Solar Energy – A Viable Contributor to Renewables in Scotland

This vision document has been designed to catalyse engagement and discussion with key government, industry and academic stakeholders in Scotland.

Executive Summary

This document sets out a vision for solar energy in Scotland and is designed to encourage government, industry and academia to work together to optimise the economic, environmental and social benefits that solar energy can offer to Scotland. These include:

- Economic - employment in installation and maintenance in the short term and potentially longer term manufacturing jobs.
- Environmental - assistance in achieving renewable energy targets and national and EU policy targets on sustainable buildings
- Social – supporting community energy management in urban and rural areas and addressing fuel poverty.

There are already important UK economic instruments to support solar energy implementation. Feed in tariffs (FiTs) and renewable obligation certificates (ROCs) are well established and the renewable heat incentive (RHI) was recently set-up. The FiT and ROC schemes have recently catalysed massive growth in UK solar photovoltaic (PV) capacity and this is expected to continue for the foreseeable future. It is expected that the UK will be the largest European market for solar PV in 2014 and that it will account for over 20% of the UK renewable electricity generation capacity. The recently announced RHI is expected to achieve similar growth in the solar thermal industry.

This document sets out how Scotland can utilise these instruments to build capacity in Scotland. It sets the following vision for solar energy in Scotland:

Solar energy can deliver a substantial contribution to Scottish renewable energy generation and will be a key contributor in delivering "nearly zero" energy buildings and addressing fuel poverty.

We believe that this vision can be achieved through concerted action by government, industry and academia and have identified a number of key actions:

1. Developing a common vision
2. Encouraging short term adoption
3. Integrating solar in the wider Scottish renewables strategy
4. Developing sustainable buildings
5. Monitoring progress and assessing impact
6. Developing a longer term road-map

The first action, where government, industry and academia unite behind a common vision and solar strategy for Scotland is the short term priority.

Table of Contents

Acknowledgements:

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1. Introduction

Solar energy generation capacity in Scotland and the rest of the UK has grown significantly in recent years. It is now a major contributor to renewable energy capacity. For example, the Department of Energy & Climate Change (DECC) now asserts that "***solar PV is an important part of the UK's energy mix***"[1]. The total installed UK capacity was almost 4.5 GW at the end of March 2014[2]. This compares to a total UK installed renewable electricity generation capacity of 19.4GW at the end of December 2013[3].

Solar energy delivers significant environmental and social impacts. It is clearly identified as a key component in achieving the forthcoming requirements for energy efficient buildings[4], delivering local energy solutions for urban and rural communities and addressing fuel poverty[5].

Recent activities by the solar energy community in Scotland are therefore very timely. It has, for several months, been developing this vision document for solar energy (including both solar photovoltaics and solar thermal), with support from the Scottish Institute for Solar Energy Research (SISER), The Scottish Solar Energy group (SSEG), The Energy Technology Partnership, AES Solar and the Scottish Universities Insight Institute. This work included an earlier workshop on 24th October 2013 and the meeting at the Scottish Parliament on 19th May 2014 where this vision document was launched.

This document summarises the current UK and Scottish status of solar energy, presents evidence of its potential in Scotland, defines a vision for solar energy in Scotland and identifies key actions to implement the vision. These actions are a call for government, industry and academia to work together so that Scotland can achieve the benefits of solar energy that to date have been accrued elsewhere.

1 UK Solar PV Strategy: Part 2 Delivering a Brighter Future, DECC, 2014

2 Finlay Colville, Solarbuzz in Solar Power Portal UK (http://www.solarpowerportal.co.uk), 8th April 2014

3 Energy Trends, March 2014, Department for Energy and Climate Change (DECC)

4 BIPV, Jeff Poortmans, IMEC, 2012

5 G. Andreadis, S. Roaf, T. Mallick, Tackling fuel poverty with building-integrated solar technologies: the case of the city of Dundee in Scotland, Energy and Buildings (2010), doi:10.1016/j.enbuild.2012.11.032

2. The Current UK Position

2.1 Solar Photovoltaics (PV)

2.1.1 Market Growth

There has been significant growth in solar energy capacity in the UK in recent years. This has predominantly been solar photovoltaics (PV). The total installed capacity was 2.7GW at the end of 2013, as shown in the figure below[1].

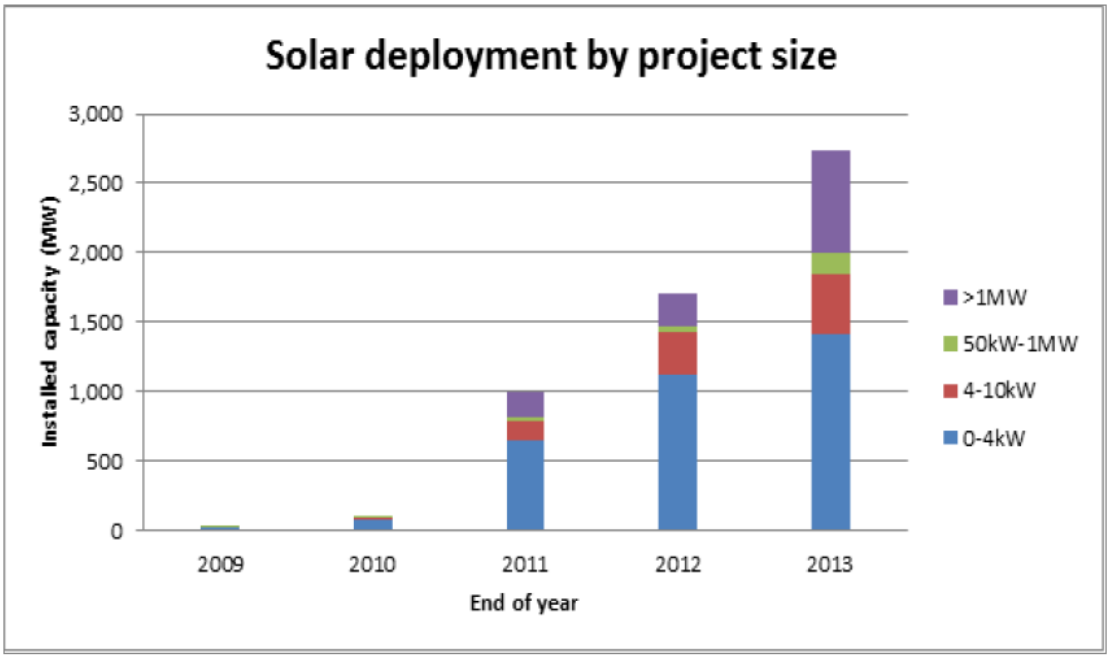

Figure 1: Solar Deployment by Project Size

This shows a 60% increase in 2013 and growth by a factor of 10 since 2010. Solar PV is now deployed on over half a million UK buildings.

As highlighted in the introduction, Solarbuzz has identified significant further growth in the first quarter of 2014 (to over 4.4GW capacity) and is estimating a total of 2.875GW of additional capacity added in 2014[6]. As a result, Solarbuzz is highlighting that the UK will become the leading European PV market and the fourth largest globally in 2014.

As a result, solar PV accounted for 14% of the UK renewable energy capacity of 19.4GW at the end of 2013, as shown in the figure below[3]. With the significant increases in solar PV installation in 2014 it is reasonable to expect that it may achieve over 20% of UK installed capacity in 2014.

The feed in tariff (FiT) and renewable obligation certificate (ROC) incentives, especially the stability in this support, have been central to developing this capacity.

6 Finlay Colville, Solarbuzz in Solar Power Portal UK (http://www.solarpowerportal.co.uk), 22nd April 2014

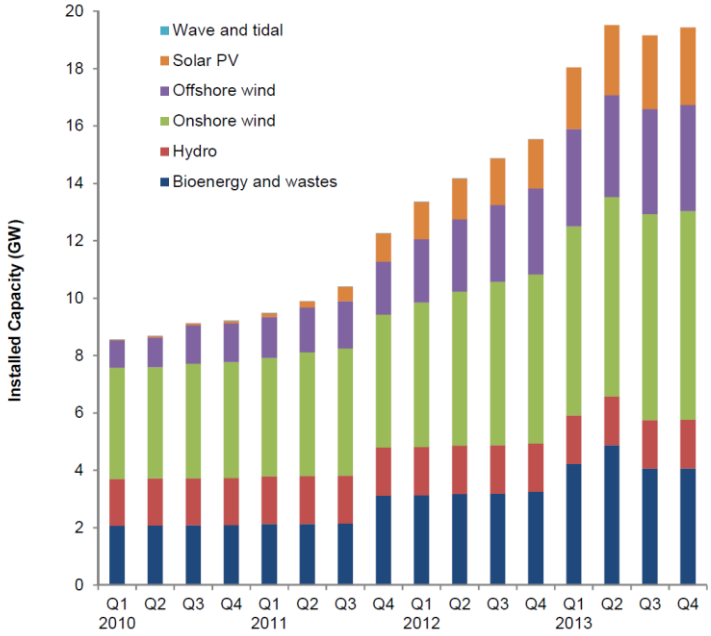

Figure 2: UK Renewable Electricity Capacity (2010 to 2013)

However, whilst solar PV accounted for 14% of capacity its share of electricity generation was lower at 3.8%, as shown below[3].

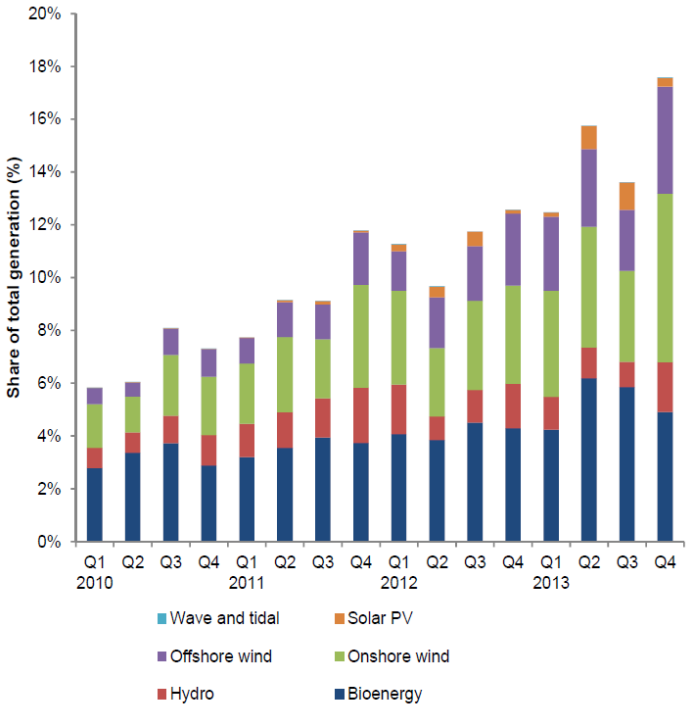

Figure 3: UK Renewable Energy Generation (2010 – 2013)

This shows the seasonal nature of PV generation. It is also affected by the time lag between installation of capacity and generation. It is expected that solar PV share of electricity generated will increase as the recently installed capacity comes on stream.

The reducing cost of PV has also been a major contributor to market growth. The costs of PV modules have reduced by over 70% in the period from 2001 to 2011, as shown below[7].

Figure 4: Trends in PV Module Costs

It is expected that the cost of PV modules will continue to decrease. EPIA estimates that systems prices could decrease by 36-51% by 2020. As a result the estimated levelised cost of electricity (LCOE) of different electricity generation technologies can be summarised as follows[8]:

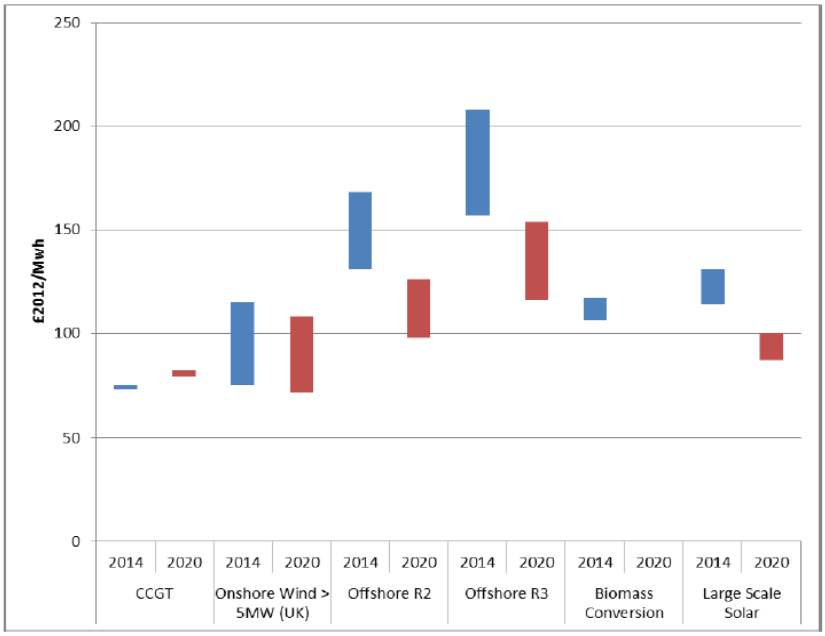

Figure 5: Estimated Levelised Cost of Electricity for Different Generation Technologies

7 Solar PV Profit's Last Stand, Paula Mints in www.renewableenergyworld.com, 20/03/2013, sourced 09/05/2014

8 UK Renewable Energy Roadmap. DECC, November 2013

This shows that by 2020, solar PV is cost competitive, if not cheaper, than other renewable technologies. Further, the UK Solar Strategy estimates that solar PV will be comparable in cost with CCGT (combined cycle gas turbines) by 2025.

Based on these significant improvements in cost competitiveness, government commitment to solar and the stable incentive regimes, industry analysts[9] are predicting 13GW of new solar capacity over the period to 2019 and achievement of the UK government's 20GW capacity target for 2020.

This indicates that solar PV in the UK is already established as a significant contributor to renewable energy generation and it is expected that significant growth in both capacity and generation will continue for many years.

2.1.2 Economic Impact

Currently, the installation and maintenance of solar PV creates significant employment. According to the National Solar Centre, there were between 11,700 and 14,000 direct and indirect jobs in the UK solar PV industry at the end of 2013[1]. The higher estimate split this as follows:

- 10,500 jobs in building-mounted deployment of solar PV, based on current FiT figures – around 20 jobs per MW installed
- 3,500 jobs in solar farm deployment assuming installation of approximately 510 MW – around 7 jobs per MW installed

In the future, it is expected that Building Integrated PhotoVoltaics (BIPV) will develop as customised and specialised products and thus are more likely to be made in the UK (to suit UK building regulations) through companies such as Romag, Kingspan and potentially innovative companies like Oxford Photovoltaics.

2.2 Solar Thermal

2.2.1 Market Position

The UK solar thermal market has undergone a significant decline in the last three years as shown in the following figure[10], although there are now over 200,000 solar thermal system already installed in the UK and the technology is also well established across Europe / worldwide.

9 Solar strategy stability could deliver 13GW of new PV by 2019, IHS Technology, 22nd April 2014 (see http://technology.ihs.com/498977/the-uk-solar-strategy-lays-ground-for-a-stable-future-13-gw-of-new-pv-capacity-to-be-installed-over-next-five-years)

10 UK Solar Thermal Statistics, Solar Trade Association, July 2013

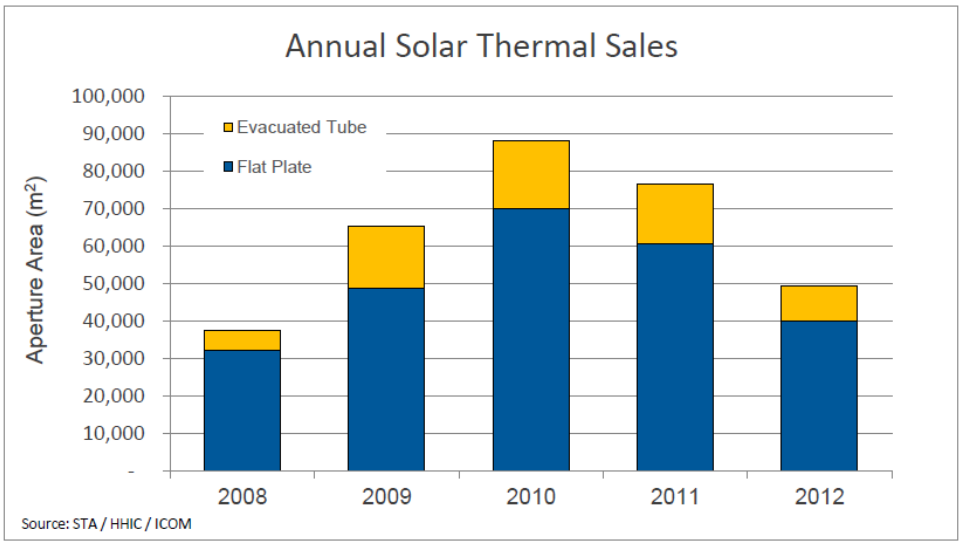

Figure 6: UK Solar Thermal Sales

Furthermore, it is expected that 2013 sales will show a 30% decline from 2012 data.

In 2012 the UK industry made up 1.7% of the European market and had the lowest capacity in Western Europe per capita.[11]

The industry has identified the lack of an effective renewable heat incentive as a key factor in this declining market.

It is expected that the introduction of the recently announced renewable heat incentive (RHI) will have a major positive impact on future sales and the Solar Trade Association[12] has suggested that costs of solar thermal systems could decline by 30% with a significant increase in sales.

The UK market for solar thermal is therefore weak, with low per capita investment. There is a significant opportunity for growth with support from the new RHI that should enable UK capacity to increase to levels that are similar to other comparable European countries.

2.2.2 Economic Impact

It is estimated, based on the data in the European Solar Thermal Industry Association 2012 market report, that the UK solar thermal sector

- Turnover was £34.4 million
- Employment was around 550

These estimates are based on a 1.7% share of the European turnover and employment of £2 billion and 32,000 respectively.

11 Solar Thermal Markets in Europe, The European Solar Thermal Industry Association, June 2013

12 The Scope for Cost Reduction in a Mass Solar Heating, Solar Trade Association, 11th September 2013). Available at: www.solartrade.org.uk//media/The%20Scope%20for%20Cost%20Reduction%20in%20a%20Mass%20Solar%20Heating%20Market%20(11.09.2013).pdf

3. The Current Scottish Position

3.1 Solar PV

3.1.1 Market Growth

The Scottish generating capacity reached 116MW at the end of 2013[13], achieving annual growth of 22%. This is 4.3% of the UK installed capacity of 2.7GW.

This is based on over 31,000 installations, as shown below for each local authority[14].

Local Authority	Estimated Number of Households	Cumulative Number of Installations								Photovoltaics Installations per 10,000 households
		Photovoltaics		Wind		Hydro		MicroCHP		
		Domestic	Total	Domestic	Total	Domestic	Total	Domestic	Total	
Aberdeen City	102,602	608	626	3	5	0	0	2	2	59
Aberdeenshire	107,960	3,143	3,171	242	281	3	5	7	7	291
Angus	53,296	1,064	1,086	37	45	1	2	0	0	200
Argyll & Bute	44,911	890	902	50	55	5	10	0	0	198
Clackmannanshire	23,676	278	288	0	0	0	0	2	2	117
Dumfries & Galloway	72,066	2,000	2,098	124	216	24	30	2	2	278
Dundee City	72,946	391	397	1	2	0	0	0	0	54
East Ayrshire	55,844	618	633	29	43	1	1	0	0	111
East Dunbartonshire	44,173	447	449	0	1	0	0	1	1	101
East Lothian	44,136	594	621	14	25	1	1	1	1	135
East Renfrewshire	36,691	285	289	9	12	0	0	0	0	78
Edinburgh City of	234,091	998	1,010	2	2	1	1	0	0	43
Eilean Siar	14,354	151	154	76	95	1	2	0	0	105
Falkirk	70,868	587	593	1	4	0	0	1	1	83
Fife	169,413	2,624	2,664	29	50	0	0	0	0	155
Glasgow City	296,383	1,086	1,102	1	2	0	0	1	1	37
Highland	109,412	2,720	2,740	115	132	19	21	4	4	249
Inverclyde	38,830	154	156	4	7	1	1	0	0	40
Midlothian	35,716	326	333	3	5	0	0	0	0	91
Moray	41,826	1,000	1,018	37	42	0	0	0	0	239
North Ayrshire	66,204	669	683	12	19	1	2	0	0	101
North Lanarkshire	148,400	999	1,022	8	9	0	0	0	0	67
Orkney Islands	10,046	305	307	469	526	0	0	0	0	304
Perth & Kinross	67,870	1,542	1,573	52	61	3	3	0	0	227
Renfrewshire	82,236	602	610	0	2	0	0	1	1	73
Scottish Borders	55,857	1,587	1,634	46	65	2	2	1	1	284
Shetland Islands	10,582	123	123	543	594	3	3	0	0	668
South Ayrshire	53,909	737	766	19	28	1	1	0	0	137
South Lanarkshire	143,156	1,492	1,516	40	68	3	3	1	1	104
Stirling	39,085	1,068	1,105	13	16	0	1	0	0	273
West Dunbartonshire	44,574	514	516	0	0	0	0	0	0	115
West Lothian	75,062	924	946	6	10	0	0	3	3	123
Total	**2,466,175**	**30,526**	**31,131**	**1,985**	**2,422**	**70**	**89**	**27**	**27**	**171**

Figure 7: Solar PV Installations in Scotland Based on Feed in Tariff Data

13 Scottish Renewable Energy Sector in Numbers, Scottish Renewables (see http://www.scottishrenewables.com/scottish-renewable-energy-statistics-glance/), sourced 07/05/2014

14 Sub-regional feed in tariffs statistics, DECC (see https://www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics), sourced 07/05/2014

In total, solar PV's share of the Scottish renewable electricity capacity (6,592 MW in 2013) is 1.75%, highlighting that PV currently plays a smaller part in Scotland's renewable electricity capacity than in England, due mainly to the scale of onshore wind capacity in Scotland, as shown in Figure 8, opposite.

This highlights Scotland's strong position in renewables where its generating capacity at the end of 2013 was over 33% of the total UK figure of 19.4GW.

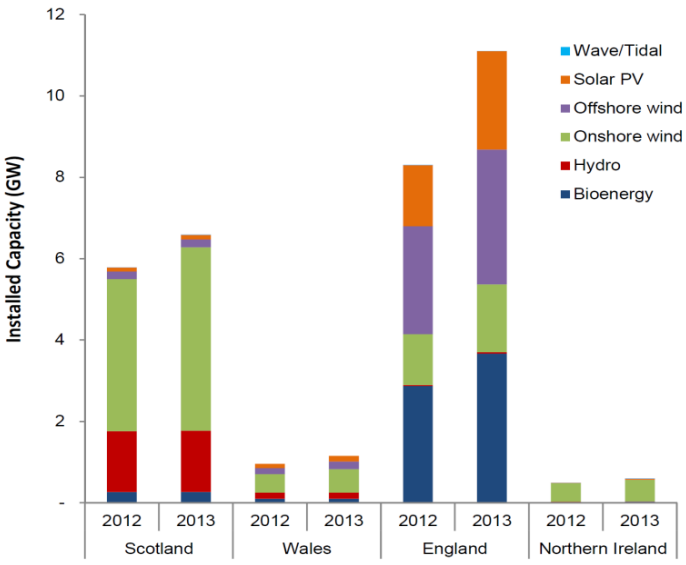

Figure 8: UK Renewable Electricity Generation Capacity by Country

The figures for renewable electricity generated in Scotland in 2013 show that solar PV made a limited contribution to the total of 46.5% of total electricity generation from renewables.

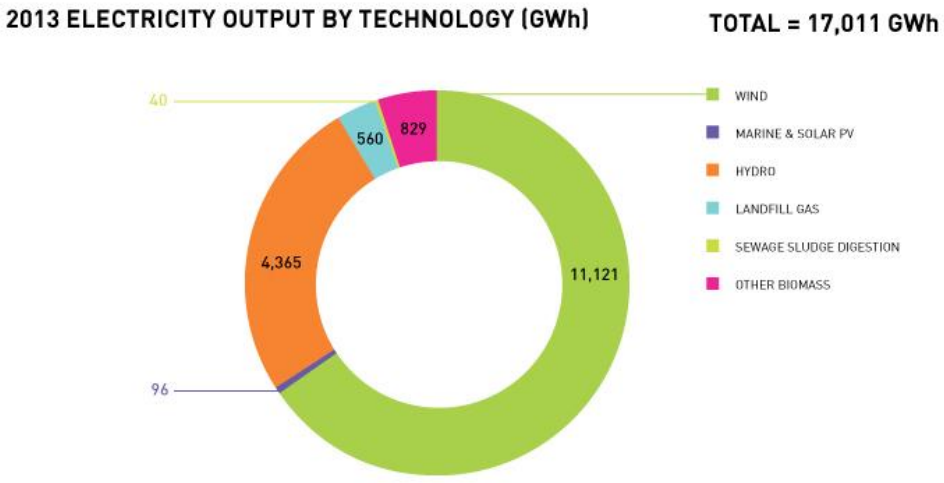

Figure 9: Renewable Electricity Generation by Country and Technology

Solar PV, wave and tidal produced just over 0.5% (96GWh) of the total electricity output achieved by renewables in Scotland in 2013[13]. This is significantly lower than the 3.8% share of UK renewables output over the same period achieved by solar PV alone.

Thus, solar PV activity in Scotland is low compared to the UK in general, although investment to date has been committed without a clear strategic framework. This vision document is designed to provide a robust framework and identify the key actions for Scotland to improve its current position.

3.1.2 Economic Impact[13]

Employment in solar PV in Scotland in 2013 was 363 – approximately 17 jobs per MW installed during the year. This figure is in line with the wider UK and European employment data.

The total investment was £54.6 million, equivalent to £2.6M per MW of capacity installed.

3.2 Solar Thermal

3.2.1 Market Growth

The solar thermal capacity in Scotland was estimated[15] at 28 MW at the end of 2012, producing an annual output of 15,544 MWh. This was 5% of Scotland's renewable heat capacity and 1% of its output as shown below.

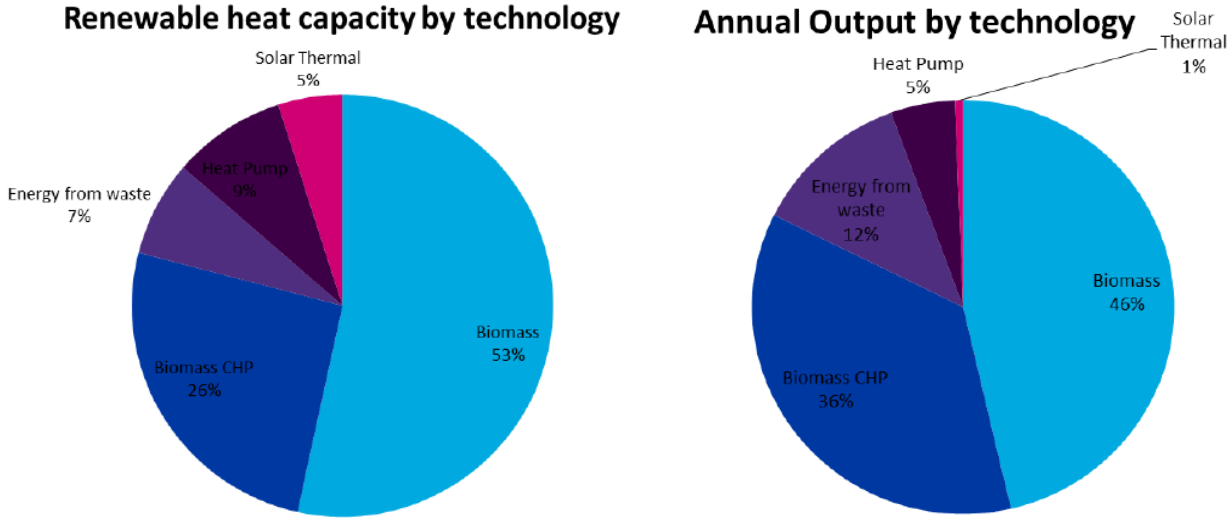

Figure 10: Renewable Heat Capacity and Output by Technology in Scotland in 2012

The capacity installed in 2012 was 6MW, compare to an estimated 41MW[11] installed in the UK. Thus the Scottish market accounted for 14% of the total UK market.

3.2.2 Economic Impact

It is estimated, based on data in the European Solar Thermal Industry Association 2012 market report and the Energy Savings Trust report on renewable heat in Scotland that the Scottish solar thermal sector

- Turnover was £5 million
- Employment was around 80

These estimates are based on a 14% share of the estimated UK figures (see Section 2.2.2, above).

15 Renewable Heat in Scotland, Energy Savings Trust, 18th June 2013

4. Solar in Scotland –Practicalities and Market Drivers

4.1 Evidence for Solar in Scotland

There is a growing body of evidence that justifies the practicality of solar energy in Scotland, despite the lower insolation levels. It is recognised that these are typically 20% lower than the south of England, as shown in the UK solar radiation map[16], opposite.

This map does however, show similar levels in much of Scotland and the North of England.

Examples of the evidence that solar energy in Scotland is a practical proposition include:

a) A yield comparison for domestic photovoltaic installation across the UK[17]. This analysis benchmarked the predicted annual yield for a typical domestic installation in 18 UK locations (from Thurso to the Isle of Wight) and showed that Scottish locations such as Edinburgh, St Andrews and Thurso outperformed locations such as Hull, Belfast, Nottingham and London.

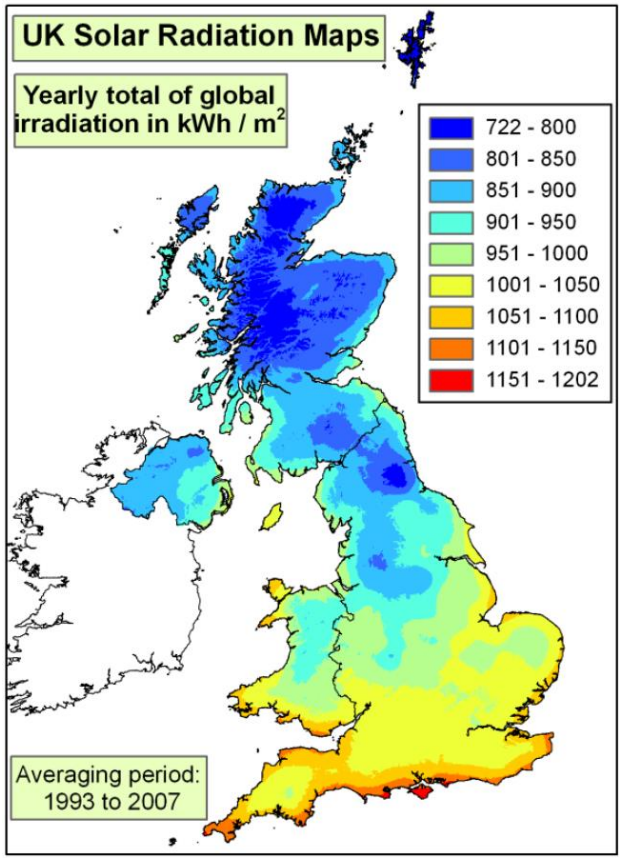

Figure 11: UK Solar Radiation Map

Typical yields in Scotland were around 3,500 kWh, which is over 80% of the average domestic electricity consumption per household in Scotland in 2012. This shows that solar PV panels can make a significant contribution to electricity consumption in Scotland.

b) Based on a conservative analysis of the footprint of almost 600,000 buildings across Scotland, it is estimated that an installed capacity of around 7 GW of domestic and non-domestic rooftop solar PV is technically feasible in Scotland. Generating around 5.6 TWh a year, this would cover approximately one-sixth of Scotland's electricity demand.[17]

c) Evience that fuel poverty in Dundee can be totally eliminated using solar energy technologies[5]

16 © British Crown Copyright, The Met Office, 2014

17 SISER Analysis, 2014, www.siser.ac.uk

d) A review of 122 social housing tenants[18], over 100 of which were in Scotland, which highlighted that solar PV "can make a valuable contribution to reducing social housing tenants' fuel bills and alleviating fuel poverty"

e) Fully integrated solar PV installation at Fife Housing Innovation Showcase. This demonstrtator showed how the 2016 zero carbon Scottish Building standard could be achieved using PV roof tiles

f) Sporsnis Community project, in Ness on the Isle of Lewis where the output over a four year period demonstrated its efficacy. It should also be noted that this example demonstrates that the environmental conditions in the area (long summer days, light conditions and relatively warm winters compared to significant parts of mainland Europe) supports solar technologies.

g) It is estimated that an average sized solar thermal roof mounted array in Scotland can provide 40-50% of the annual hot water requirements for a family home, and up to 100% of summer requirements[19].

There are many more developments in the pipeline in Scotland, including:

- Glasgow
  - 700 properties at the Commonwealth Games Athlete's Village
  - 27,000 potentially suitable roof-tops identified (Glasgow's Future City project)
  - A survey of 400 brownfield sites across the city to identify attractive locations
- Edinburgh
  - The council is investigating nine possible sites
- Argyll & Bute
  - Installation contract placed for eight schools in the regions
- Angus
  - Plans for several major solar farms

And evidence suggests Northern Ireland also considers it to be practical, with recently announced projects including:

- 3.8MW solar farm at Bombardier, Belfast
- 5.1MW solar farm in County Down

It should be noted that the yield comparison for domestic photovoltaic installation across the UK quoted above ranked several Scottish locations higher than Belfast.

4.2 Key Drivers for Solar Energy

There are three major drivers for solar energy:

- Achieving renewable energy targets

18 Using Solar PV to Tackle Fuel Poverty, Changeworks for Eaga Charitable Trust, February 2014

19 Community and Landowner Renewable Energy Loan Study, The Scottish Government (see http://www.scotland.gov.uk/Publications/2010/10/01105500/6) quoting Andy McCrea, Renewable Energy - A User's Guide Crowood Press (2008), sourced 09/05/2014

- Meeting national and EU policy on sustainable buildings
- Addressing fuel poverty

These are discussed below.

Achieving Renewable Energy Targets

Solar PV is considered to be a key component of the technology mix to achieve future renewable energy targets. As already stated the UK government considers that "solar PV is an important part of the UK's energy mix". A conservative estimate shows the technical feasibility to meet around one-sixth of Scotland's electricity demand with domestic and non-domestic rooftop solar PV.[17]

The Scottish Government has also increased its focus on solar energy. Its most recent update of the 2020 Routemap for Renewable Energy in Scotland[20] specifically addressed solar PV, identified the advantages of timely and affordable grid access and confirmed input to the UK solar strategy.

Meeting National and EU Policy on Sustainable Buildings

There are a number of requirements for sustainable buildings, particularly:

- Low Carbon Building Standards Strategy for Scotland (2013 update)
- UK Government's zero-carbon policy for new homes from 2016
- The recast Directive 2010/31/EU of The European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings. This Directive requires that Member States shall ensure that after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings and by 31 December 2020, all new buildings are nearly zero-energy buildings

These place significant demands for change in the design of both public and private buildings. It requires significant enhancement to current energy efficient buildings and many expert commentators[4] highlight that solar thermal linked with long-term heat storage and photovoltaics linked to electricity storage (battery) are essential to achieving the required building performance.

Addressing Fuel Poverty

It is estimate that there are around 900,000 households in Scotland in fuel poverty[21].

The recently launched Renewable Heat Incentive (RHI), which can be accessed by householders and social landlords, offers the opportunity to install renewable heat technologies, including solar thermal technologies to address this issue. It is expected to be particularly relevant in rural areas that are not connected to the gas network and thus need to use more expensive heating methods. The solar thermal industry[22] expects that the RHI will

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20 2020 Routemap for Renewable Energy in Scotland – Update, Scottish Government 19th December 2013 (see http://www.scotland.gov.uk/Resource/0044/00441628.pdf), sourced 07/05/2013

21 Scottish Renewables, (see http://www.scottishrenewables.com/news/making-domestic-RHI-tool-tackling-fuel-poverty/), sourced 07/05/2014

22 Paul Barwell, CEO, Solar Trade Association – see http://www.solarpowerportal.co.uk/editors_blog/solar_thermal_to_take_centre_stage_in_2014_2356), sourced 07/05/2014

have a significant beneficial effect on the sector and make a key contribution to delivering more affordable heating solutions.

It has also been demonstrated that solar PV is a major contributor in addressing the energy bills in social housing[18] and, as already highlighted, in addressing fuel poverty[23] in Scotland.

23 G. Andreadis, S. Roaf, T. Mallick, Tackling fuel poverty with building-integrated solar technologies: the case of the city of Dundee in Scotland, Energy and Buildings (2010), doi:10.1016/j.enbuild.2012.11.032

5. Potential for Growth

Prior to defining a vision for Scotland, this section summarises the evidence presented to date. Key points are:

Solar PV

1. Growth of UK solar PV capacity has been dramatic in the last three years, catalysed by effective incentives. This growth is expected to continue to 2020 with an additional capacity of 13GW projected for the five year period to 2019.
2. Case study evidence underlines that solar PV is a practical option in Scotland.
3. Scotland currently accounts for 4.3% of the UK solar PV capacity.

   Scotland should, as a minimum, strive to retain this market share over the period to 2020. If the UK target of 20GW is achieved this would mean 860MW capacity in Scotland, compared to the 116MW capacity quoted at the end of 2013.

   A more ambitious target would be to achieve per-capita parity with the rest of the UK. To do this would essentially mean doubling the 4.3% current share over the period to 2020.
4. Such capacity growth would make an important contribution to renewable electricity and zero energy building targets and help alleviate fuel poverty.

Solar Thermal

1. Solar thermal markets in both Scotland and the UK have been difficult in recent years due to the lack of an effective incentive mechanism.
2. The recent introduction of the renewable heat incentive is expected to catalyse significant market growth.
3. Case study evidence underlines that solar thermal is a practical option in Scotland.
4. Solar thermal current accounts for 1% of renewable heat generation. The newly introduced RHI, together with an effectively supported industry should enable this figure to be increased in the future.
5. Such capacity growth would make an important contribution to renewable heat and zero energy building targets and help alleviate fuel poverty.

6. A Vision for Solar in Scotland

Our vision for solar energy in Scotland based on the current position and future potential is:

> ***Solar energy can deliver a substantial contribution to Scottish renewable energy generation and will be a key contributor to achieving "nearly zero" energy buildings and addressing fuel poverty***

We believe that these can be achieved through concerted action by government, industry and academia. Key actions are described in the following section.

7. Action Plan

Our action plan to catalyse and support the development of solar energy in Scotland has six key action points:

1. Developing a common vision
2. Encouraging short term adoption
3. Integrating solar in the wider Scottish renewables strategy
4. Developing sustainable buildings
5. Monitoring progress and assessing impact
6. Developing a longer term road-map

These are described in more detail below:

Action 1- Developing a Common Vision

Objective:	Develop a common vision and solar strategy for Scotland
Actions:	Recognise the huge growth anticipated over the period to 2020 under the current incentive regimes (FiT, RHI and ROCs).
	Plan to maximise Scottish benefits (including jobs, zero-carbon buildings, social returns in cities and rural communities, novel products and niche IP).
	Define and confirm an action plan to achieve these
	Identify Scotland's "solar champion"
	Establish a leadership group
Context:	Solar energy is a practical option for Scotland
	Solar energy is key to achieving "nearly zero" buildings
	The short to medium term opportunity is in installation and generation
	Current UK PV incentives (FiTs scheme and RO) encourage investment so additional fiscal instruments are not required
	The stability of UK incentives has been a major factor in market growth
Responsibility:	Government, industry and academia joint action

Action 2 - Encouraging Short Term Adoption

Objective:	Promote solar as an attractive renewable source
Actions:	Raise awareness and promote existing incentives - FiTs for building applied PV - ROCs for solar farms - RHI for solar thermal
	Identify addition financial instruments required to support existing schemes
	Develop best practice case studies
	Develop and publicise demonstrator projects

Context: Investment in solar PV energy and solar thermal heat generation in Scotland are both financially and environmentally attractive

Responsibility: Industry with government support

Action 3 - Integrating Solar in the Wider Scottish Renewables Strategy

Objective: Integrate solar as a core part of the Scottish renewables strategy

Actions: Engagement with key stakeholders

- Other renewables sectors
- Grid and storage sector
- DNOs
- OFGEM
- Council planning departments

Address challenges from increasing solar energy generation

Context: Solar energy is a practical option for Scotland

Solar energy is key to achieving "nearly zero" buildings

Responsibility: Government with industry and academic support

Action 4 - Developing Sustainable Buildings

Objective: Demonstrate the value of solar in achieving (nearly) zero energy buildings

Actions: Review requirements to meet EU and national targets

Define the role of solar

Address barriers to development (e.g. regulation)

Build on best-practice elsewhere

Engage in European networks (e.g. Solarrok)

Develop case studies and demonstrators

- "Nearly-zero" buildings
- Community based energy models

Establish innovative development options

- Public procurement
- Design competitions for public buildings

Context: Solar energy is key to achieving "nearly zero" buildings

Responsibility: Government, industry and academia joint action

Action 5 - Monitoring Progress and Assessing Impact

Objective: Monitor development and impact of solar in Scotland

Actions: Monitor economic impact

- Jobs

- Gross Value Added (GVA)

Monitor environmental impact

- Installed capacity
- Energy generated
- Energy efficiency – domestic, industrial and public buildings

Monitor social impact

- Develop models for "social benefits" / social "rate of return"
- Impacts on social housing and fuel poverty

Context: The application of solar is growing rapidly. It is important that its growth and impact are monitored.

Responsibility: Academia with government and industry support

Action 6 - Developing a Longer Term Road-Map

Objective: Develop a the way forward for solar in Scotland to 2025 and beyond

Actions: Map out market development

- Raise awareness of all solar options
- Energy self-sufficiency demonstrators in rural areas

Review technology options / developments

- Assess suitability for Scotland
- Optimise solar PV for Scottish conditions
- Assess maturity of BIPV and architectural options

Assess industry development options

- Identify options for local supply chain development (manufacturing?)

Context: Solar energy is a practical option for Scotland

Solar energy is key to achieving "nearly zero" buildings

Responsibility: Government, industry and academia joint action

8. Potential Impact

8.1 Economic Impact

Employment in installation activities in Scotland would be between 1,500 and 2,000 if UK solar PV capacity grows to 20GW by 2020 and Scotland retains its current 4.3% market share.

8.2 Environmental Impact

The environmental impacts expected from development of solar energy are:

- A contribution to meeting Scotland's 2020 renewable target of generating the equivalent of 100% of gross annual electricity consumption by 2020, with an interim target to meet the equivalent of 50% of Scottish electricity demand from renewables by 2015[20]
- Reduced GHG emissions – solar PV offers almost 1Kg per kWh saving compared to coal and oil generated electricity[24]
- Contributions to the Scottish Government's Renewables Routemap targets of
  - the equivalent of 11% of heat demand to come from renewable sources by 2020
  - at least 500MW of renewables installed capacity to be in local or community ownership by 2020
- "Nearly zero" energy buildings demonstrated and implemented

8.3 Social Impact

Development of solar energy in Scotland will provide a number of key social impacts, including:

- Employment opportunities
- Fuel poverty alleviation
  - Both in cities and in off-grid application in remote areas
  - Addresses the inclusion agenda
- Behaviour change - domestic system owners change their behaviour and reduce energy use
- Empowers consumers to take control of energy use

[24] Photovoltaic energy – electricity from the sun, EPIA, April 2010

9. Next Steps

The first step in implementation is for key stakeholders to unite behind a common vision and solar strategy for Scotland (Action 1 in Section 7, above). This requires government, industry and academia to work together to prepare a way forward that they can collectively support. It is assumed that the other actions identified will be a core part of the agreed way forward.

It is recommended that a leadership group is set up and facilitated to develop the common vision and strategy.