COVENTRY & WARWICKSHIRE
GREEN BUSINESS
NETWORK

‘Solar Power for Business What is the future?’

Coventry & Warwickshire Green Business Network
Friday 1st December 2017

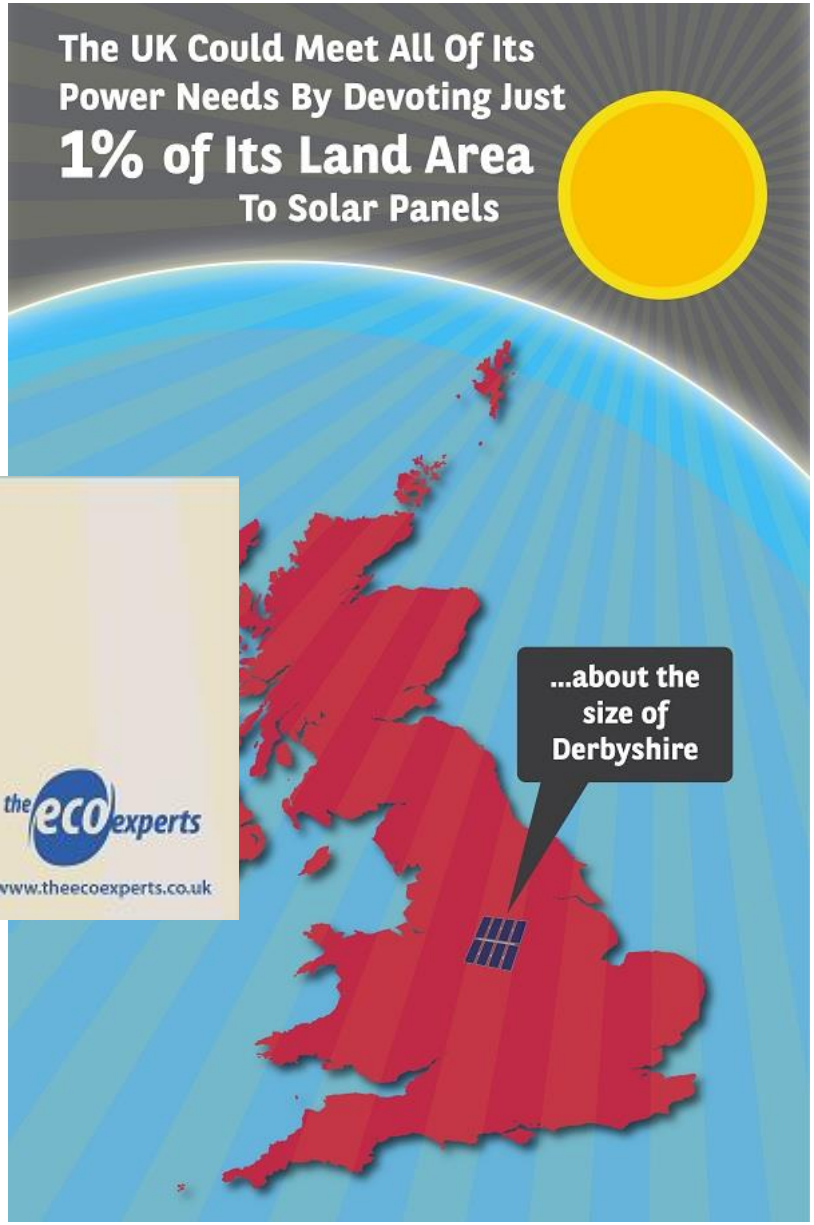
Greenwatt
sustainable solutions

Greenwatt Technology

Creative thinking; practical solutions!

- Warwickshire based low carbon and renewable energy project managers
- Provide independent site-specific feasibility studies
- Develop integrated solutions for business, public sector and communities.
- Solar power, biomass, heat pumps, battery storage and electric vehicles

The Power of Solar!



How We Arrived At This Figure

In 2009 the UK consumed **351.8 billion kWh of electricity**

Under optimal conditions (south facing, no shade) a 4 kWh solar panel system (largest home system) can produce **3,433.60 kWh per year** and takes up 25.72m² of space

This means the UK would need **102,458,062** of these installations to meet all power needs

These would take up 2.63522135×10^9 m² of space which works out to **2,635 km²**

The UK is **244,820 km²**

So the UK would need to devote **about 1% of total land area** to solar panels to meet all power needs.

the eco experts
www.theecoexperts.co.uk

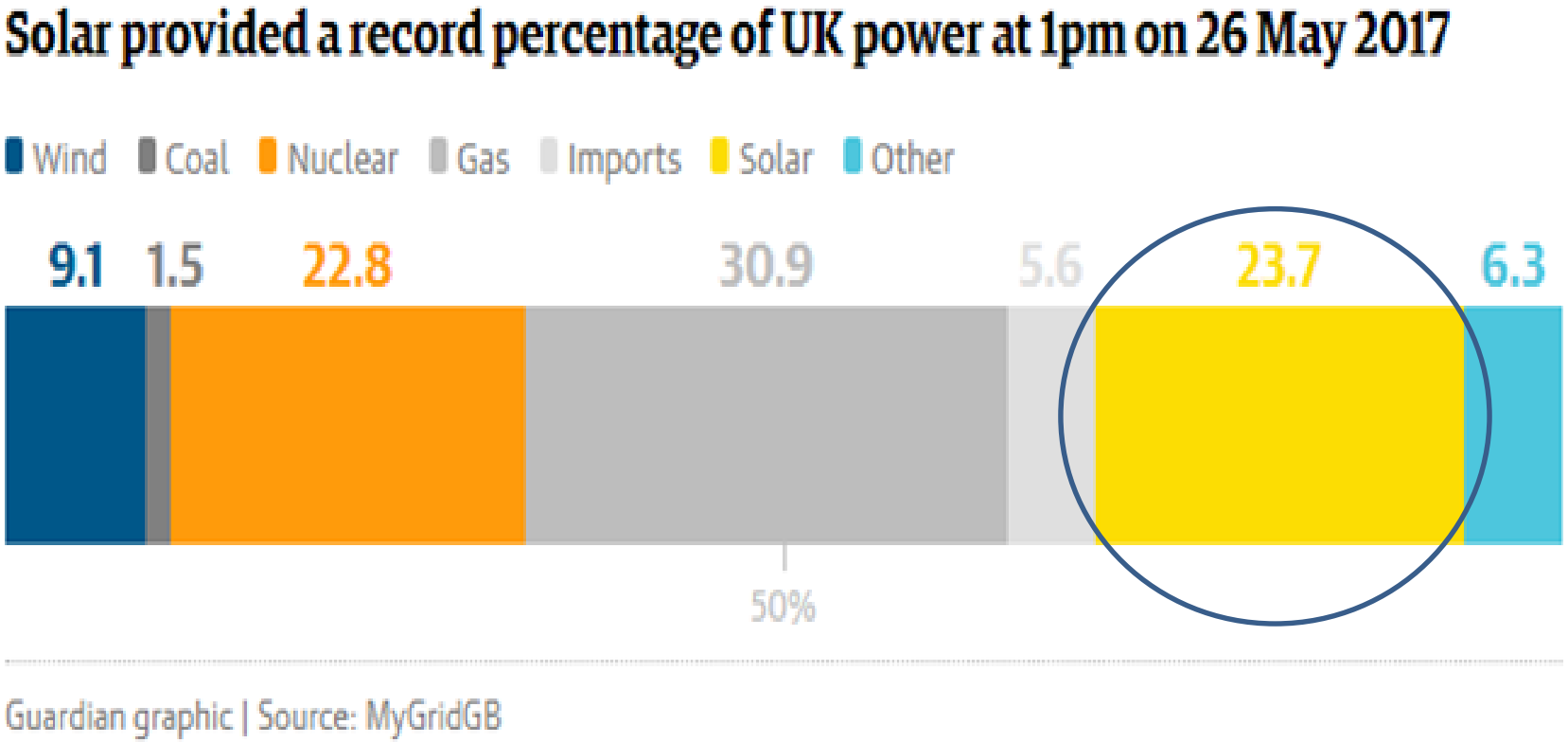
Greenwatt
sustainable solutions

Solar Power potential

Solar and other renewables will generate more than half of all electricity in the UK by the mid-2020s according to a new study by Bloomberg New Energy Finance and Eaton, which expects the cost of the technology to more than halve by 2040.

Greenwatt
sustainable solutions

Solar energy share of UK energy mix



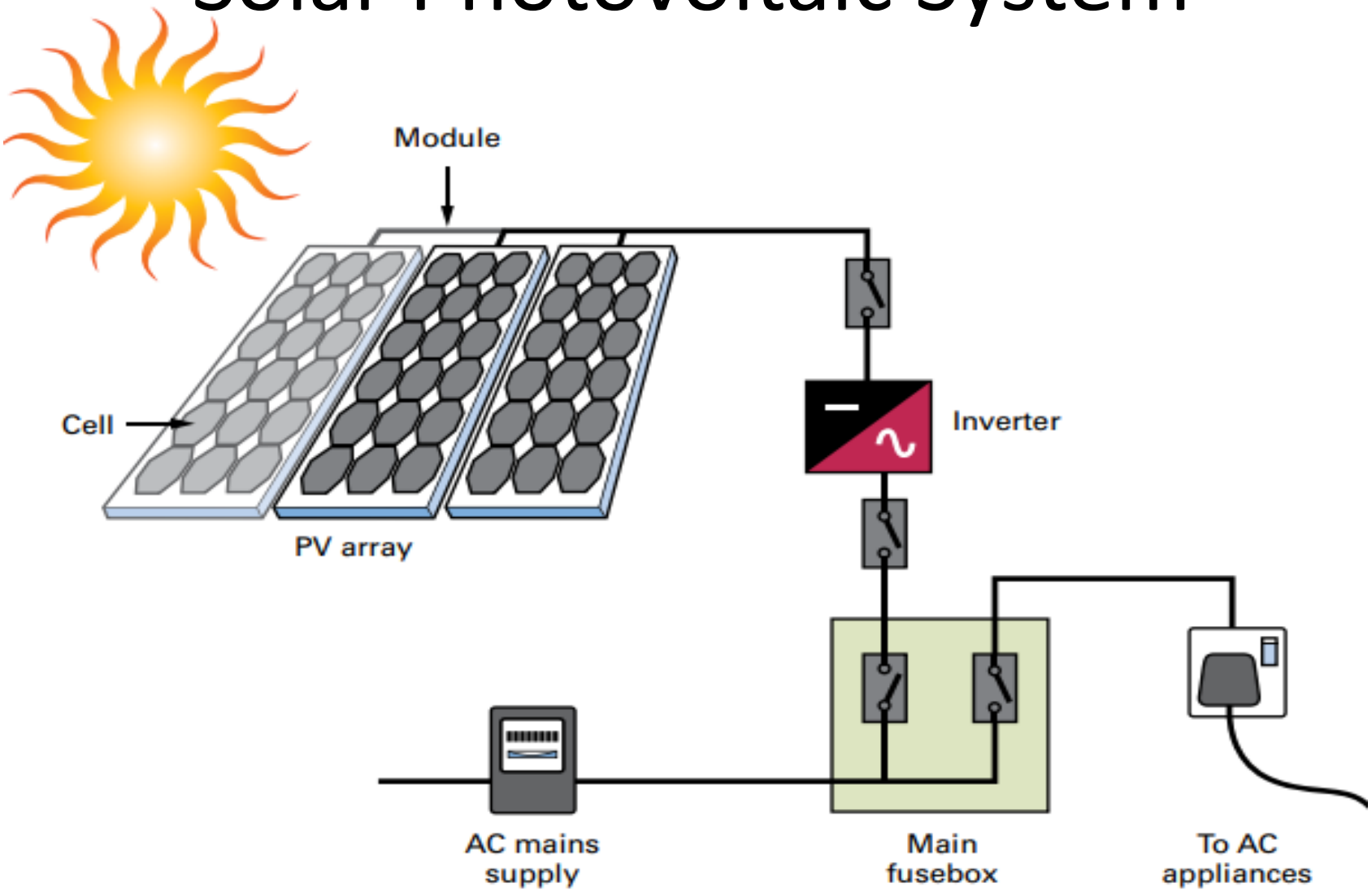
Greenwatt
sustainable solutions

Solar PV - Energy Source of Choice!

	UK (2,020 respondents)	International average (26,401 respondents)
Solar power	77%	80%
Tidal power	71%	58%
Offshore wind	70%	67%
Onshore wind	61%	64%
Sustainable biomass	53%	51%
Natural gas	34%	37%
Nuclear	31%	26%

Greenwatt
sustainable solutions

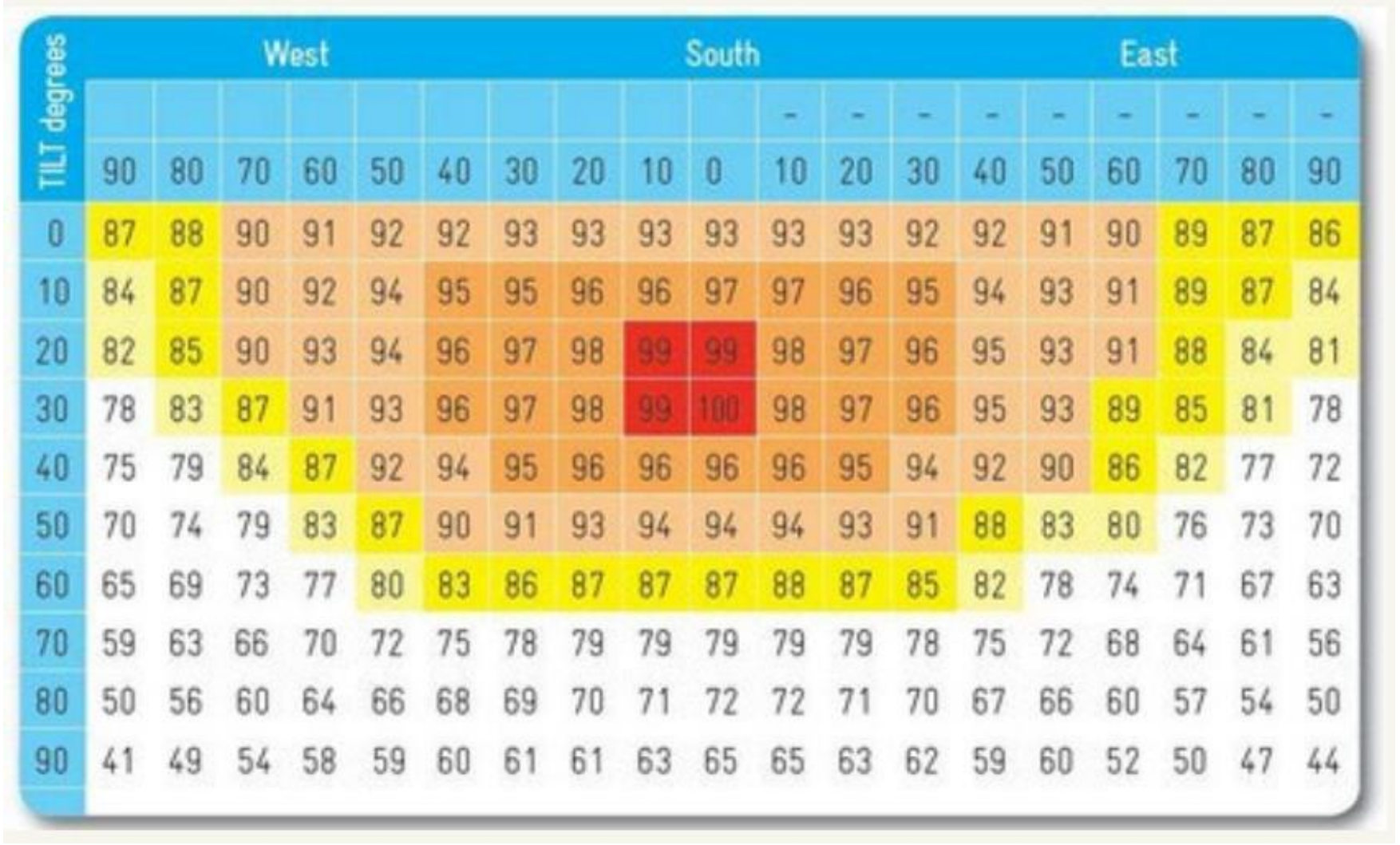
Solar Photovoltaic System



Greenwatt
sustainable solutions

The Solar Sweetspot!

Greenwatt
sustainable solutions

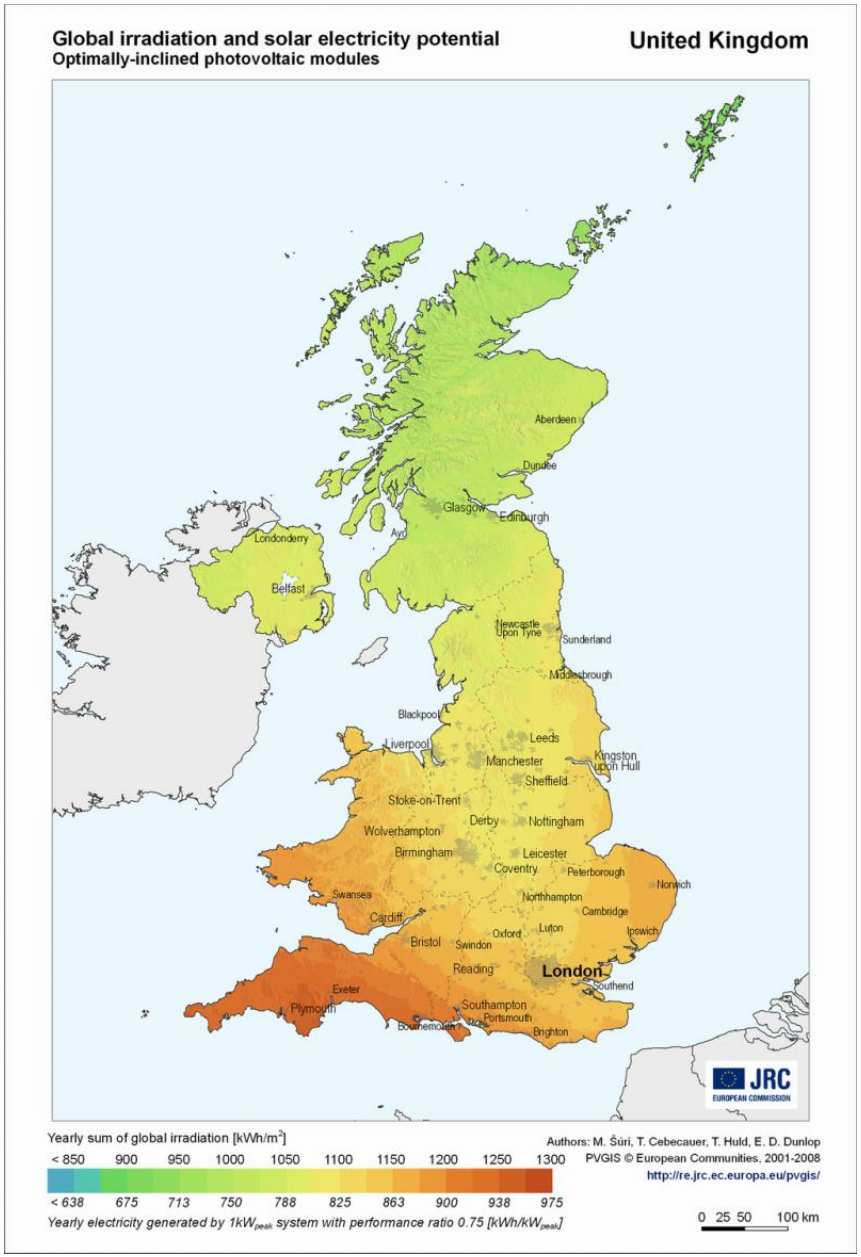


TILT degrees	West									South						East		
										-	-	-	-	-	-	-	-	-
	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90
0	87	88	90	91	92	92	93	93	93	93	93	93	92	92	91	90	89	87	86
10	84	87	90	92	94	95	95	96	96	97	97	96	95	94	93	91	89	87	84
20	82	85	90	93	94	96	97	98	99	99	98	97	96	95	93	91	88	84	81
30	78	83	87	91	93	96	97	98	99	100	98	97	96	95	93	89	85	81	78
40	75	79	84	87	92	94	95	96	96	96	96	95	94	92	90	86	82	77	72
50	70	74	79	83	87	90	91	93	94	94	94	93	91	88	83	80	76	73	70
60	65	69	73	77	80	83	86	87	87	87	88	87	85	82	78	74	71	67	63
70	59	63	66	70	72	75	78	79	79	79	79	79	78	75	72	68	64	61	56
80	50	56	60	64	66	68	69	70	71	72	72	71	70	67	66	60	57	54	50
90	41	49	54	58	59	60	61	61	63	65	65	63	62	59	60	52	50	47	44

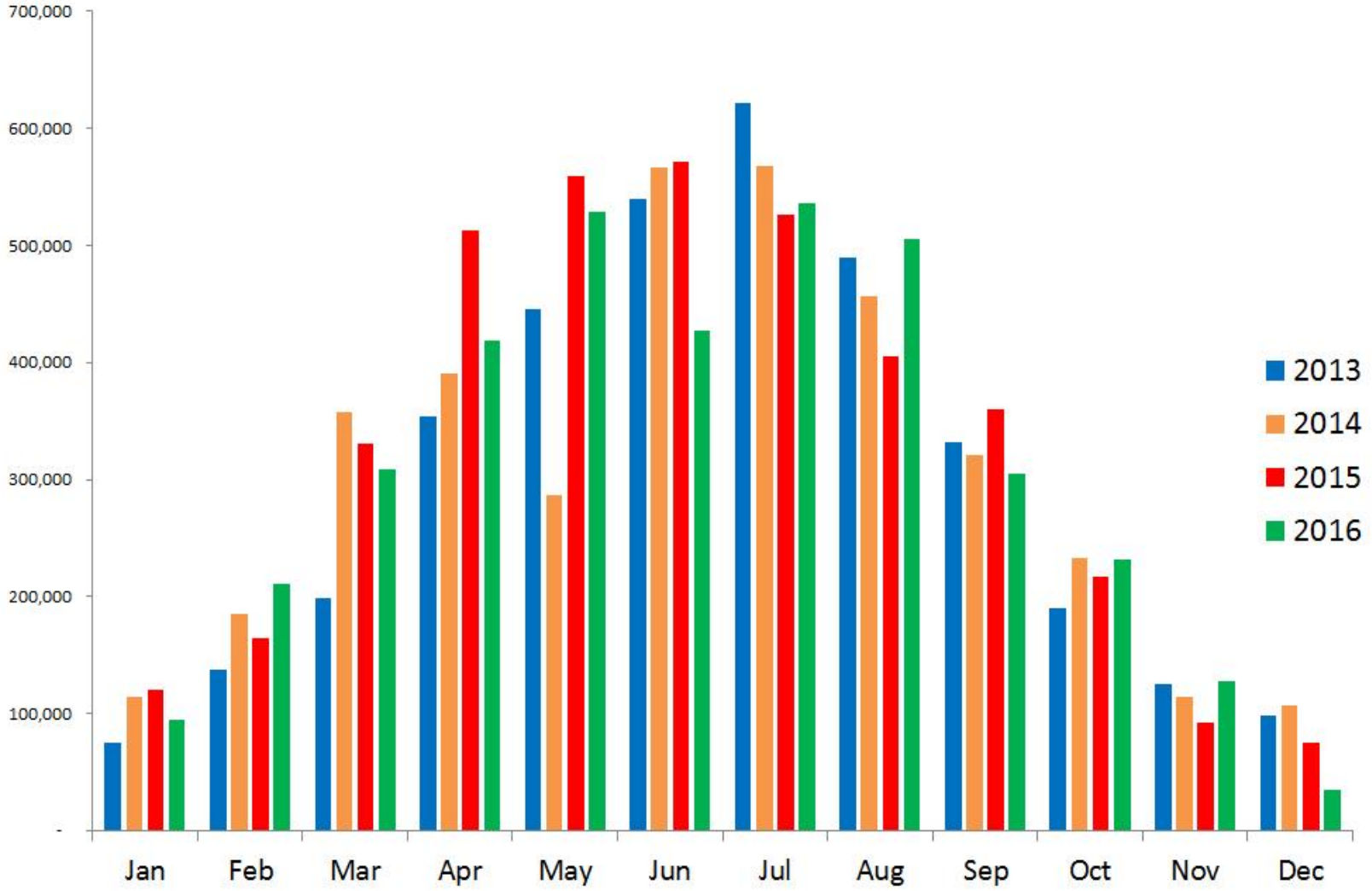
Location matters!

Location in the UK	kK factor
Land's End	1091
Oxford	984
Birmingham	935
Edinburgh	902

kK = kWh / kWp



Solar Profile Variation

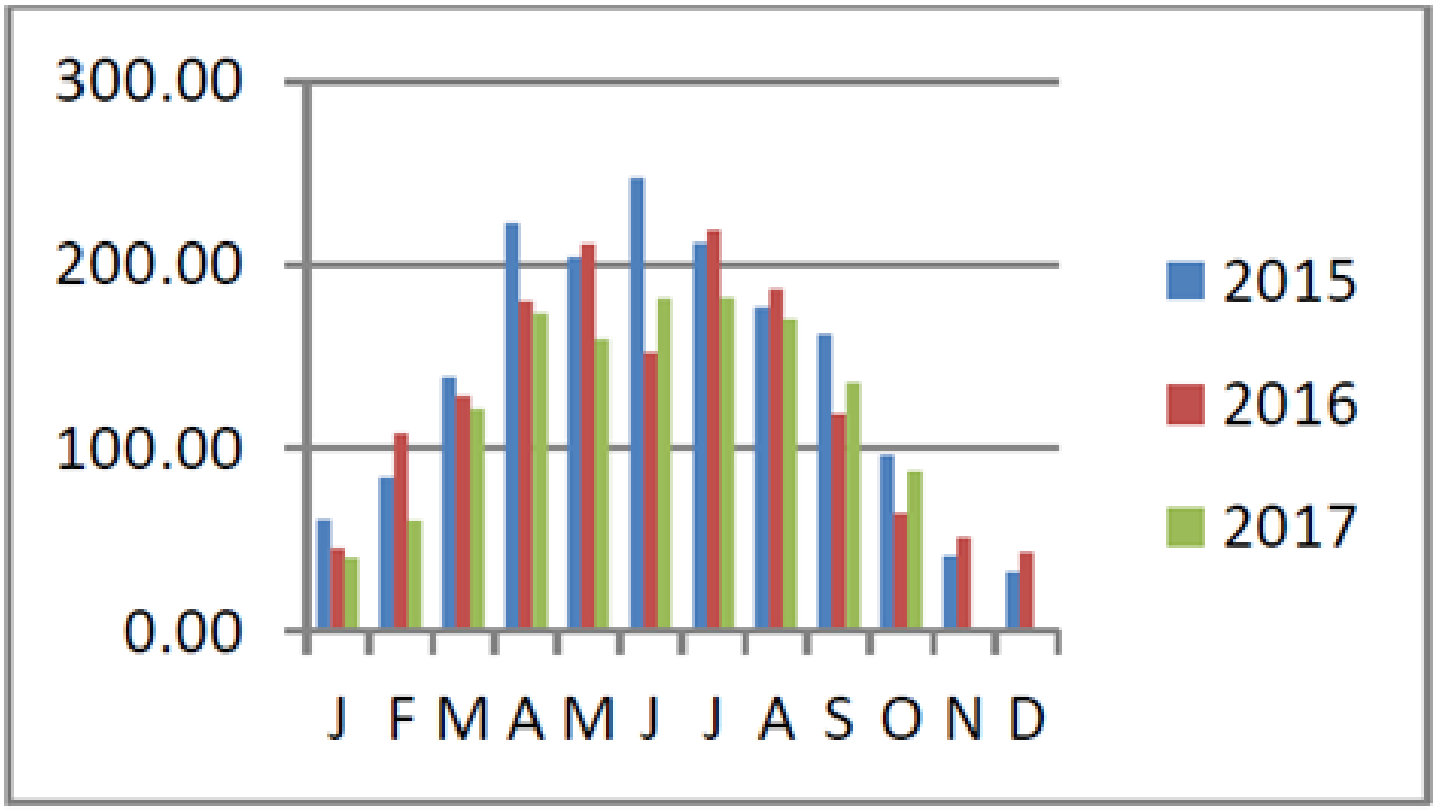


Solar Profile Variation

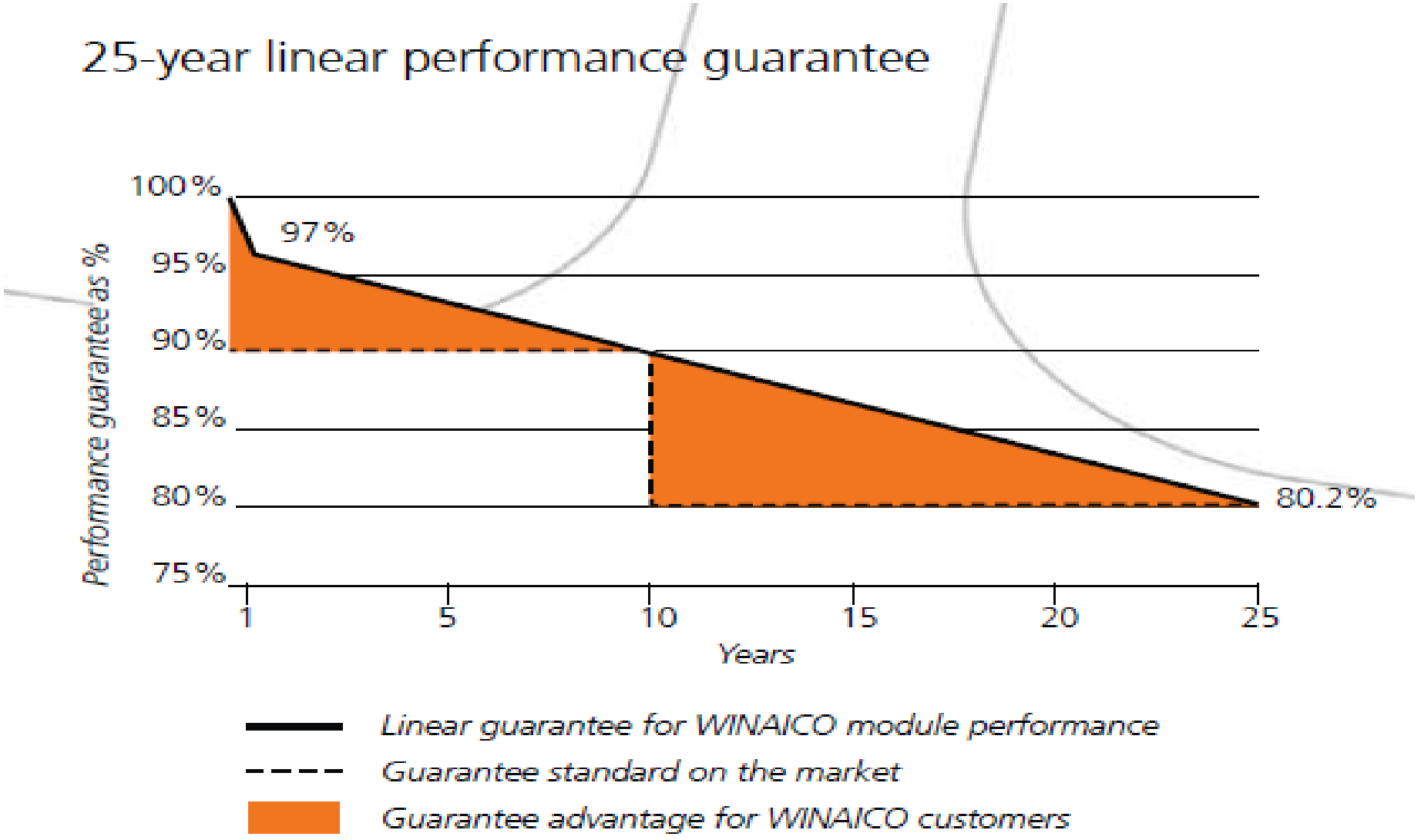
Greenwatt
sustainable solutions

Average daily output by month:

Leamington Spa – 2015-2017



Solar Panel ~ performance profile (Winaico)



Solar PV – the income stream

1. Generation Tariff on all solar electricity generated
   November 2017 10-50kWp system 4.22p/kWh
1. Export Tariff to electricity grid
   - <30kWp deemed 50:50 export:own use
   - >30kW actual export (need smart export meter)
   - export @ 5.03p/kWh (November 2017)
3. Money saved through own use of solar electricity
   e.g. 10p/kWh

Solar energy Feed In Tariff rates to Dec 2017

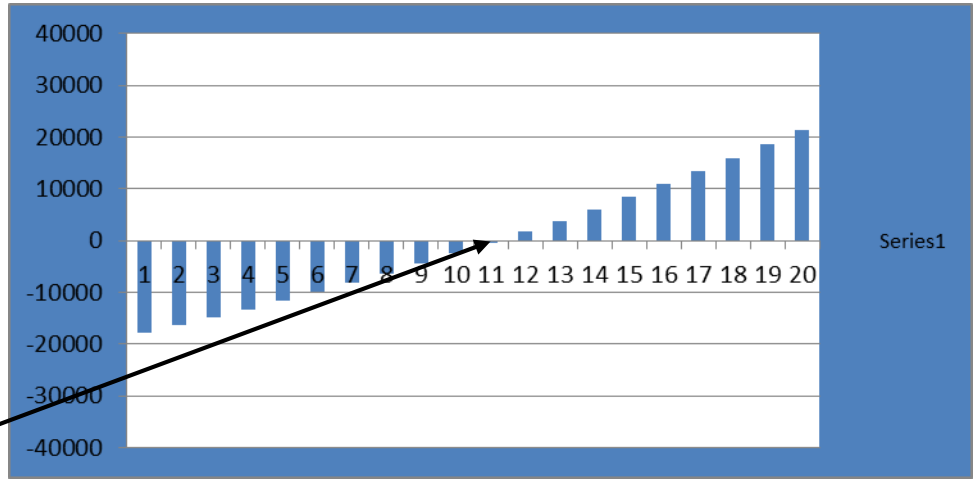
System size	Generation Tariff p/kWh	Export Tariff p/kWh
<10kWp	4.00	5.03
10-50kWp	4.22	5.03
50-250kWp	1.89	5.03

Greenwatt
sustainable solutions

Solar returns worked example
50% onsite use

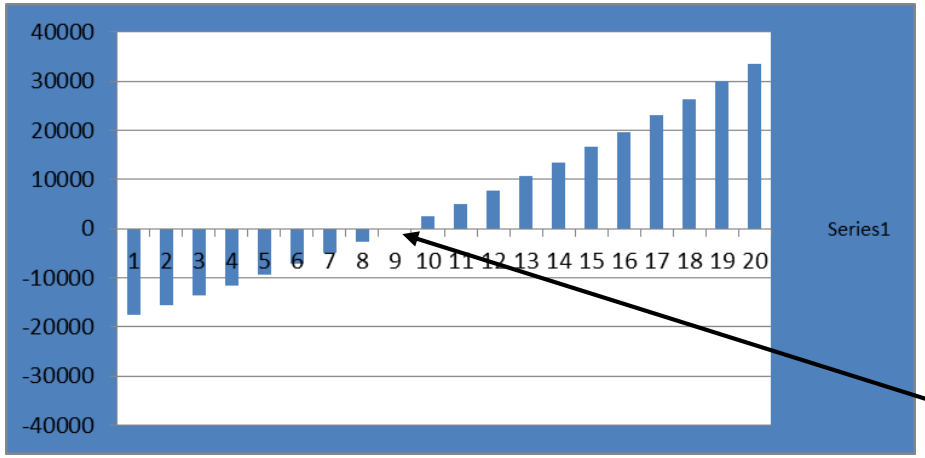
Data and Assumptions	
System size kWp	15.400
Install cost est £ ex VAT	19364
Annual generation kWh	11812
Own use % electricity	50%
% electricity export Deem	50%
FIT Generation p/kwh	0.0422
FIT Export p/kWh	0.0503
Current elec cost p/kWh	0.1151
Annual RPI % est	3.0%
Annual Elec infln % est	5.0%
IRR FIT only	0.47%
IRR FIT + elec saving	7.38%
Payback years FIT + ownuse	11.00

15.4kWp 56 panels east/west facing barn roof 15° pitch



Solar returns worked example
80% on site use

15.4kWp 56 panels east/west facing barn roof 15° pitch



Data and Assumptions	
System size kWp	15.400
Install cost est £ ex VAT	19364
Annual generation kWh	11812
Own use % electricity	80%
% electricity export Deem	50%
FIT Generation p/kwh	0.0422
FIT Export p/kWh	0.0503
Current elec cost p/kWh	0.1151
Annual RPI % est	3.0%
Annual Elec infln % est	5.0%
IRR FIT only	0.47%
IRR FIT + elec saving	10.55%
Payback years FIT + ownuse	9.00

Solar PV – what are the costs

- Independent feasibility? = £400 + VAT
- The solar PV system
  - 4kWp system = approx £ 6,000 + VAT
  - 10kWp system = approx £12,000 + VAT
  - 50kWp system = approx £50,000 + VAT
- Plus cabling and trenching ....
- Structural survey = £250 - £500 + VAT
- DNO approvals G59 = £250 - £400 + VAT
- EPC = £200 - £300 + VAT
- VAT on installation (domestic 5% inc; commercial 20%)
- VAT payable on export kWh only not generation.
- NB Build inverter replacement into 20year cashflow!

Solar PV – is it worth it?

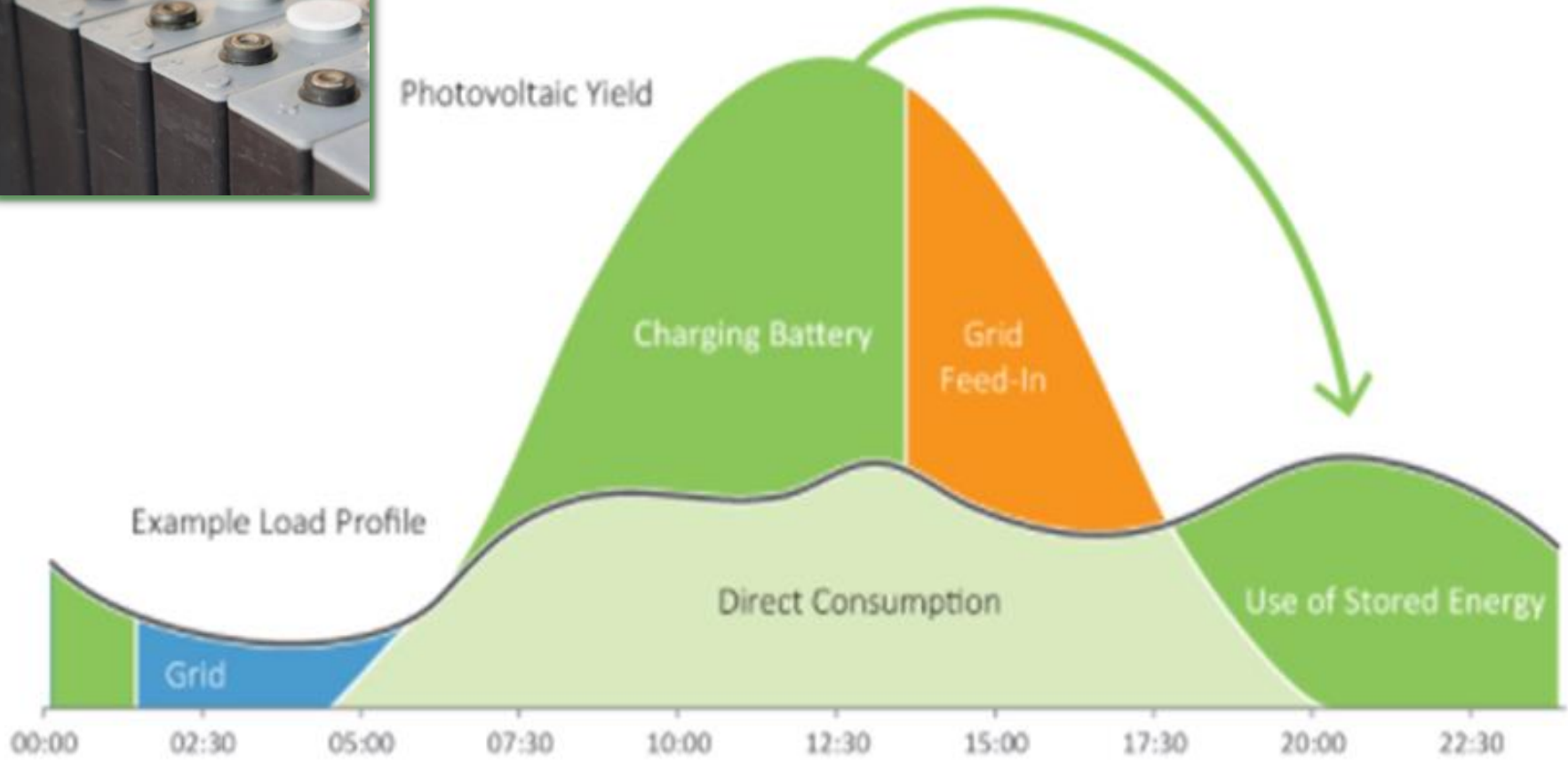
- **If using 50% or more – probably so!**
- **If using 50% or less – less so!**

Improving returns on solar:

1. Ensure **solar panel efficiency** maintained e.g. regular service checks; washing
2. **Store** solar power and use 24/7 i.e. 100%
3. Bring in **additional uses of power** e.g. electric vehicles; new enterprises

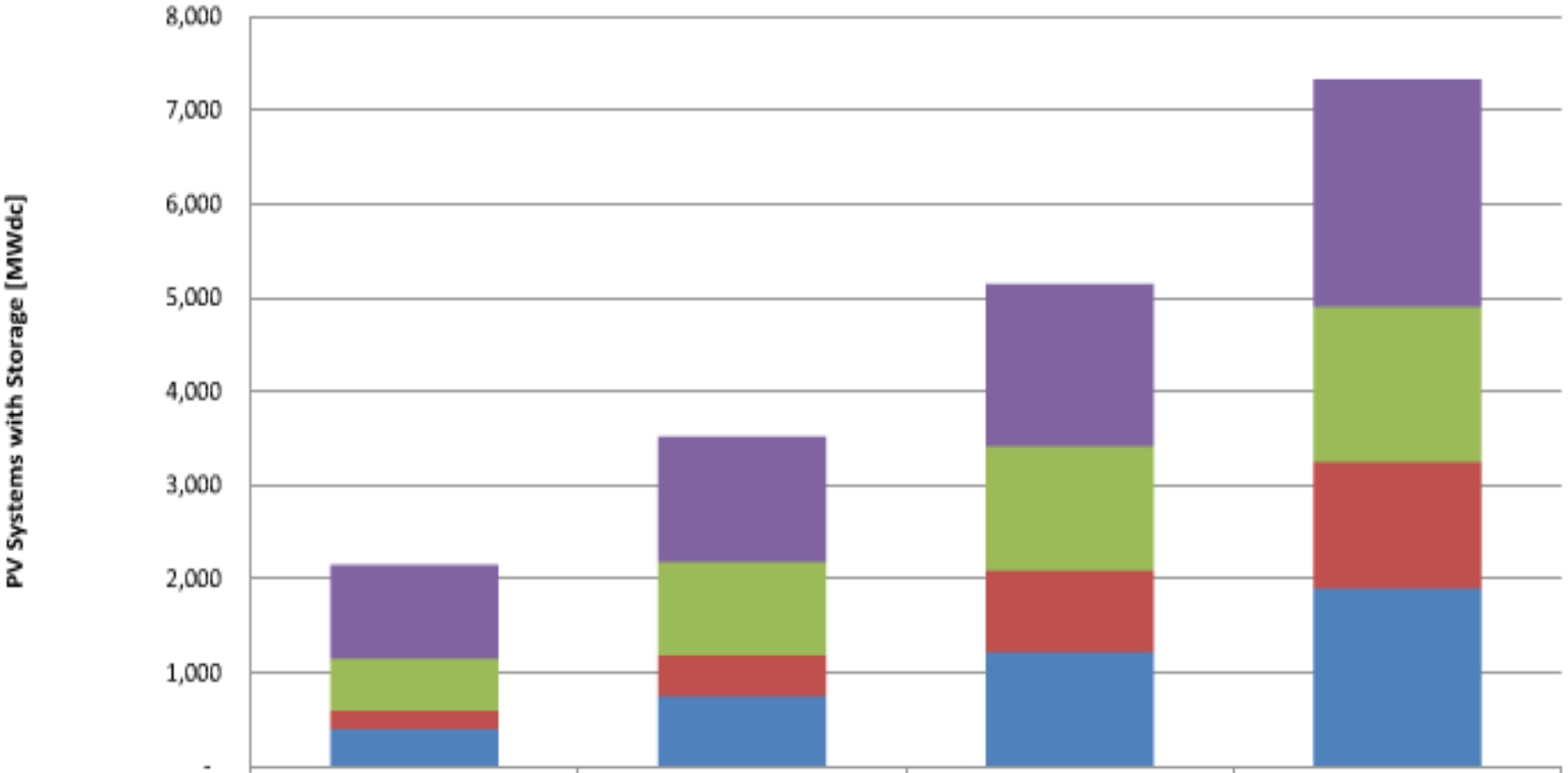
Solar energy – storage potential

https://youtu.be/yxc2y1mcwEM



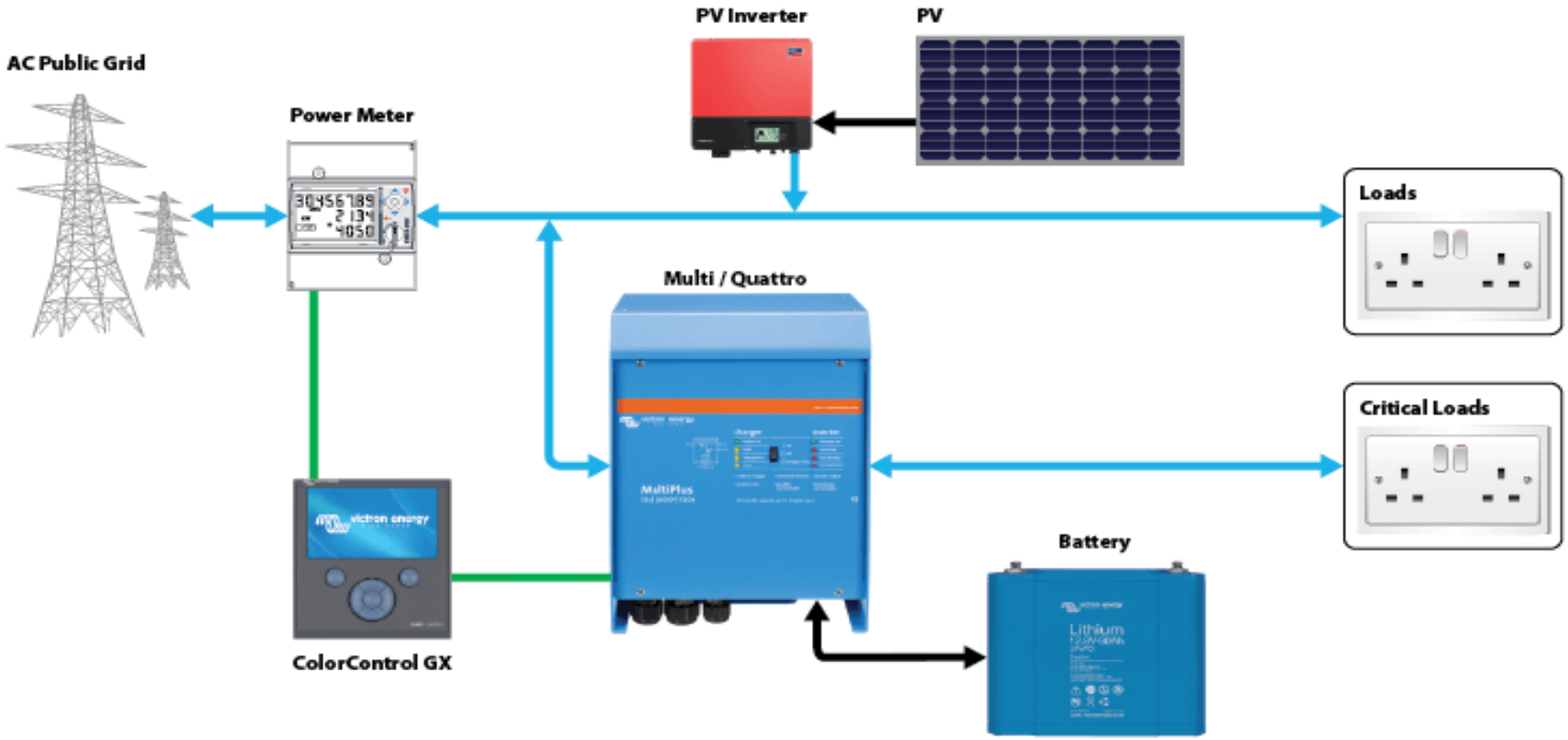
Greenwatt
sustainable solutions

Battery Storage Trends



	2015	2016	2017	2018
Off-Grid	1,009	1,342	1,736	2,424
On-Grid Utility	552	993	1,325	1,653
On-Grid Commercial	195	437	875	1,346
On-Grid Residential	396	748	1,213	1,900

Victron Self-consumption and Back-up battery system (Hub-4)



Solar energy – storage potential

Greenwatt
sustainable solutions

Solar energy – the future?

Greenwatt
sustainable solutions

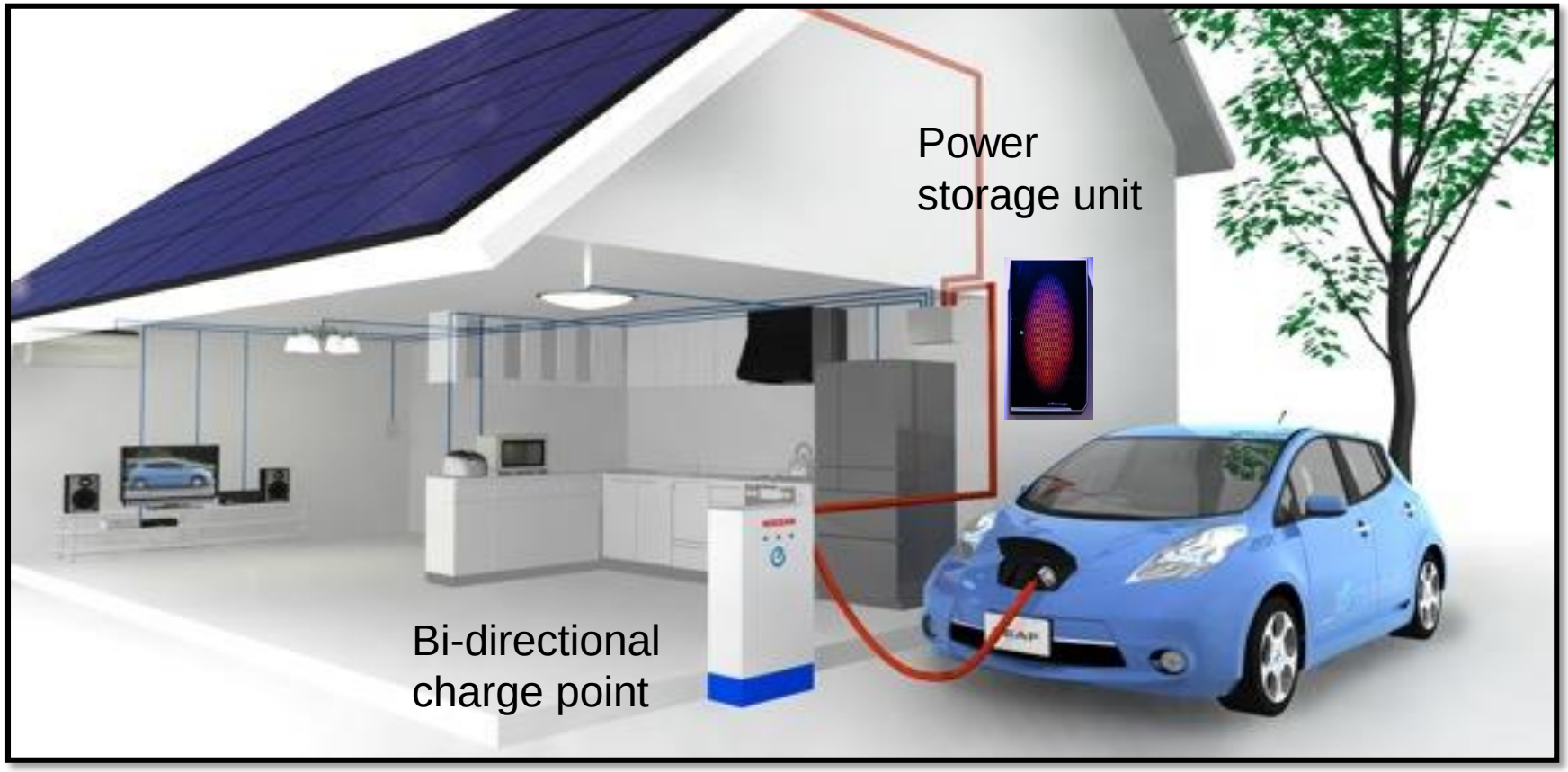
Solar energy – the future?

Solar energy – the future?

Greenwatt
sustainable solutions

Solar energy – the future?

Integrated solar PV, storage and Electric vehicle systems



EVs for grid balancing at peak load.
Storage - a (big) battery on wheels!

Nissan Leaf – 30kW battery enough power for a 3-bed house for 2 days!

Thank you very much for your attention

mike@greenwatt.co.uk