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Arcing in PV arrays

Martin Cotterell – Sundog energy Ltd



Arcing in PV DC-Arrays

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



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Sundog energy have been installing systems since 1995

Hundreds of systems installed across the UK



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Sundog energy accredited installation partners for companies including BP Solar

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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.

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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?**

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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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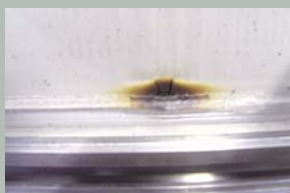




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Module hotspots



Failure at joints

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

etc

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Consequences



System stops working

Glass shatters – roof / facade leaks

Glass shatters – module falls

Fire – limited to immediate array area

Fire – major (spreads beyond array)



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Consequences ?



System stops working

Should be obvious to system owners!

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Consequences ?



Glass failiure

For integrated systems:

- Leaking roofs / facades ?

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Consequences ?



Glass failiure

➤ Falling debris most serious consequence ?

More serious for some locations and types of installations?

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Consequences ?



Fire

Arc causes local fire

Fire spreads beyond array ?

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Fire spread beyond PV array?



What is the material directly behind the array?

- Wood?
- Bitumen?
- Plastic / Rubber?

Spread of flame:

- Direct
- Flaming droplets?

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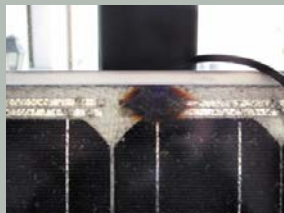
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Testing / inspection



Visual inspection:

- Obvious failures
- Brown spots / scorching
- Inspection of rear & front



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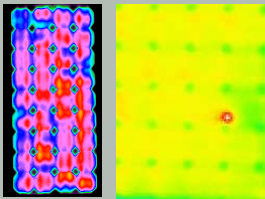
Testing / inspection



IR test

Hotspots should be obvious

Connect module to power supply to simulate operating conditions?



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Testing / inspection



IV Curve irregularities?

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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

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Prevention



- Module standards?
- Installation standards?
- Requirements for facades?
- Requirements for integrated systems?
- Fire barriers?
- Arc detector?

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