed_strategy.pdf page 7.

Sustainable Prosperity – economic growth cannot be at all costs. The reason we seek economic growth for the sub-region is to improve the quality of life for our residents. **We must therefore seek growth within sustainable limits.** This will include environmental, social and economic sustainability. We must promote sustainable business practices to ensure we use scarce resources efficiently, reduce waste **and minimise our environmental impact**; we must use technology to enable smarter working and reduce the need for travel; we must demand sustainable construction techniques and minimising the need for travel; we must encourage growth in areas with positive long term prospects; and we must ensure social inclusion and opportunity for all.

(source 15) www.push.gov.uk/pdf/Official%20Documents/ed_strategy.pdf page 18.

(source 16) Mission Development Plan 2015 – 2020 - http://stfaith.com/wp-content/uploads/2014/12/Mission-Development-Plan.pdf

Useful emails & websites: (also see my CV on the next page together with some references).

www.bre.co.uk/filelibrary/nsc/Documents%20Library/Not%20for%20Profits/KTN_Report_Solar-PV-roadmap-to-2020_1113.pdf

www.psecc.com alan@psecc.com **www.psecc.com/html/global_warming.html**

john.townsend@havant.gov.uk

www.sunsmartenergy.co.uk david.lewis@sunsmartenergy.co.uk

www.havant.gov.uk John.Townsend@havant.gov.uk

www.english-heritage.org.uk

www.climatechangeandyourhome.org.uk/live/content_pdfs/519.pdf

www.futuresolent.org.uk

www.planningguidance.planningportal.gov.uk

www.planningportal.gov.uk/planning/planningpolicyandlegislation/currentenglishpolicy

www.gov.uk/government/publications/national-planning-policy-framework-technical-guidance

www.legislation.gov.uk/ukpga/1979/46

www.planningportal.gov.uk/planning/planningpolicyandlegislation/previousenglishpolicy/ppgpps/ppg15

www.havant.gov.uk/development-management-more-information/pre-application-advice-and-charges

www.legislation.gov.uk/ukpga/1990/9/contents

http://www.renewableenergyworld.com/rea/blog/post/2015/04/solar-distress-signs-at-yingli-in-europe?cmpid=SolarNL-Saturday-May2-2015

www.havant.gov.uk/planning-policy-design/havant-borough-local-plan-core-strategy

www.stfaith.com/wp-content/uploads/2014/12/Mission-Development-Plan.pdf

www.youtube.com/watch?v=bI8DB0L0mm8&feature=youtu.be **Solar Panel ballasted system Turret Roof of Church**

www.youtube.com/watch?v=Jr8h51M8sW8 **Pitch roof fixing of Church House Hall**

Installers websites

www.sunsmartenergy.co.uk www.myplanetuk.com/

www.warm-space.co.uk www.alpin-sun.de/

Telephone numbers:

FUTURE SOLENT | 01329 242420 | 023 8068 8283 | 07770 605664| E:richard@futuresolent.co.uk

Sun Smart Energy Ltd – David Lewis MD – 07801 097939 **www.sunsmartenergy.com**

Warm Space Ltd - Robert Smith **-** Senior Energy Surveyor - Tel: 07737 516635 **www.warm-space.co.uk**

Orange Solar Systems Ltd - Ian Aitchison – 07779 337160 **www.orangesolarsystems.co.uk**

My Planet UK Ltd - Graham Shiret – 07793 252075 - **www.myplanetuk.com**