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Micro-generation: Solar PV Systems

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Photon Energy

- Design, supply, installation, commissioning and maintenance:
 - Solar PV
 - Small wind turbines
 - Solar Water Heating
 - Air Source Heat Pumps



Photon Energy

- UK-wide
 - Offices in Reading & Glasgow
 - Warehouse in Huddersfield and Swanley
 - Links with local installers

- Commercial, agricultural and residential sectors



Photon Energy

- Micro-generation Certification Scheme Certified
- NICEIC Approved Contractor
- CHAS Certified Contractor
- Constructionline registered
- BSEN ISO9001:2008 certified
- REAL Assurance Scheme

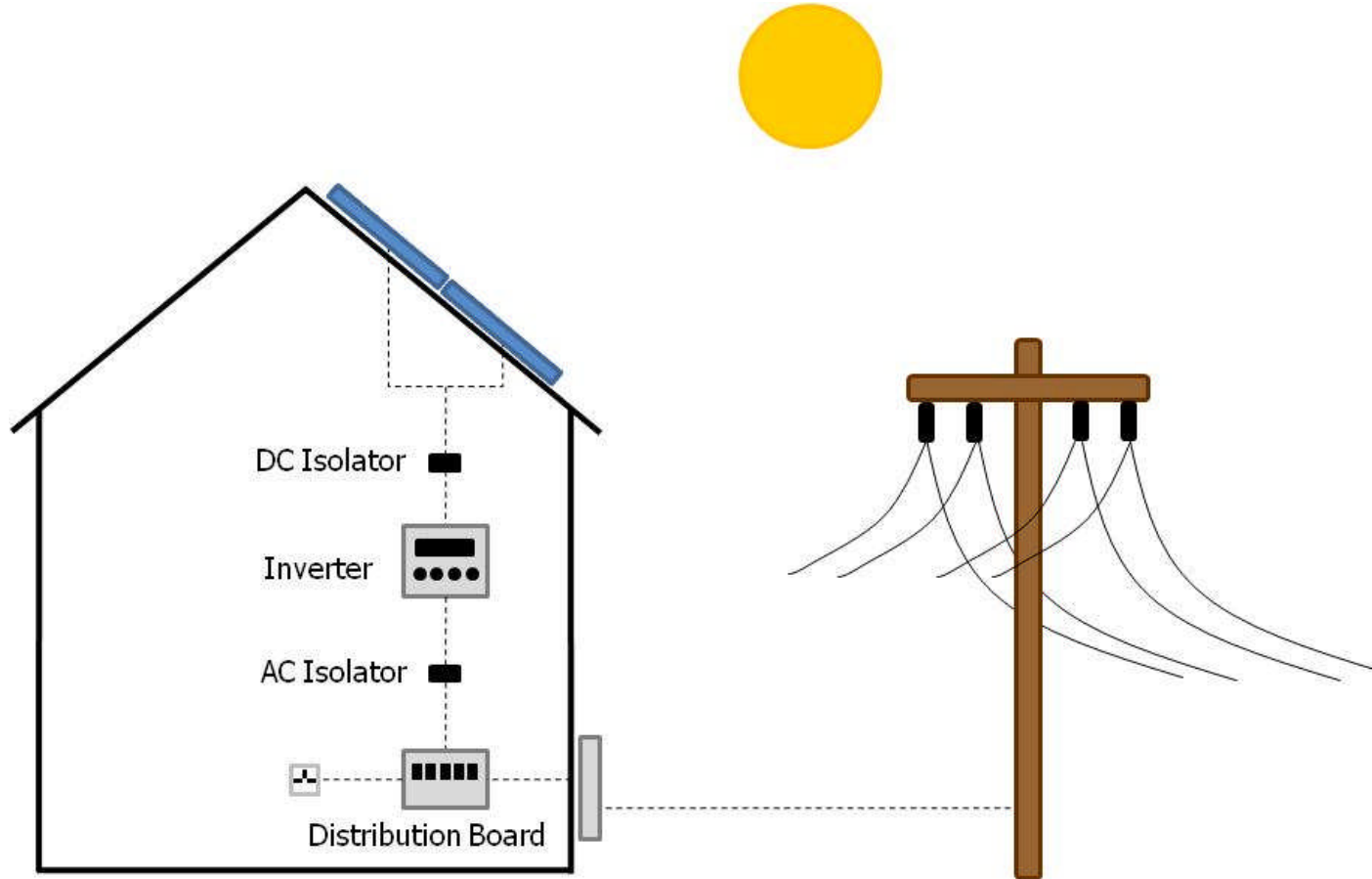


What is a PV system?

- Solar panels that generate electricity
- Generally roof mounted
- Inverter in loft / plant room to convert DC electricity to AC
- Connected directly to the distribution board
- Parallel operation with grid supply



PV system schematic



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Solar Technologies

Type	Efficiency	Comments
Mono	14.5%	Well proven technology Suited for limited area
Multi	13.5%	Well proven technology Most commonly used
Amorphous	8.0%	Low panel prices High mounting system and installation costs Uncertainty over product longevity
Hybrid technologies	16.0%	Highest efficiency Ideal for limited areas Significantly more expensive

The energy generation per kWp is the same for all technologies – do not get hung up on efficiency!!!!



Options for Integrating PV

- Bolt-on systems for pitched roofs (using standard PV modules)



Options for Integrating PV

- Roof-integrated systems for pitched roofs (using standard PV modules)



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Options for Integrating PV

- Roof-integrated systems for pitched roofs (using PV tiles)



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Options for Integrating PV

- A-frames or ballasted systems for flat roofs (penetrating/ non-penetrating)



Building orientation

- South facing is optimum
- 30 degree tilt of roof is optimum
- South east or south west – output reduced by around 5%
- East or west facing – output reduced by around 15%

Roof layout / obstructions

- Hipped roofs and dormer windows reduce the space available for a PV system
- Shading from small objects such as vent pipes can significantly affect output
- System can require more space on a flat roof due to spacing between rows



Location of electrical equipment

- Electrical equipment is generally one or more inverters plus associated isolators
- In houses inverter etc. usually located in loft
- In flats (communal system) in plant room
- AC isolator and kWh meter adjacent to distribution board
- Optional more detailed display
- Typical inverter: 434 x 295 mm, 30 kg



Integration with Other Trades: Roofers

- Roof hooks / stand-offs
- Up-stands
- Integrated system - tile up to bottom of PV panels, work with roofer
- Cable entry to building before roofer waterproofs the roof



Integration with Other Trades: Electricians

- To install non-specialist aspects of the work, e.g. AC wiring
- Can't commission systems until there is electricity on site and a DB to connect into



Other Issues to Consider

- Health and Safety
 - Electrical – DC wires, always live
 - During installation / maintenance
- Scheduling / lead times
- Site access / storage
- Roof penetration
- Strength of roof



User Issues

- New technology for the resident
- Simple kWh meter should be provided
- Energy monitors to monitor overall usage
- Visual display indicating energy generation (e.g. Sunnybeam)
- User information sheets



Approximate costs

System Type	1 x 1.3 kWp	50 x 1.3 kWp
Bolt-on system	£6,500	£4,200
Semi-integrated system	£7,500	£5,100
PV tile system	£10,500	£9,500
Bespoke Systems (glass/glass for atria)	-	£9,500/kWp

Note: Prices ex VAT and scaffold



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Maintenance

- Minimal maintenance requirements – no moving parts
- Regular check of meter to ensure system is operating
- Full mechanical check of roof system every 5 years



Drivers

- Feed-in-tariff
- Code for Sustainable Homes
- 10% planning requirements (Merton Rule)
- Obligation to minimise fuel poverty

FiT Revenues

System Size (kWp)	Price (£/kWp)	Annual Generation (kWh)	FiT (£/MWh)	Annual Revenue (£)	Simple payback (Years)	IRR over 25y (%)
2	£4,200	1,700	413	£887	9.5	11.0%
3	£4,000	2,550	413	£1,330	9.0	11.7%
10	£3,600	8,500	361	£3,959	9.1	12.5%
25	£3,300	21,250	314	£8,870	9.3	12.6%
50	£3,150	42,500	314	£17,739	8.9	13.6%
100	£2,900	85,000	314	£33,279	8.7	12.8%
500	£2,600	425,000	293	£162,473	7.7	15.1%
1000	£2,450	850,000	293	£324,947	7.1	15.9%
3000	£2,000	2,550,000	293	£974,840	6.6	16.1%

Asset depreciated over 25y, assumes no loan finance

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Summary

- Range of different technologies and integration options
- Easy to integrate into existing buildings and new-build programmes in both residential but also commercial sectors
- Feed-in tariff makes PV an excellent investment opportunity
- Many financing options being developed



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