



Solar PV Update

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Low carbon buildings and microgeneration
Session 2 - Solutions



The Present

- At the end of 2008, cumulative global PV installations reached 16GW
- 13GW grid-tied, 9.5GW of which in EU
- UK ~ 20MW installed capacity
- ROO 2009: Banding introduced as of 1 Apr 09, so Solar PV now 2 ROCs per MWh
- SSE paying export rate of £0.28 per kWh
- Manufacturing cost now under magic figure of \$1 per Watt





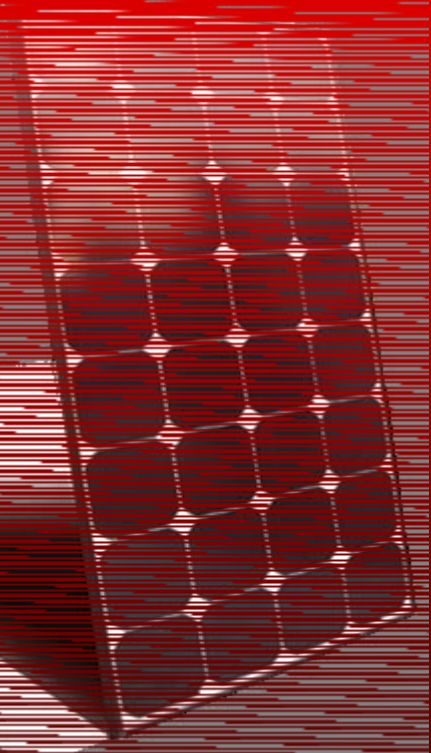
Solar PV Perception

- “Solar panels.....in Scotland ?”
- “Solar pv only makes sense in areas of high insolation, Africa, perhaps lower states of US”
- “Solar only financially viable in the UK because of heavy subsidy”
- Covering 3% of the Sahara with PV would supply present world electricity demand
- Domestic PV installations future-proof against hikes in energy prices
- Increase value of property
- Useful life 25yrs+
- Key component in a renewable energy mix



Crystalline Silicon PV

- Mono-crystalline and poly-crystalline silicon still common choice for most pv installations
- Typical efficiencies around 17% for mono and 12% for poly
- Under \$2 per Watt - typical payback times of 8-12yrs in UK
- 3kWp domestic PV system can meet the electricity needs of energy efficient household (<2800kWh per annum)
- HIT (Heterojunction with Intrinsic Thin Layer) cells – Sanyo claim 23% efficiency in lab



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Thin Film PV

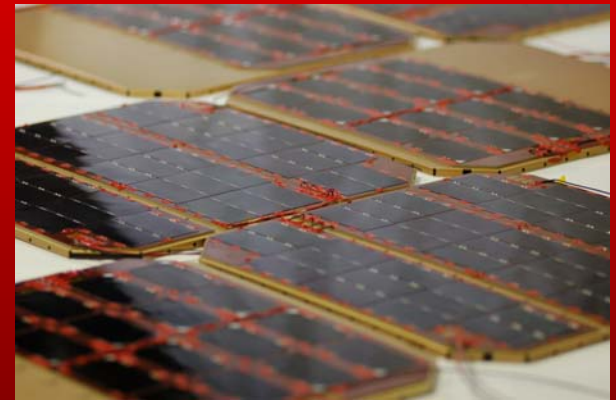
- Thin Film can use <math><1\%</math> of the expensive material used in wafer based pv cells
- Flexible, even rollable, lightweight
- Require sophisticated and expensive production lines
- NREL still hold record of 19.9% on CIGS – ZSW achieve 19.6%
- CdTe is easier to deposit – better suited to large scale production – but toxicity still argued
- First Solar aiming to slash \$1 per Watt cost





Multi-junction PV

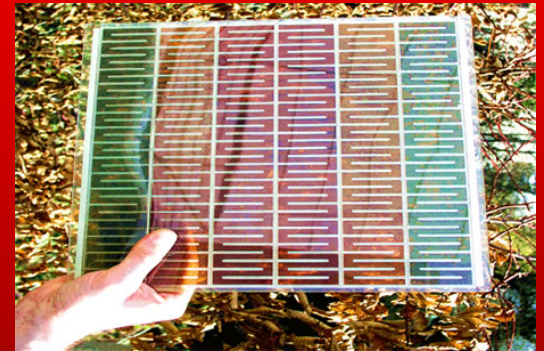
- Multiple junctions each with a different band gap to absorb specific sections of the solar spectrum leading to greater cell efficiency.
- 30% efficiency barrier broke in 1994 at NREL and now 40.8% (measured at 326x)
- Used in space and large concentrated PV
- Cost prohibitive for domestic PV





Dye Solar Cells (DSC)

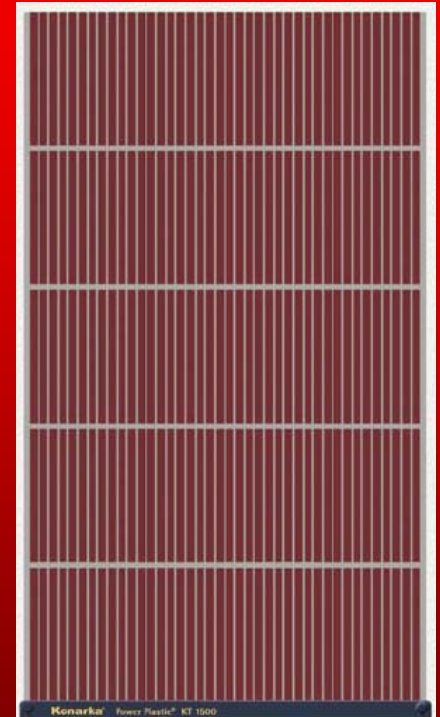
- Invented in 1988 by Professor Michael Graetzel
- Layer of titanium dioxide particles impregnated with dye
- Low-cost materials, low-cost manufacturing
- Efficiencies of over 10% in lab
- Claimed more efficient than silicon and thin film in low light
- Attractive for low density applications, e.g. BIPV
- DSC degrades from UV radiation
 - UV stabilizers and/or absorbing chromophores
- Not fully commercialised yet





Polymer Solar Cells

- Mostly in research phase in universities and national laboratories
- Lightweight and inexpensive to fabricate
- Current efficiency around 5%
- Perform well on cloudy days
- Can be used indoor also
- Not really commercialised yet, except Konarka





Feed In Tariffs (FIT)

- European countries with long-term FIT include Germany, France and Spain
- UK implementation in 2010 FIT - £0.40 per kWh for PV ?
- Drive up green jobs market
- Colin Challen MP tabled EDM 689 in Feb 09, urging Government to push solar PV in Renewable Energy Strategy due this Spring.





Building Integrated PV

- Crystalline cells commonly used at present
- Thin films likely to be used more
- DSC and/or Polymer Cells targeted for future BIPV
- FIT weighted towards BIPV in some countries



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Remote Off-Grid Power

- Generation of power increasingly sought at point-of-use in remote areas
- Organisations keen to reduce frequent site visits to recharge batteries in off-grid locations
- Solar CCTV solution for Grampian Water to monitor fly-tipping in a remote location





The Future

- Future cell efficiencies >50%
- Thin film will gain increasing market share
- 2009 – new installations predicted at 3.5GW, down from 5.2GW in 2008
- UK Government will introduce Feed In Tariffs in 2010 – expect domestic solar pv installations to increase
- Grid parity 2013 – 2015 ?