Arcing in PV arrays

Martin Cotterell – Sundog energy Ltd

Note: Photos in this presentation are from various sources. Many photos have nothing to do with the BP recall process, or even PV.

Sundog energy have been installing systems since 1995

Hundreds of systems installed across the UK
Sundog energy accredited installation partners for companies including BP Solar

Over 1 year has now passed since notification of BP “precautionary disconnection” ...

Much achieved, however scale of problem means that Sundog energy still has 80+ systems still switched off awaiting remedial works.

Huge impact on Sundog energy – massive investment in time and energy to address the problem. Presently, 3 staff dedicated to the programme – with close co-operation with BP.

So far - no sign of arcs found in any of the Sundog energy systems inspected.
The bigger picture

Module issues:
• Sources of module arcs
• Consequences
• Testing/inspection
• Remedial works
• Prevention

Related issues:
• Array design (voltage, strings, etc)
• String fusing
• Connectors
• Cables
• Earthing
• Installation practice

➢ BP problem – or industry problem?
➢ Standards problem - or quality problem?

Module hotspots

Failure in junction box
• High resistance fault in junction box
• Results in overheating
• Results in further increase in resistance
• Results in arc
• Arc only halts when irradiation level falls significantly, or contact burnt out

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Module hotspots

Failure at joints

- High resistance fault within laminate
- Results in overheating
- Results in further increase in resistance
  etc

Consequences

System stops working

Glass shatters – roof / facade leaks

Glass shatters – module falls

Fire – limited to immediate array area

Fire – major (spreads beyond array)
Consequences?

System stops working
Should be obvious to system owners!

Glass failure
For integrated systems:
- Leaking roofs / facades?
Consequences?

Glass failure

➢ Falling debris most serious consequence?

More serious for some locations and types of installations?

Fire

Arc causes local fire

Fire spreads beyond array?
Fire spread beyond PV array?

What is the material directly behind the array?
- Wood?
- Bitumen?
- Plastic / Rubber?

Spread of flame:
- Direct
- Flaming droplets?

Testing / inspection

Visual inspection:
- Obvious failures
- Brown spots / scorching
- Inspection of rear & front
**Testing / inspection**

**IR test**

Hotspots should be obvious

Connect module to power supply to simulate operating conditions?

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**Testing / inspection**

IV Curve irregularities?
Remedial works

Remove, inspect & test

Install fire barrier where flammable materials beneath array?

Fire barrier beneath whole module, or just beneath junction box zone?

Barrier must be fit for purpose – prevent spread of flame for the maximum possible duration & intensity of arc

Prevention

- Module standards?
- Installation standards?
- Requirements for facades?
- Requirements for integrated systems?
- Fire barriers?
- Arc detector?
BP problem – or industry problem?
Standards problem - or quality problem?