SOLAR TRADE ASSOCIATION

O&M WORKING GROUP DELIVERABLES

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TO OUR O&M WORKING GROUP DELIVERABLES

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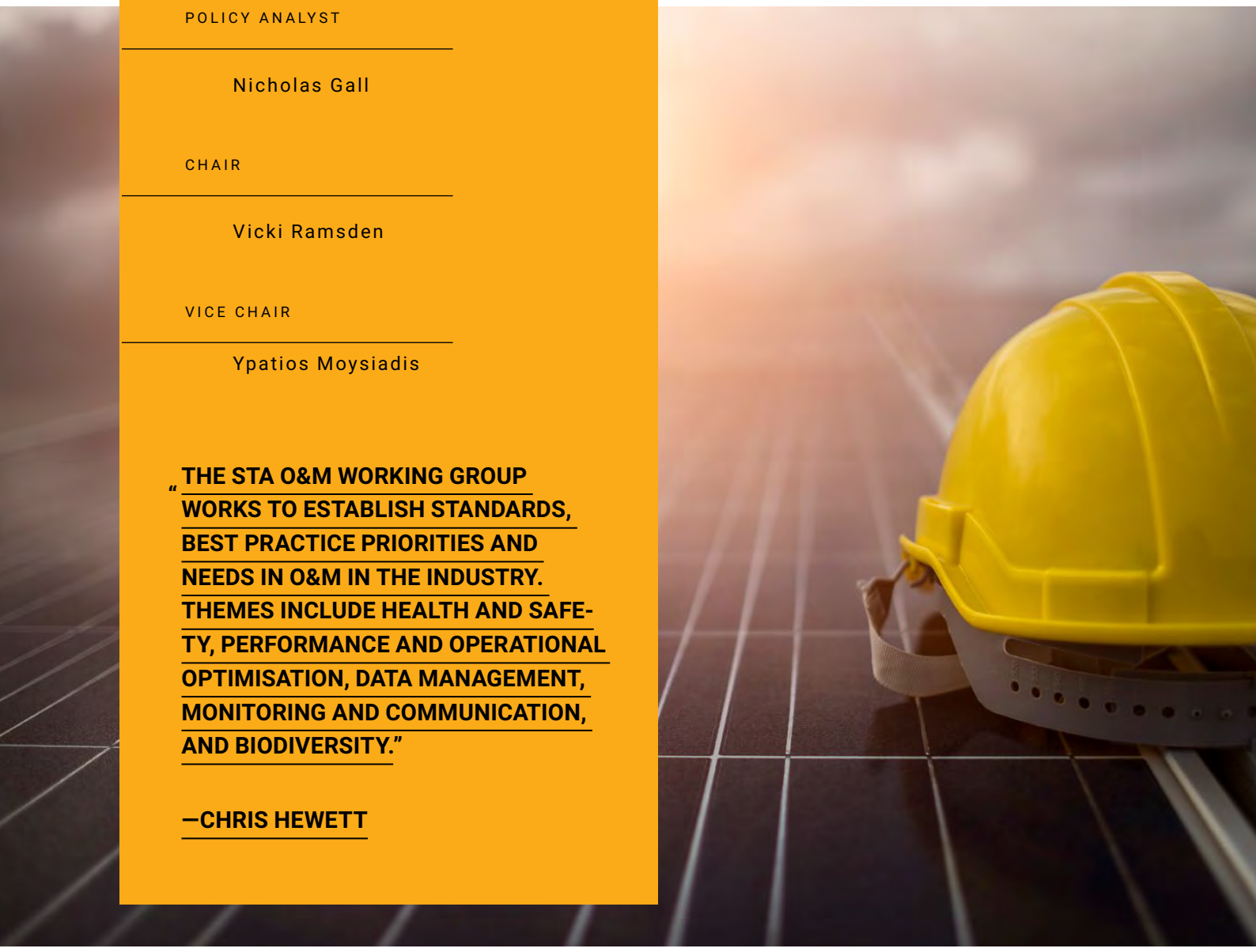

“THE STA O&M WORKING GROUP WORKS TO ESTABLISH STANDARDS, BEST PRACTICE PRIORITIES AND NEEDS IN O&M IN THE INDUSTRY. THEMES INCLUDE HEALTH AND SAFETY, PERFORMANCE AND OPERATIONAL OPTIMISATION, DATA MANAGEMENT, MONITORING AND COMMUNICATION, AND BIODIVERSITY.”

—CHRIS HEWETT

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INTRODUCTION MESSAGES

CHRIS HEWETT

CHIEF EXECUTIVE, SOLAR TRADE ASSOCIATION

From aerial thermography to module cleaning, high-quality O&M is integral to the success of any solar PV development, and to our industry as a whole. On behalf of the Solar Trade Association, I extend my sincere thanks to Ypatios Moysiadis and Vicki Ramsden for their leadership of the O&M Working Group over the past two years, and to all our O&M members who continue to contribute to making this Working Group a success.

VICKI RAMSDEN

WISE ENERGY – SMART RENEWABLES SERVICES
VICE-CHAIR OF O&M WORKING GROUP, 2016-18

In less than ten years' time, solar has gone from zero to 4% of the UK's electricity supply. With this remarkable pace of growth, it's easy to lose sight of the fact that ours is still a very young industry. That's why the work of the O&M Working Group in collaboratively developing and promoting industry standards and best practices is so important in driving our industry forward.

YPATIOS MOYSIADIS

VICE CHAIR STA - BUSINESS DEVELOPMENT DIRECTOR

It's been an honour and a privilege to work for the last two years, alongside such a diverse group of smaller and larger O&M service providers, as well as specialised companies that form the backbone of the solar industry in the UK. Without their perseverance and hard work on a daily basis, under harsh and difficult conditions the solar industry would not be able to operate.

GUY AUGER

CHIEF EXECUTIVE, GREENSOLVER

The Greensolver team strives to be at the forefront of the Renewable Energy Industry. We actively participate in major national and international bodies helping shape the policies, drive standardisation and disseminate Best Practises. We proudly sponsor the work of the STA.

CONTRIBUTORS

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SECTION 1: O&M Best Practice Guidelines for Contractors and Clients

MODULE CLEANING

OVERVIEW

This document aims to provide best practice guidelines for those cleaning or managing the cleaning of commercial scale solar installations in the UK and ROI. The information recorded herein is not intended to be an exhaustive list. It must be stressed that all contractors and workers are responsible for ensuring they follow relevant legislation and codes of practice.

DEFINITIONS

Contractor(s): A person or firm that undertakes a contract to provide materials and/ or labour to perform a service or do a job.

Worker(s): A person working for or under the control of a contractor.

Client(s): A person or organisation that receives a service in return for payment.

1. Health and Safety

Those contracted to undertake works on solar installations should be able to demonstrate sound Health and Safety (H&S) performance. It is recommended that all contractors meet an internationally recognised standard of H&S management through BS OHSAS 18001/ ISO 45001 certification or equivalent via SafeContractor/CHAS accreditation/ approval.

All workers must have received H&S training specific to the dangers of operating on/ around solar installations. This can be provided in-house by a competent person or externally via a third party.

Emergency action plans, First Aid kits and trained First Aiders should be provided for workers whilst on site.

H&S documentation must be available to all workers whilst on site. Employers are required, by law, to either display the HSE-approved law poster or to provide each of their workers with the equivalent leaflet.

Suitable and sufficient risk assessments must be carried out by a competent person. Contractors should have a designated H&S representative and receive an induction from a site manager prior to conducting works.

It is a legal requirement for all employers to have Employers' Liability Insurance. In addition, it is recommended that all contractors working on solar installations have a minimum of £10M Public and Product Liability Insurance.

Clients must exercise due diligence when selecting a contractor. It is recommended that clients request and scrutinise risk assessments, safe systems of work/method statements, training records and insurance policies. Clients should use an experienced, reputable contractor who follows STA Best Practice guidelines.

Should any contractor or worker deem a site or job unsafe they should cease activities pending further discussion/investigation. Health and safety must never be compromised.

SECTION 1: O&M Best Practice Guidelines for Contractors and Clients:

MODULE CLEANING

2. Module Cleaning

Panels should be cleaned regularly. A build-up of dirt on the surfaces will affect the output of the system and subsequent removal of severe soiling may damage the panels. Allowing lichen and bird faeces to accumulate on solar modules may degrade the glass surface via both chemical and mechanical action. Uneven soiling may also cause localised hot-spot failures.

To optimise output and maintain asset value in the long-term panels should be cleaned at least annually, best practice would see sites regularly monitored and output data analysed. Some sites may require cleaning more frequently if subject to heavy soiling.

Purified water should be used to clean solar modules. Raw water contains impurities that will adhere to panel surfaces and depending upon the source may also contain material in suspension. Best practice is to use water purified to less than 10ppm impurities. High pressure water should not be sprayed directly onto solar panels as this may damage modules and is likely to invalidate warrantees.

Cleaning thin-film panels may expose workers to increased risks of electrocution. In these instances, isolation of panels prior to commencing works or cleaning at night should be considered. Refer to manufacturer guidelines for additional information.

Only equipment specifically designed for module cleaning should be used to clean panels.

All machinery used on site must be fit for purpose. Contractors should ensure that workers operating machinery are properly trained and equipped. When operating around moving vehicles, high-visibility clothing should be worn.

When cleaning rooftop systems workers must be Working at Height trained (unless cleaning from the ground via long-reach pole or similar). When cleaning floating systems workers should wear buoyancy aids. Inflatable lifejackets may cause entrapment risks.

3. Environmental Management

All contractors should take care to minimise any negative effects their operations have on their surroundings and comply with legal requirements relating to the environment. Contractors should monitor and review their operations with a view to reducing environmental impacts in the long term.

Ground conditions should be considered when deciding upon dates for cleaning and type of machinery to be used. If sites are wet, specialist wheeled or tracked machinery should be used to reduce damage to sites. Landscape, agricultural and ecological management plans should be reviewed by clients prior to commencing works. Contractors should be informed of any specific conditions which they must obey.

Weather conditions should be monitored throughout operations. Panels should not be cleaned during thunder/ lightning storms due to increased electrocution/ fire risk or during high winds due to risk of panels becoming dislodged and injuring workers.

Chemicals should only be used to clean panels as a last resort in circumstances where stubborn dirt or contaminants cannot be removed by purified water alone. Manufacturer guidelines should be consulted prior to use as chemicals may invalidate panel warranties.

Considerations should be made by contractors relating to spillage of chemicals and fire control. Care must be taken to ensure chemicals do not enter water courses and where petrol/diesel is used spill kits and fire extinguishers should be on hand.

SECTION 2: O&M Best Practice Guidelines
for Contractors and Clients

UAV AERIAL THERMOGRAPHY & PHOTOGRAPHY

OVERVIEW

This document aims to provide best practice health and safety guidelines for those carrying out aerial inspections of commercial scale solar installations in the UK. The information recorded herein is not intended to be an exhaustive list. It must be stressed that all Operators are responsible for ensuring they operate within the bounds of UK Law.

DEFINITIONS

CAA: Civil Aviation Authority

UAV: Unmanned Aerial Vehicle

SUA: Small Unmanned Aircraft

NQE: National Qualified Entity

ATC: Air Traffic Control

ANO: Air Navigation Order

NOTAM: Notice to Airmen

RAMS: Risk Assessment & Method Statement

1. Qualification, licensing and insurance

All commercial drone operations should be carried out by an approved operator who has permissions from the CAA to carry out commercial operations using an UAV/SUA. This permission takes the form of a PfCO (Permissions for Commercial Operations). The approved operator must also have insurance cover which meets the requirements of EC Regulation No. 785/2004. All UAV Operators must hold a current UK NQE SUA pilot license. All flight operations need to adhere to the ANO 2016.

SECTION 2: O&M Best Practice Guidelines for Contractors and Clients:

UAV AERIAL THERMOGRAPHY & PHOTOGRAPHY

2. Pre-inspection planning

Before any operations can take place, each flight must be thoroughly planned from a logistics, regulatory and safety perspective. The output from this planning activity will take the form of RAMS document. The following areas need to be covered in the RAMS document:

- Airspace checks – Restricted or prohibited areas, Danger zones, other aerial activity, local air traffic control and NOTAMS.
- Site setting risk assessment – Overhead power lines, masts, public footpaths, railway lines, highways, property and people.
- Inspection methodology and flight plans – Flight zone duration, battery considerations, take-off point, height and speed.

The RAMS document should be issued to the client ahead of the onsite works for approval.

Any prior permission required to operate at the site should be arranged well ahead the aerial works. Sites which may require prior permission can include local ATC, Prisons, Military and other critical infrastructure facilities close by.

3. Carrying out the inspection

The UAV Operator will usually be responsible for selecting a day when the weather conditions will enable the aerial work to be safely carried out. For aerial thermography, the irradiance level is a critical factor in ensuring accurate and high-quality data and imagery is collected. For all aerial operations, wind strength is also a key consideration. Limits are typically set by the UAV equipment to be used as well as the Operators own policies.

- Before any aerial work can start on site, a UAV Operator will require site induction by the client's O&M provider. The UAV Operator will should then carry out an onsite risk assessment and record the findings in a flight log. This onsite risk assessment should validate all hazards identified during the pre-inspection desktop phase as well as identify anything not already identified. Any alterations to the flight plans and methods should be made to accommodate any additional hazards or restrictions. The UAV Operator should then brief any other persons who will be present at the site during the inspection period.
- Full PPE should be worn during all aerial operations and the take-off and landing area cordoned off using cones.
- In addition to the collected inspection data, each flight should be fully recorded in terms of date, time, wind speed and direction and battery levels.

BRE NATIONAL SOLAR CENTRE

FIRE & SOLAR SYSTEM RESEARCH

BRE National Solar Centre was commissioned by BEIS to conduct research into the type and root cause of fires involving PV systems and how PV systems can influence firefighting operations. The aim of the project was to feed the data and conclusions into industry standards and the National Occupational Guidance system, which is used to disseminate information to the fire and rescue services.

The project began in July 2015 and finished February 2018. This final output from the research is a series of reports published by BEIS. The interim reports are currently available for download[1].

During the project the research team conducted several strands of research on the topic of PV-related fires, including a review of 184 papers (national and international) relating to the subject, an assessment of 33 historical fire incidents involving PV systems and investigations into 47 new fire incidents involving PV systems as they occurred, including both on-site investigation and off-site forensic investigations.

The severity of the fires varied. 22 of the incidents that were caused by PV systems were classified as 'serious' (i.e. difficult to extinguish and spreading beyond the PV system). 36 incidents were localised fires (affecting only PV components and the immediate area) or 'thermal events' (smoking or smouldering that did not develop into a fire). In 16 incidents the cause was not thought to be the PV system and in six incidents, there was insufficient information to arrive at a reliable conclusion, so classified as 'cause unknown'.

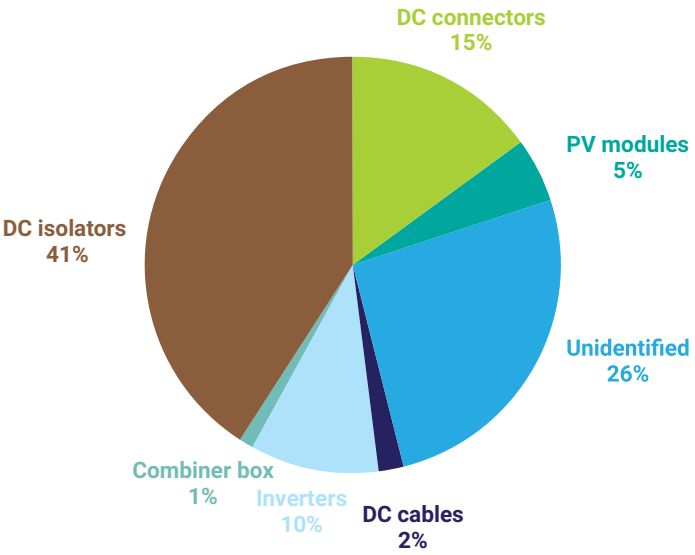
There was a 50/50 split between incidents reported on domestic and non-domestic buildings. Incidents on solar farms accounted for less than 10% of those investigated.

We were notified by the responding Fire Rescue Service for the majority of contemporary incidents, as a result there is a skew on the incident research to more serious fires and non-domestic buildings.

Anecdotal evidence from the delivery of the research and dissemination suggests that there are significantly more 'thermal events' occurring at domestic properties that are directly responded to and resolved by an electrical contractor before escalation of the incident can occur, which have not been captured by the research.

Approximately 36% of incidents recorded that were caused by PV systems were attributed to poor installation practices. 5% were attributed to faulty products and 10% to system design errors. The causes of the remainder were inconclusive, typically as a result of the high severity of the fire.

The experience of investigating 47 recent incidents in the UK has resulted in very similar findings to those noted in the literature review. The analysis of the incidents showed that DC isolators were most likely to develop faults that led to a fire incident (as shown in the chart). It was common for these components to show signs of water ingress and therefore it is considered that DC arcing was the root cause of the fire in these cases.



[1] www.gov.uk/government/publications/fire-incidents-involving-solar-panels

The research concluded that the potential fire risk introduced by a PV system should be assessed and mitigated from design stage, respected during installation and managed throughout the operational lifetime of the system. The following recommendations were made by BRE to industry stakeholders:

CONSIDERATIONS FOR DESIGN

Location of equipment	Layout of roof mounted PV modules
	Cable routes
	Isolation devices
	Maintainable components
	Reducing risk of spread and penetration of fire
Selection/ specification of components	IP rating
	DC connectors
	DC arc fault detection devices
	Inverters
	Cable containment
	Isolation devices

CONSIDERATIONS FOR INSTALLATION

System information	MCS labelling requirements
	Isolator ratings
	O&M information
Selection of installation methods	Cable routing
Environmental protection	IP rating
	Mechanical protection
Assembly of components	Wiring of isolators
	Quality control of DC connectors

CONSIDERATIONS FOR O&M

Preventative maintenance	Removing debris build-up
	Thermography
	Checking DC connections
	Checking component functionality & integrity
Periodic verification schedule	Low risk - inspections to be completed as per IEC 62446-2 at time intervals appropriate to local regulation
	Medium risk - inspections completed every 5 years
	High risk - inspections completed every 2 years, first one at 6 months

IDENTIFYING AND ASSESSING FIRE RISK

Assessing fire risk	Identifying hazards
	Identifying people / property at risk
	Existing fire safety measures
	Mitigation measures
Mitigating fire risk	Good PV system design
	Good quality installation
	Measures for supporting firefighter and rescue service operations

For more information about the PV Fire Research or for support with PV fire risk assessments please contact Chris Coonick, Senior Consultant, BRE National Solar Centre chris.coonick@bregroup.com

ASSET OWNER CHECKLIST

This checklist applies to asset owners or asset managers looking to engage new O&M services providers. The list is form from sets of indicative questions that can be adopted accordingly.

A. CORPORATE CHECKS

Company information	YES	NO	COMMENT
Is the Contractor an EPC? *What are the benefits to the small asset owner in knowing this? Why does it help them to know – should there be a brief explanation?*			
Is the Contractor an independent O&M service provider? *As above*			
Is the Contractor an Asset owner? *As above*			
Do you have sufficient information on the Geographical Coverage of the Contractor?			
Do you have a list of in-house resources, equipment and tools?			
Is sufficient documentation on Quality Control Provided? *What should be regarded as sufficient? ISO 9000 Certified/Working to that standard or other?*			
Is sufficient H&S documentation Provided? What is sufficient in this case? *What reports/records here could help? What should they be looking for?*			
Is a CSR and Environmental Policy document provided? (disposal of hazardous waste etc)			
Financial details	**YES**	**NO**	**COMMENT**
Last two audited financial statements of the company provided?			
Last two audited financial statements of the company of the mother Company provided? (if applicable)			
Corporate Insurances	**YES**	**NO**	**COMMENT**
Public Liability Level Provided			
Professional Indemnity Level Provided			
Other Insurances Provided			
Organisation structure	**YES**	**NO**	**COMMENT**
Is the Corporate organisational Chart Provided			
Headcount	**YES**	**NO**	**COMMENT**
Number of Employees			
Number of Field Service Engineers			
Number of in-house SAPs and APs.			

A. CORPORATE CHECKS / *continued*

Subcontractors	YES	NO	COMMENT
Do you use Subcontractors to provide your core Preventive Maintenance?			
Do you use Subcontractors to provide additional services?			
Subcontractor details provided			
Is there a clear H&S protocol for subcontractors?			
Is there a Sub-contractor/Vendor Management Process/Policy Document?			
Training	**YES**	**NO**	**COMMENT**
Is there a Training Program Provided? *To cover what specifics? Eg: HV, H&S, SCA-DA, First Aid, Fire etc*			
Anual Training Program Provided			

B. SCOPE OF SERVICES

On boarding process	YES	NO	COMMENT
Is an initial Site Assessment Included free of charge?			
Is the on boarding process included free of charge?			
Is land management and landlord management included?			
Do you have sufficient information on the Geographical Coverage of the Contractor?			
Is there an on-boarding process flow chart?			
Preventive and Corrective Maintenance	**YES**	**NO**	**COMMENT**
Is this a two year contract underneath the EPC contractor?			
Is this a Post-FAC O&M contract?			
Is a detailed Schedule of Preventive Maintenance Provided (monthly, Quarterly, Semi-annually and Annually basis)?			
Is Responsive / Corrective Maintenance Provided on an Uncapped basis?			
Is Responsive / Corrective Maintenance Provided on a fixed prices basis?			
Is Response time and Repairing times clearly indicated?			
If the contract is still under the 2 year warranty period are the IAC and FAC test provided?			

B. SCOPE OF SERVICES / *continued*

Additional Services included	YES	NO	COMMENT
Aerial Thermography / Thermography ?			
IV Curve Test?			
Flash Testing?			
Electroluminescence?			
Is spares management included?			
Is spares warehousing included?			
Warehousing Free of Charge?			
Is panel Cleaning Included?			
Is there a Land Management Plan			
What specifically is included/excluded in the Land Management Plan?			
Is fence maintenance included?			
Is data / comms hardware and sensors maintenance included?			
Pyranometers and Weather station maintenance and calibration?			
Security	**YES**	**NO**	**COMMENT**
Is CCTV / Surveillance Management included?			
CCTV Monitoring and On-Call policy?			
Additional Works	**YES**	**NO**	**COMMENT**
Is the O&M contractor able to provide rectification Works if needed?			
Is able to carry out necessary works to clear out outstanding items within the punch list prior FAC?			
Data Monitoring	**YES**	**NO**	**COMMENT**
Is a uniform Data Platform Provided?			
Does the contractor has in-house data integration capabilities?			
Are there sufficient evidence of Fault Identification Processes?			
Do you have full ownership of the DATA?			
Do you have full access of the DATA?			
Do you have sufficient evidence of adequate DATA backup / storage processes on multiple physical locations?			
Do you have sufficient evidence of adequate DATA security measures?			
Is monitoring provided 24/7?			
Are there Monthly Reports and on-line Client Portal samples/examples? Please provide			

B. SCOPE OF SERVICES / *continued*

Guarantees	YES	NO	COMMENT
Is an Availability and PR guarantees Guarantees included?			
Is Response Time Guaranties included?			
Do you have details on the agreed KPIs (specific calculation formulas)?			
Are there any safe indications on Resolution Times based on experience and statistics from the contractor?			
Is there a Parent Company or Bank Guarantee provided?			

C. TECHNICAL COMPETENCE AND CAPABILITIES

	YES	NO	COMMENT
Evidence on years of Operation and Organisational Maturity			
Evidence of number of Assets under service / management			
Evidence on ratio of Owned sites vs Third Party Sites			
Evidence on Resource Allocation - True number of Engineers per MWs			
Evidence on Geographical Team Locations / Geographical Spread			
Evidence of HV Capabilities and Authorisation on HV			
Evidence on level of experience on on-boarding new sites			
Evidence on H&S policies and lone worker policies			

D. O&M STRATEGY

	YES	NO	COMMENT
Is there an existing Predictive/Enhancement plan Maintenance Strategy?			
Is there a specific HSE strategy in place?			

INDICATIVE ON-BOARDING LIST

The site-onboarding list provides an indicative, categorised, itemised checklist that an O&M service provider should go through when on-boarding a solar site. The list can also help asset owners to organise the information necessary when assigning a new O&M contractor.

A. PROJECT SPECIFIC INFORMATION

Section	Documentation	Outstanding Document	Action By	Complete
Section 1 - System Information	System Overview Document			
	Introduction			
	Project Organogram			
Section 2 - Technical Summary	Technical Summary Document			
Section 3 - As Built Drawings	Site Layout Drawing			
	System Schematics			
	Earthing Information			
Section 4 - Project Information	DNO Connection Offer			
	DNO Connection Agreement			
	Supply Agreement & PPA			
	Planning Permissions			
	Meter Operator Agreement			
	MPAN Information			
	Wayleaves			
	Adoption Agreement			
	Joint Operational Agreement			
	Ofgem Registration			
Section 5 - Plant O&M Info	Operating Statement Document			
	Maintenance Schedule			
Section 6 - H&S File	H&S file Document			
	Design Risk Assessment			
Section 7 - Spare Parts	Spare Part Lists			
Section 8 - LEMP	Current Land & Environment Plan			
	Ground Maintenance History			
Section 9 - Communication	Full Stakeholders Communication Details			

B. TEST AND COMMISSIONING

Section	Documentation	Outstanding Document	Action By	Complete
Section 1	Testing Equipment			
Section 2	PV Installation Commissioning Sheets			
Section 3	LV Tests (NICEIC)			
	Subcollector Distribution Board Charts			
Section 4	CT/VT tests			
Section 5	HV Tests			
Section 6	G59 Witness Tests			
Section 7	PAC Results			
Section 8	Visual Inspection Tests			
Section 9	EPC Cert			
Section 10	PV System verification certificate			
Section 11	Thermographt Data (if available)			

C. EQUIPMENT DATASHEET AND INFORMATION

Section	Documentation	Outstanding Document	Action By	Complete
Section 1 - Modules	Module Datasheet			
	Module MCS Certificate			
	Module Container Serial Numbers			
	Module Warranty Documents			
Section 2 - Inverters	Inverter Datasheet			
	Inverter G59 Certificate			
	Inverter Serial Numbers			
	Inverter Installation/User Manual			
	Inverter Warranty Documents			

C. EQUIPMENT DATASHEET AND INFORMATION

Section	Documentation	Outstanding Document	Action By	Complete
Section 3 - Monitoring	Monitoring Datasheet			
	Monitoring Installation/User Manuals			
	Monitoring Login Details			
	As built drawings			
	Monitoring Warranty Documents			
	Pyranometer Datasheet/Manual			
	Pyranometer Calibration certifi-cates			
Section 4 - Transformer	Transformer Datasheet			
	Transformer Drawings			
	Anesco Transformer Installation Information			
	Transformer warranty			
Section 5 - Switchgear	Switchgear (Manufacturer's O&M manual)			
	Switchgear Drawings			
	Switchgear Warranty Documents			
Section 6 - Security	CCTV Spec Sheet/Manual			
	CCTV Installation Information and Maintenance			

D. SECONDARY EQUIPMENT CHECKS

Section	Documentation	Outstanding Document	Action By	Complete
Section 1 - Structure / Mounting System	Structure Datasheet/Brochure			
	Design Premise			
	Geotech Survey			
	Chemical and pH soil results			
	Structural Calculations			
	Structure / Pilling drawings			
	Sign off sheet			
	Structure Warranty Documents			

D. SECONDARY EQUIPMENT CHECKS / *continued*

Section	Documentation	Outstanding Document	Action By	Complete
Section 2 - Cable Spec	Cable Datasheets/Literature			
	Anesco Cable Designs			
	HV Cable Designs (Athena)			
	Transformer tail cable designs			
Section 3 - Trenching	Trenching Layout			
Section 4 - Fencing	Fencing Datasheet			
Section 5 - Access Roads	Access Road Drawings			
Section 6 - Security System	Intruder Alarm Instructions			
	Security Datasheets			
	User Guides			
	Completion Certificates			
	Security drawings			
	Warranty Documents			
Section 7 - Lightning Risk Assessment	Lightning Protection Risk Assessment			
Section 8 - PVSYST	PVSYST Report			
Section 9 - Tboot Information	Tboot Drawings			
	Tboot O&M			

INITIAL SITE ONE DAY TECH DUE DILIGENCE

Indicative list of items to be checked from trained authorised personnel, when performing a one-day Technical Due Diligence on assets.

1. SUMMARY

Site Location		
MWp		
DNO		
ICP		
EPC		
Client Contact		
Security Arrangements		

2. LANDOWNER

Address		
Contact details		
History		
Potential for Cutting or Grazing?		

3. DNO BUILDING

Switch gear		
Type & Protection Settings		
Access requirements		
Adoption agreement		
Emergency number		
Emergency signs		

3. DNO BUILDING / *continued*

Earthing Kit		
Padlock keys		
Alarm		
Metering / monitoring		
Basement Dry		
Flood sensor - Pump		
Cable entries sealed		
SF6 Warnings		
Intertripping		
Aux Supply		
corrosion		
Cables identified		
BS7671 Guards in place		
G59 Settings		
Blow out zone		

4. WEATHER STATIONS

Irradiance Sensors -		
gel changed, angle correct,		
clean, calibrated		
Temp Sensors - functioning		
Module cleaned, output		
Wind Speed Meter, disruption,		
Monitoring, all data working		
Corrosion		
Cables identified		
Cables Glanded		
Technical Assessment		

5. INVERTER STATION

Inverter Station		
Earth system installed		
Earthing continous		
Functional tests		
Shutdown procedure		
Access requirements		
Monitoring tested		
Metering as expected		
Fault codes		
Corrosion		
Cables identified		
BS7671 Guards in place		
Filters Clean		
Housing Clean		
Blow out zone		

6. MODULES

Fixings		
Clean		
Anti theft system		
Connections		
Thermal check		
Scratches and cracks		

7. ACCESS ROUTE

Signage on boxes:-		
inverters, fence, substation		
Fencing		
CCTV		
Sat Coms		
Ecological items		
Vermin Controlled		
Site Storage sufficient?		

8. STRUCTURE

Type/s		
Inclination for module surface		
approved for location?		
rammed or concreted		
Dipped or Galv		
Earthing continuity		
Earth connections		
corrosion		
Cables identified		
Static Calcs		
Cable tray		

9. TRANSFORMERS

Connections ok		
Earthing continous		
Oil temp/Pressure		
Sensors functioning		
Protection Measures (fencing)		
Labels Affixed		
Aux Transformers		
Warning signs		
Connection caps secure		
corrosion		
Cables identified		
BS7671 Guards in place		
Touch protection		

10. COMBINER BOXES

Fused on both sides		
Main Isolator		
Monitoring		
Box type		
Earthing Connections		
Protected from sheep/mowers		
Thermal check		
BS7671 Guards in place		
Cable entries sealed		
Labels Present		

GENERAL COMMENTS

Working Groups are a key part of our activities here at the STA. With quarterly meetings, each group has produced a variety of expert publications relevant to their own industry sector.

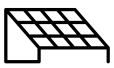
STA WORKING GROUPS

OPERATIONS AND MAINTENANCE

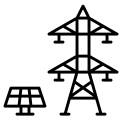
STA SCOTLAND

NEW BUILD

LARGE SCALE AND ASSET MANAGEMENT

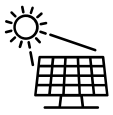


PV ROOFTOP



GRID-SCALE STORAGE

BEHIND THE METER STORAGE



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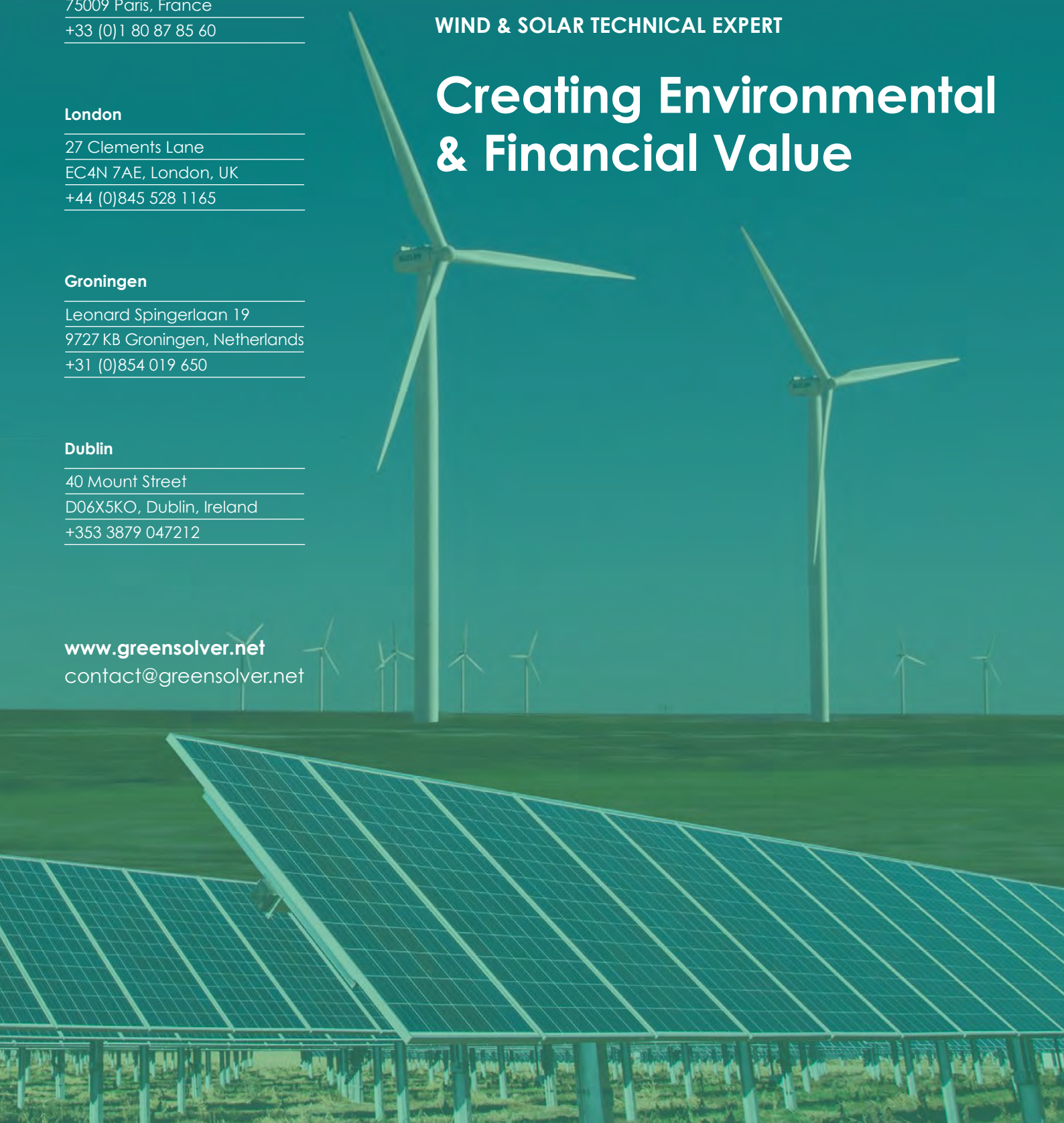

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THANK YOU, FOR READING.

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