IECRE OD-402

Edition 21.0 2016-xx-xx05-10

IECRE OPERATIONAL DOCUMENT

IEC System for Certification to Standards relating to Equipment for use in Renewable Energy applications (IECRE System)

Annual PV plant performance certificate

IECRE OD-402:2016(EN)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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PRICE CODE ZZ

CONTENTS

IECRE

ANNUAL PV PLANT PERFORMANCE CERTIFICATE

INTRODUCTION

Arguably, the most important aspects of assessment of a PV system require documentation of the performance of the system and the cost to maintain the system at that level. A ~~Provisional Acceptance~~Conditional PV Project Certificate may be completed at the time a PV system is commissioned as described in IECRE OD-401 ~~Provisional Acceptance~~Conditional PV Plant Certificate, providing information about the design, quality control during installation, and initial performance. The Annual PV Plant Performance Certificate is intended to be completed after one full year of operation (or subsequent full years of operation) so as to quantify the observed performance of the system and document maintenance costs. This Operational Document describes the requirements for the Annual PV Plant Performance Certificate based on application of IEC 61724 Photovoltaic System Performance, Part 3, documenting the electrical energy delivered relative to what would be expected for the measured weather. Losses in output are separated into times when the system is not functioning and when the system is functioning. Additionally, the cost of maintenance is documented. Subsequent annual application of this certification can provide a means to track the health and ongoing performance of a system throughout its life.

1 Scope

This Operational Document defines the requirements for issuance of an Annual PV Plant Performance Certificate that reflects the ongoing performance of the system. The Annual PV Plant Performance Certificate reports performance data from a full year of operation so as to quantify the observed performance of the system as well as documenting the maintenance costs to achieve stated performance and availability.

The Annual PV Plant Performance Certificate may also be issued annually to reflect the ongoing health of the PV system throughout its life and may be a key input for assessment of overall certification of the plant.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60300-3-3 *Dependability management - Part 3-3: Application guide - Life cycle costing*

IEC 61078 (2016) *Analysis techniques for dependability - Reliability block diagram and boolean methods*

IEC 61724-1 ed 2.0 (2016) *Photovoltaic system performance – Part 1: Monitoring*

IEC/TS 61724-2 (2016) *Photovoltaic system performance – Part 2: Capacity evaluation method*

IEC/TS 61724-3 (2016) *Photovoltaic system performance – Part 3: Energy evaluation method*

~~IEC 62446-2 (2016) *Grid connected photovoltaic (PV) systems – Part 2: Maintenance of PV systems*~~

IECRE 01 *System Basic Rules*

IECRE 02 *System Rules of Procedure*

IECRE 04 *Rules of Procedure*

ISO/IEC 17065: 2012 General Requirements for bodies operating certification systems

ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories

ISO/IEC 17020:1998 General Criteria for the Operation of Various Types of Bodies Performing Inspections

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the International Electrotechnical Commission Glossary (http://std.iec.ch/glossary and the following apply.

3.1
Energy availability

metric of energy throughput capability that quantifies the expected energy when the system is operating relative to ~~that quantifies the expected energy when the system *is* operating relative to~~ the total expected energy. The energy availability is calculated from the energy unavailability and may be expressed as a percentage or a fraction.

3.2
Energy unavailability

metric that quantifies the energy lost when the system is *not* operating (as judged by an automatic indication of functionality such as the inverter status flag indicating that the inverter is actively converting DC to AC electricity or not). The energy unavailability is the ratio of the expected energy (as calculated from the original model and the measured weather data) that cannot be delivered because of inverters or other components being off line divided by the total expected energy for the year. The energy unavailability may be expressed as a percentage or a fraction. Energy unavailability may be caused by issues either internal or external to the PV system.

3.3
External-cause-excluded energy availability

metric that quantifies the expected energy when the system *is* operating relative to the total expected energy during times when it was possible for the plant to be operating. Exclusions are made for times when the grid is not operating or for other times when the plant was not operating for reasons outside of the control of the plant.

3.4
Predicted energy
energy generation of a PV system that is calculated with a specific performance model, using *historical* weather data that is considered to be representative for the site, whereby the specific performance model has been agreed to by all stakeholders to the test. See Figure 1. The historical weather data may be gathered from a weather station that's within reasonable proximity to the site.

3.5
Expected energy
energy generation of a PV system that is calculated with the same specific performance model as that used in the predicted energy model, using *actual* weather data collected at the site during operation of the system for the year in question. The weather data is collected locally at the site.

NOTE: The expected energy is used to calculate the Energy Performance Index.

3.6
Measured energy
electric energy that is measured to have been generated by the PV system during the test over the same duration as the expected energy model.

NOTE 1: See also 3.14 Test boundary to define the location of measurement

3.7
Performance index
electricity generation of a PV system relative to expected, as defined in IEC 61724-11 and calculated as described in ~~this technical specification~~IEC 61724-3

3.8
Energy performance index
electricity generation of a PV system relative to the expected energy over a specified time period, as defined in IEC 61724-1 and calculated ~~in this technical specification~~according to IEC 61724-3. The energy performance index may refer to all times or only times of availability as defined by the all-in energy performance index or the in-service energy performance index, respectively.

3.9
All-in energy performance index
electricity generation of a PV system relative to the total expected energy over a specified time period, including times when the system is not functioning

3.10
In-service energy performance index
electricity generation of a PV system relative to the expected energy over a specified time period during times when the system is functioning (excluding times when inverters or other components are detected to be off line).

3.11
Power performance index
electricity generation of a PV system relative to expected power production for a specified set of conditions, as defined in IEC 61724-1 and calculated as in IEC 61724-22.

4 General Provisions

The normative ISO/IEC references define the general program requirements for RECBs and REIBs operating under the PV program.

Additional requirements for RECBs and REIBs operating the PV program are described in IECRE 01, IECRE 02, and IECRE 04 *PV-OMC Rules of Procedure*.

5 PV System Performance Simulation

The system performance model shall be recorded for at least the year of operation being analysed. Preferably, the model results are recorded for the anticipated life of the system, as described in Table 1 and using the guidance described below to provide a basis for comparison to the Performance Test Results.

Table 1. Documentation of Simulated PV System Performance (using historical weather data)

Year*	Annual Plane-of-Array Solar Irradiation, H_i (kWh/m^2)	Annual Predicted Active Electrical Production**, E_{out} (kWh)	Predicted Energy Availability	Predicted annual planned O&M cost

1 Under preparation. Stage at time of publication: IEC/CDV 61724-1:2016

2 Under preparation. Stage at time of publication: IEC/DTS 61724-2:2016

Year*	Annual Plane-of-Array Solar Irradiation, H_i (kWh/m^2)	Annual Predicted Active Electrical Production**, E_{out} (kWh)	Predicted Energy Availability	Predicted annual planned O&M cost
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

* A line should be included for each year of expected operation.

** This column should indicate the predicted electrical production after reducing the modelled electrical production to reflect the predicted unavailability.

5.1 Annual In-plane Irradiation used by simulation, H_i

The annual irradiation that forms the basis of the simulated performance for the system is documented as described in Table 1. The test report shall indicate the source of this data.

If the plane-of-array of the PV array is variable or poorly defined, it may be chosen to document the horizontal irradiation instead, taking care to align the reporting described in sections 5 and 6.

5.2 Annual predicted active electrical production, E_{out} (active) predicted

The active (real) output energy predicted for each year starting at the time of commissioning should be documented as shown in Table 1, reflecting anticipated degradation during the life of the system, anticipated soiling losses, etc. The active output energy, E_{out} (as measured at the point of metered connection to the grid) is defined in IEC 61724-1 in Table 3 and section 7.6. The predicted electrical production should be reduced by the anticipated unavailability and for non-unity power factor.

5.3 Predicted availability

Operation of the PV plant may be intentionally stopped for maintenance purposes or may be interrupted because of hardware failure or lack of grid availability. The availability assumed for prediction of the annual electrical production shall be recorded as part of Table 1. The availability may also be the output of a reliability prediction analysis. The basis, methodology and source of the availability estimate shall be indicated in the test report. If the prediction of annual electrical production did not consider the availability, then 100% theoretical (assumed) energy availability is recorded in Table 1.

~~Predictions of availability estimates can be generated over the operating lifetime of the PV plant by utilizing simulation models built of Reliability Block Diagrams (RBD's). Each field repairable or replaceable (FRU) unit of the PV system is represented by a RBD and these RBD's can be interconnected to model the overall system reliability model. A RBD model is a graphical representation of how the components of a system are reliability wise connected which are generally either arranged in series or parallel or a hybrid series-parallel connection~~

~~to accurately represent the system from a reliability standpoint. RBD's are described in IEC 61078 standard.~~

~~Once a RBD model is developed for the system, it can then be populated with information on the repair and maintenance characteristics of the components and resources available in the system, other information can also be analyzed/obtained, such as system availability, throughput, spare parts utilization, life cycle costs, etc. for any discrete time in the operating life of the plant. This can be accomplished through discrete event simulation.~~

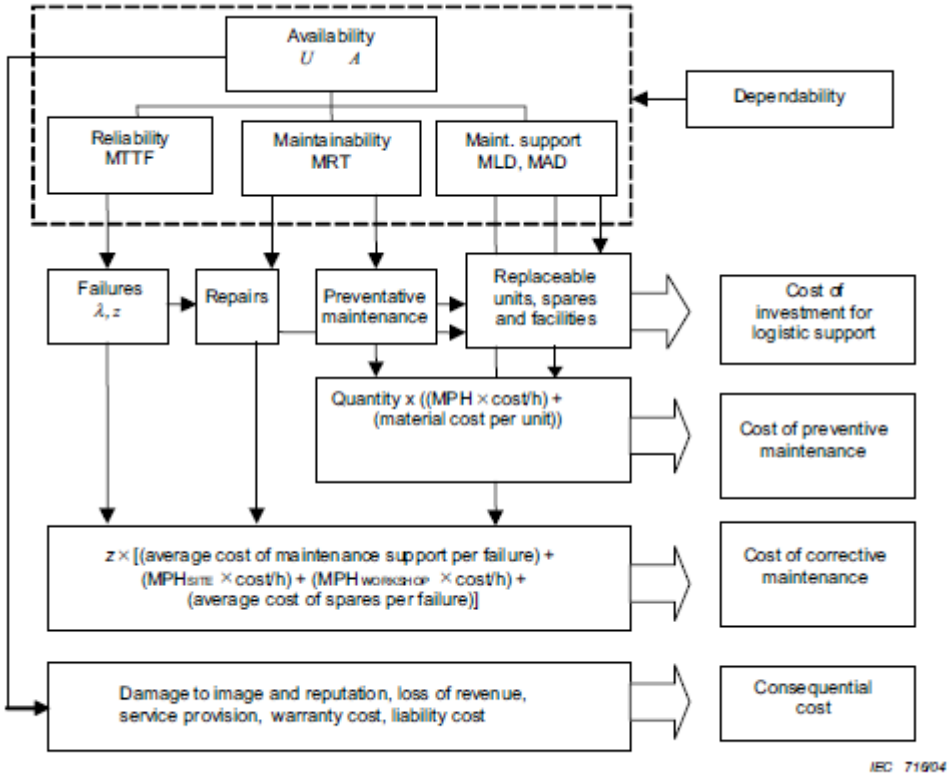
~~Each RBD in the system can be assigned with parametric distributions modelling the FRU's reliability characteristics such as failure rate distribution or Mean Time Between Failures (MTBF); the FRU's repair or restoration properties such as troubleshooting and fault detection duration distributions or Mean Time to Detect (MTTD), its repair/restoration distribution or Mean time to Repair (MTTR); its logistic delay distributions as well as part repair or replacement costs; in addition to organized repair crews, behaviours of crews, spare part pools etc.~~

~~Commercially available reliability prediction and simulation packages are available to facilitate generation of reliability, availability and total cost of operational expense estimates. In addition throughput simulation models allow us to model the overall energy delivered at the top system level considering impacts of outages and degradation of sub system components. From these costs of downtime inclusive of repair and loss of energy costs can be calculated.~~

5.4 Predicted cost of operations and maintenance (O&M)

If an estimate has been made as to the anticipated O&M costs for each year, this should be documented for comparison to the actual values. IEC 60300-3-3 is an application guide for Life Cycle Costing and can be utilized to develop the cost models. The below figure reproduced from IEC 60300-3-3 illustrates the relationship between dependability and LCC costs for the operational and maintenance phase.

For the intent of this analysis, the costs (acquisition, ownership and consequence aspects only) associated with operations and maintenance phase only are considered for reporting. All other costs related to design, manufacturing, installation and disposal are excluded from the LCC analysis. In addition for simplicity, only the reportable loss of revenue, warranty and liability costs are considered for reporting of consequential costs.



Symbols and abbreviations apply in accordance with IEC 60050(191).

6 PV System Performance Test Results

The system performance shall be analysed to include the metrics according to Table 2 and with guidance described below. The IEC 61724-1 measurement class defines the accuracy required for the measurement. The certificate type (U1, U2, U3, or U4) defines which analyses are completed.

Table 2. IEC 61724 requirements for PV system performance measurements by category

Project Type	U1 – Utility	U2 – Residential	U3 – Commercial	U4 – Distributed
IEC 61724-1 Measurement Class	A	C	B	B
Measurements				
1. One-year in-plane irradiation, H_i, as described in IEC 61724-1 Ed. 2 in Table 10, Section 9.3 and Table 3, section 7 and as tabulated under the guidance of IEC 61724-3.	X	X	X	X
2. One-year Measured Active Output Energy, E_{out}, as defined in Table 3 and section 7.6 of IEC 61724-1 with data filtering and analysis guided by IEC 61724-3.	X	X	X	X
3. Energy expected during observed system availability for the one-year test period, as defined in IEC 61724-3.	X		X	
4. Total (all-in) energy expected for the one-year test period, as defined in IEC 61724-3	X		X	
5. Predicted cost of planned O&M	X		X	X
6. Output power measurement as described in IEC 61724-2 for specified reference conditions	Optional		Optional	Optional
7. Energy expected during times of availability and during times of internally caused unavailability	Optional		Optional	Optional

6.1 One-year In-Plane Irradiation, H_i

The performance of a PV plant will reflect the irradiation received during the one-year test period, so a critical piece of the assessment is to identify the irradiation during that time period. Depending on the class of the measurement, satellite data may be used to derive the irradiance during the test period, as described in IEC 61724-1 Ed. 2, section 7, Table 3. The integration of the irradiance to obtain the irradiation is described in IEC 61724-1 Ed. 2 Section 9.3, Table 10. The total in-plane irradiation is reported, including times when the PV plant was not available. These data are compared directly to the data used for the initial PV plant assessment (Table 1 above), so every effort should be made to align the definition of the quantities in Tables 1 and 2, as described in IEC 61724-3.

If the plane of the PV array is variable or poorly defined, it may be chosen to document the horizontal irradiance instead, taking care to align the reporting described in sections 6 and 7 (and Tables 1 and 2).

6.2 One-year Output Energy, E_{out}

The active output energy will be measured for one year starting at the time of commissioning or at a different date as long as a full year of data can be evaluated. The output energy (as

measured at the point of metered connection to the grid) is defined in IEC 61724-1 in Table 3 and section 7.6. Data filtering and correction are described in IEC 61724-3. The value reported here shall be consistent with the analysis of section 7.

6.3 One-year active energy expected during observed system unavailability

As defined in IEC 61724-3, the active energy (calculated using the actual power factor) expected during times of observed system availability during the performance period is reported. The test report shall comment on the observed unavailability and the associated causes for each event exceeding 0.1~~2~~% of the annual expected energy, including whether the reduced availability was caused by external factors, such as lack of grid availability, whether the reduced availability was associated with a specific hardware item, or a system interaction issue and whether the issue was resolved.

6.4 Observed cost of operations and maintenance (O&M)

The cost of the O&M experienced during the test period is reported for comparison with the original prediction. The actual costs are tracked based on an accounting structure that tracks the costs incurred for each of the corresponding sub categories as estimated in section 5.4. The comparison can be simplified to an annual expected versus actual comparison for reporting purposes.

6.5 Output power measurement

Optionally, the output power, P_{out}, as defined in Table 3 and section 7.6 of IEC 61724-1 is measured for reference test conditions using the method described in IEC 61724-2. The measurement may be reported for each inverter or for the entire system as measured at the point of metered grid connection. The reference test conditions used for IEC 61724-2 shall be reported along with the output power measurement result. If applicable, the plant performance is reported both for constrained and unconstrained operation as described in Section 8, item 15 in IEC 61724-2.

7 Calculation of derived metrics

The data defined in Table 2 can be used to calculate various performance metrics. These performance metrics are defined more thoroughly in IEC 61724, but the descriptions and formulas are included here for convenience. The choice of which metrics to report on the certificate is optional, but each of these metrics can be derived from the data reported in Section 6.

7.1 Capacity Factor

The capacity factor is a metric commonly applied to power plants and allows direct comparison between PV and other power plants. It's calculation is based on the AC rating of the plant and defines the fraction of electrical energy that was generated compared with what the plant would have generated if it operated at the rated power 100% of the time.

Capacity Factor = (E_{out} /AC rating)/(24**days*)

Where E_{out} is in kWh, the AC rating is in kW as calculated from the sum of the inverter ratings, and *days* is the number of days of the test – typically 365 or 366.

7.2 Performance Ratio

The performance ratio (as defined in IEC 61724-1, section 10.3.1) reflects the electrical energy generated relative to the amount of irradiation and the DC rating of the plant. It is calculated from

Performance ratio = $(E_{out} / P_0) / (H_i / G_{i,ref})$

Where E_{out} is in kWh, P_0 is the DC rating is in kW, H_i is the irradiation in kW/m^2, and $G_{i,ref}$ is the irradiance used for rating the modules, usually 1 kWh/m^2.

7.3 Energy Availability

Poor performance of a PV system may be divided into times when the system is not functioning and other times when the system is functioning, but at reduced output because of non-ideal performance. Following the definition provided in IEC 61724-3 and implemented in a convenient and cost-effective way, a PV system or part of a system is considered to be unavailable when it's status is observed to be non-functional. For example, if the status register of an inverter indicates that the inverter is off line, or, (for example) if a measurement of a string current indicates that a string has become disconnected, the associated generation of electrical power will be stopped. It is typically quite expensive to instrument a system for the sake of collecting this status data, so the availability calculation may typically be related to observed inverter data, but other situations are also possible. The availability is calculated as:

Energy Availability = 1 – (E_{out} expected during times of unavailability/Total expected E_{out})

Where the E_{out} is the active energy.

The External Cause-excluded energy availability is calculated in a similar way, but reducing the denominator to reflect ~~on~~ the expected energy when it would have been possible to operate the plant. This metric excludes issues that are outside of the plant's control.

7.4 Energy Performance Index

The energy performance index (as defined in IEC 61724-1, section 10.4, Table 11 and as calculated using the approach of IEC 61724-3) is measured for a full year starting at the time of commissioning or at a different date as long as a full year of data can be evaluated. The in-service performance index is calculated only for times when the system is available, as described in IEC 61724-3 and shall be consistent with the analysis used for the reported energy availability and AC output energy. The energy performance index is calculated from the expected energy (applying the original model applied to the measured irradiation, as described in IEC 61724-3) according to:

In-service Energy Performance index = E_{out} Measured / E_{out} Expected

Where both values are calculated only for times when the PV system is considered to be available.

All-in Energy Performance index = E_{out} Measured / E_{out} Expected

Where both values are calculated for all times.

8 Test report

The final test report will include the test reports created by execution of the measurements in IEC 61724~~ and IEC 62446~~. In addition, the Annual PV Plant Performance Certificate will include the following using the template in Annex A. ~~[Sarah's note: this is evolving and I propose that mention of IEC 62446-2 be moved to a different OD]~~

1) Description of the party doing the test
2) Description of the site being tested, including climate classification, latitude, longitude, and altitude
3) Description of the site quality attributes such as system integrator name, O&M operations provider names etc.
4) Description of the system being tested including DC and AC power ratings, module model and manufacturer, number of modules, inverter model and manufacturer, number of inverters, transformer model and manufacturer, number of transformers, tracker model and manufacturer, type of tracker, power plant controller model and manufacturer, mounting structure tilt and azimuth.
5) Description of the site design parameters such as design model, irradiation design model, expected power, plant capacity, rated energy, etc.

6) A list of critical milestone dates such as commissioning complete date, operations commence date, first energy tests date etc.

7) A list of any irregularities including substantial observations or omissions in the periodic prescribed inspections or maintenance activities.

8) Summary of the test results as described in IEC 61724-3~~ (and IEC 62446-2?)~~.

9) Reference to each report generated during execution of IEC 61724 Parts 2 and/or 3.

   A record of any major events impacting product/personnel safety or requiring regulatory oversight classified by causal root cause (same list as below) ~~[This may be moved to a "Safety Certificate" or may be included here, at the discretion of the IECRE working groups.~~

   A record of major outage or system downing events impacting system availability (For events causing loss of >0.1% of annual energy as analysed by IEC 61724-3) classified by causal root cause and the corresponding kWh lost.

   a) Equipment failure driven (identify equipment, contributing outage % or MWh, failure, and remedy)
   b) Installation driven (identify equipment, contributing outage % or MWh, failure, cause and remedy)
   c) Operation & Maintenance driven (identify equipment, contributing outage % or MWh, failure, cause and remedy)
   d) Design/ System interaction driven (identify equipment, contributing outage % or MWh, failure, cause and remedy)
   e) External factors (grid, utility, and contributing outage % or MWh)
   f) Other (Acts of god, flora/fauna) (identify equipment, contributing outage % or MWh, failure, cause and remedy)
   g) Undetermined (identify equipment, contributing outage % or MWh, failure, and remedy)
   h) Under Investigation (Equipment, contributing outage % or MWh, Containment plan)

10) A record of the annual cost incurred for corrective maintenance for unplanned events inclusive of parts, logistics and labour.

11) A record of the annual costs incurred for planned preventative events inclusive of parts, logistics and labour if greater than 10% of original O&M assumptions.

    Note: It is assumed that costs incurred for planned maintenance are already planned during the design and agreed upon by all parties in contract negotiation phase of project and hence not reported unless those assumptions are changed significantly.

12) A record of annual cost for lost energy due to low performance of components (modules etc.)

13) A record of annual cost for lost revenue from lost energy generation

14) A record of annual cost for any penalties for loss of performance.

Annex A: Template for Annual PV Project Performance Certificate

Annual PV Project Performance Certificate
Certificate Type: U1

Client	
Installation Address Lat., Long. Altitude	
System Integrator	
Site Construction Firm	
Site Climate per IEC 60721	
Test date	
O&M Contractor	

Description of Installation	
Rated power – kW DC	
Rated power – kW AC	
Location	
Module type	
Number of modules	
Inverter type	
Number of inverters	
Tilt Angle	
Azimuth	
Tracker Type	

I / we being the person(s) responsible for the issuance of the Final PV Project Certificate for the electrical installation (as indicated by the signature(s) below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design construction, inspection and testing, hereby certify that the said work for which I/we have been responsible is, to the best of my/our knowledge and belief, in accordance with ……..

Signature(s): Name(s): Date: (The extent of liability of the signatory(s) is limited to the work described above)	COMMENTS:

Annual PV Project Performance Certificate Test Results

Table A1. Documentation of Predicted PV Project Performance Simulation Inputs

Certificate name	Reference (entity completing test and document reference number)	Date
Project performance simulation description		
Installation date to define start of year 1		

Table A2. Documentation of Predicted PV Project Performance

Year*	Annual Plane-of-Array Solar Irradiation, H_i (kWh/m^2)	Annual Predicted Active Electrical Production, E_{out} (kWh)	Predicted Energy Availability	Predicted annual planned O&M cost
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

*Table should be extended to include a line for each year

Table A3. PV Project Performance – Test Results for One-year energy test

Parameter	Measured value	Predicted value*	Comment
Start date			
End date			
Year #			
Plane-of-array irradiation measured for entire year	kWh/m^2/y	kWh/m^2/y	
Expected active electrical output energy for all times based on Table 1 inputs using IEC 61724-3	kWh/y	kWh/y	
Measured active electrical energy using IEC 61724-3	kWh/y	kWh/y	
Expected electrical energy during times of unavailability using IEC 61724-3	kWh/y	kWh/y	
Cost of planned O&M activities	~~$ or Euros?~~		

*This column is completed using Table 2; it may require interpolation if the test period does not align exactly with the years of the original prediction. The measurement point for electrical generation should match that of the prediction.

Table A4. PV Project Performance – Optional Metrics Derived from Test Results for One-year energy test (Optional)

Derived metric	Measured value	Predicted value*	Comment
Capacity factor			
Performance ratio			
Availability			
Energy performance index			

*This column is completed using Table 2; it may require interpolation if the test period does not align exactly with the years of the original prediction. The measurement point for electrical generation should match that of the prediction.

Table A5. PV System Performance Test Results (Optional)

Test or measurement	Result	End date of test period	Reference conditions
Output Power according to IEC 61724-2, section 8, item 15, including uncertainty of measurement	kW		W/m^2 °C
Power performance index for power generated at TRC as defined in IEC 61724-2, section 8, item 15	%		W/m^2 °C

Table A6. Documentation of Significant Events

Event description	Root cause	Action taken to resolve issue	Electrical generation loss associated with event*	Date of finding	Date of resolution

*List events causing loss of more than 0.1% of annual yield and any events reported to impact safety or attract need for regulatory review

Annex B: ~~Template for Final PV Project Certificate for digital reporting~~Prediction of Energy Availability (informative)

B.1 Prediction of Energy Availability

Predictions of availability estimates can be generated over the operating lifetime of the PV plant by utilizing simulation models built of Reliability Block Diagrams (RBD's). Each field repairable or replaceable (FRU) unit of the PV system is represented by a RBD and these RBD's can be interconnected to model the overall system reliability model. A RBD model is a graphical representation of how the components of a system are reliability-wise connected which are generally either arranged in series or parallel or a hybrid series-parallel connection to accurately represent the system from a reliability standpoint. RBD's are described in IEC 61078 standard.

Once a RBD model is developed for the system, it can then be populated with information on the repair and maintenance characteristics of the components and resources available in the system, other information can also be analyzed/obtained, such as system availability, throughput, spare parts utilization, life cycle costs, etc. for any discrete time in the operating life of the plant. This can be accomplished through discrete event simulation.

Each RBD in the system can be assigned with parametric distributions modelling the FRU's reliability characteristics such as failure rate distribution or Mean Time Between Failures (MTBF); the FRU's repair or restoration properties such as troubleshooting and fault detection duration distributions or Mean Time to Detect (MTTD), its repair/restoration distribution or Mean time to Repair (MTTR); its logistic delay distributions as well as part repair or replacement costs; in addition to organized repair crews, behaviours of crews, spare part pools etc.

Commercially available reliability prediction and simulation packages are available to facilitate generation of reliability, availability and total cost of operational expense estimates. In addition throughput simulation models allow us to model the overall energy delivered at the top system level considering impacts of outages and degradation of sub system components. From these costs of downtime inclusive of repair and loss of energy costs can be calculated.

Annex C: Template for Final PV Project Certificate for digital reporting

~~Under development~~This data list is under development, but the current version is reproduced here for informational purposes.

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
CertificateNumber	AAAAAAA identifies the sector, YYYY identifies the year, OD4XX identifies the OD that is applied, PPPPPPPP provides a unique system identifier assigned by IECRE, CCCCCCCCCC identifies the certificate number assigned by IECRE.	**AAAAAAA.YYYY.OD4XX.PPPPPPPP.CCCCCCCCCC**	**IECREPV.2016.OD402.12345678.0123456789**	YYYY
CertificateType	OD401, OD402, OD403 or OD4XX	**Milestone**	**OD402**	YYYY
NameOfSystem		**Name**	**Gondwana#1**	YYCC
CertificateHolder	entity paying	**Name**	**PG&E**	YYYY
UtilityConnect	Interconnecting Utility. Utility with whom the grid connection will reside	**Name**	**PG&E**	YYYC
AHJID	Authority having jurisdiction to define local code requirements	**Name**	**City of San Diego**	YYYC
DateIssueForProcurement	Design is completed and ready to move forward with ordering equipment and start construction			
DateMechanicalCompletion	Mechanical Completion Date when all major equipment has been installed, but the project is not yet interconnected to the grid			
DateElectricalCompletion	Electrical system is complete including capability to connect to the grid, but not yet fully tested and not necessarily connected to grid			
DateInterconnectAvailability	All of the equipment is in place, so could connect to the grid, (ready to request PTO), but do not yet have permission [is this different from "DateElectricalCompletion" ?]			
DateSubstantialCompletion	Substantial Completion Date: when the power plant has been interconnected and is ready to generate power. This is often used for funding purposes.			
DateCompletedCommissioning	Date of commissioning, (i.e. milestone E at last inverter or string commisioned measured at the revenue meter) Includes conditional acceptance by owner	**yyyy.mm.dd**	**2015.05.21**	YYYN

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
DatePlacedInService	Placed in Service (PIS) status is a term used for tax purposes and means the plant has met the following: (1) It is synched with the grid, (2) It has no major outstanding permits, (3) It has or is capable of commencing delivery of energy to the grid, (4) Care, custody and control has been transferred to the operator, (5) Critical tests are complete, e.g., those required by the EPC and interconnection agreements.			
PermissionToOperateDate	Permission to Operate Date (PTO) date conditional acceptance and permission from utility is completed and move into operating phase.	**yyyy.mm.dd**	**2015.05.21**	YYYC
OperationsCommencedDate1	Date the operations of the entity commenced.When interconnection is made and electricity starts flowing onto the grid (Commercial operations date, COD) (Asset mgmt and transaction/trade , 2015 US GAAP Financial Reporting XBRL Tag)	**yyyy.mm.dd**	**2015.05.21**	YYYC
DateFinalAcceptance	After one year of operation when owner accepts plant			
DateFinalCompletion	Final Completion date when all punch list items are complete.			
LongTermContractForPurchaseOfElectricPowerDateOfContractInitiation	Date of contract initiation of long-term contract to purchase electricity from a production plant. (Asset mgmt and transaction/trade) PPA Effective Date	**yyyy.mm.dd**	**2015.05.21**	CCCC
LongTermContractForPurchaseOfElectricPowerDateOfContractExpiration	Date of contract expiration of long-term contract to purchase electricity from a production plant. (Asset mgmt and transaction/trade , 2015 US GAAP Financial Reporting XBRL Tag) PPA Expiration Date	**yyyy.mm.dd**	**2015.05.21**	CCCC
AuthorizedViewerN	security ticket - detail in OD, n integer, multiple security tickets can be issued to link certifier and viewer of data	**alphanumeric**	**a6233578fd**	YCYC
CertifierIECRE	RECB for issuing this certificate	**Name**	**TUVR**	YYYY
OperatorID	Entity that is operating the plant at time certificate is issued.	**Name**	**NextEra**	YCYC
EPC1ID	General contractor	**Name**	**First Solar**	YCYC
EPC2ID		**Name**		CCCC
ContractCcurrency		**international currency letters**	**EUR**	YCYC

Name of data field	PV definitions	Data format	Data example	U1	U2	U3	U4
Metadata entered when OD-403 is completed; may be updated when other OD is completed							
GeoLocationAtEntrance	latitude and longitude at plant entrance	**deg/deg**		Y	Y	Y	C
IntSiteClimateClassification	Per IEC 60721	**alphanumeric**		Y	Y	Y	Y
SiteAltitudeAverage	Average altitude of PV plant array	**m**	**525**	Y	C	Y	C
ModuleType1Technology	CdTe, CIGS, ASi, MonoSi, MultiSi, CPV	**technology type**	**MultiSi**	Y	C	Y	C
ModuleType1ID	Manufacturer	**Name**	**YINGLI**	Y	C	Y	C
ModuleType2Technology	CdTe, CIGS, ASi, MonoSi, MultiSi, CPV	**technology type**	**CIGS**	Y	C	Y	C
ModuleType2ID	Manufacturer	**Name**	**Solar Frontier**	Y	C	Y	C
ModuleType3Technology	CdTe, CIGS, ASi, MonoSi, MultiSi, CPV	**technology type**	**CdTe**	Y	C	Y	C
ModuleType3ID	Manufacturer	**Name**	**First Solar**	Y	C	Y	C
InverterType1rating	AC rating of inverter	**kW**	**1000**	Y	C	Y	C
InverterType1ID	Manufacturer name	**Inverter type**	**GE**	Y	C	Y	C
InverterType1Grounding	Ungrounded (Transformerless), Grounded	**Inverter design to define grounding**	**Grounded**	Y	C	Y	C
InverterType2rating	AC rating of inverter	**kW**	**5**	Y	C	Y	C
InverterType2ID	Manufacturer name	**Name**	**Fronius**	Y	C	Y	C
InverterType2Grounding	Ungrounded (Transformerless), Grounded	**Inverter design to define grounding**	**Ungrounded**	Y	C	Y	C
InverterType3Rating	AC rating of inverter	**kW**	**0.25**	Y	C	Y	C
InverterType3ID	Manufacturer name	**Name**	**Enphase**	Y	C	Y	C
InverterType3Grounding	Ungrounded (Transformerless), Grounded	**Inverter design to define grounding**	**Grounded**	Y	C	Y	C
TransformerLVType1Technology	2/3/4 winding, Inverter step up transformer	**technology type**	**2 Winding**	Y	C	C	C
TransformerLVType1ID	Manufacturer of T/f	**Name**	**GE**	Y	C	C	C
TransformerMVType2Technology	2/3/4 winding, Inverter step up transformer	**technology type**	**2 Winding**	C	C	C	C
TransformerMVType2ID	Manufacturer of T/f	**Name**	**GE**	Y	C	C	C
TrackerdualaxisID	Manufacturer/type ID	**ID designator**	**Pringle 6573**	Y	C	C	C
TrackersingleaxisID	Manufacturer/type ID	**ID designator**	**SesorCCF**	Y	C	C	C
RackingSystemIDID	Manufacturer/type ID	**ID designator**	**SesorCCF**	Y	C	Y	C
SystemCapacityContracted	Maximum Generating Capacity: max power accepted by grid. This should be included for full plant, but may be ommitted if the plant is partial	**kW**	**100000**	Y	C	C	C
RatedPowerkWpeakAC	AC Nameplate Capacity at revenue meter	**kW**	**100000**	Y	Y	Y	C
DCPowerDeisgn	DC Nameplate Capacity: Sum of module ratings at STC as defined in the design	**kW**	**10000**	Y	Y	Y	C
OffTakeContractType	Contract type (PPA, Merchant, etc.)	**Name**	**PPA**	Y	C	C	C
Model metadata preferably entered at time OD-403 is completed							
Major Design Modelv0	version used for Perf. Prediction	**Design Model**	**NREL SAM**	Y	C	Y	C
UpdatedDesignModelv1	version used for 2nd Perf. Prediction	**Design Model**	**NREL SAM**	Y	C	Y	C

Name of data field	PV definitions	Data format	Data example	U1	U2	U3	U4
Metadata entered when OD-403 is completed; may be updated when other OD is completed							
AssumedIrradiationDesignModel1	plane of array (POA) irradiation per annum	**kWh/m2a**		Y	C	Y	C
AssumedIrradiationDesignModel2	plane of array (POA) irradiation per annum	**kWh/m2a**		Y	C	Y	C
ModelFactorsSoiling	Annualized dust soiling loss	**%**	**3**	C	C	C	C
ModelFactorsSnow	Annualized Snow Loss	**%**	**5**	C	C	C	C
ModelFactorSeriesResistance	AnnualizedOhmic Losses (both AC and DC)	**%**	**0.8**	C	C	C	C
ModelFactorMismatch	Annualized Module Array Mismatch Loss because of differences between modules	**%**	**0.3**	C	C	C	C
ModelFactorShade	Annualized Shading Loss	**%**	**10**	C	C	C	C
ModelFactorsParasiticLoss	Annualized Parasitic Energy loss (inverters, trackers, etc.)	**kWh**	**5050**	C	C	C	C
ModelFactorsExternalCurtailment	Annualized loss due to curtailment required by outside party	**kWh**	**3100**	C	C	C	C
ModelFactorsNonUnityPowerFactor	Annualized loss due to operating at non-unity power factor	**kWh**	**19520**	C	C	C	C
PredictedEnergyRevenueMeter	Predicted Active Electrical Production at the revenue meter for each year, Eout (kWh) per IEC 61724-3 using historical weather data that is considered to be representative for the site; the Predicted_energy should be reduced from the total predicted energy to reflect times of unavailability and parasitic losses, if applicable. Sometimes called Energy Production Estimate.	**kWh/a (matrix for "n" years, where "n" is expanded for the number of years found for the plant performance model)**	**60000**	Y	Y	Y	Y
PredictedEnergyAvailability	Predicted Energy Availability at the revenue meter estimate by Year using historical weather data; the modeled predicted energy for unity availability may be obtained by dividing "Predicted_energy_revenue_meter" by "Predicted_Energy_Availability". Sometimes called System Availability	**ratio, dimensionless (matrix for "n" years, where "n" is expanded for the number of years found for the plant performance model)**	**1**	Y	C	Y	C
PredictedO&Mcost	Predicted cost of ownership for system by Year	**currency/a (matrix for "n" years where "n" is expanded for the number of years found for the plant performance model)**	**5000**	Y	C	Y	C
Data entered when IEC 61724-2 (Capacity test) is executed for unconstrained operation							
StartDateElectricalPowerTest	time stamp indicating first day of IEC 61724-2 test, administered under OD-401 or OD-402	**yyyy.mm.dd**	**2015.05.21**	Y	Y	Y	Y
EndDateElectricalPowerTest	time stamp indicating final day of IEC 61724-2 test, administered under OD-401 or OD-402	**yyyy.mm.dd**	**2015.05.21**	Y	Y	Y	Y

Name of data field	PV definitions	Data format	Data example	U U U U 1 2 3 4
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
PowerTargetCapMeasurement	Power expected for capacity measurement when executing IEC 61742-2for the specified target conditions	**kW**	**1000**	Y Y Y Y
PcorrMeasuredCapacity	Power measured at the targeted measurement conditions by IEC 61724-2	**kW**	**950**	Y Y Y Y
PowerPerformanceIndex	Ratio of measured to targeted power from IEC 61724-2 measurement, section 6.4	**ratio, dimensionless**	**0.95**	C C C C
IrradianceforPowerMeasurement	Irradiance used for the Targeted conditions for the capacity measurement using IEC 61724-2	**kWh/m2**	**1000**	Y Y Y Y
AmbientTemperaturePowerMeasurement	Ambient temperature used for the Targeted conditions for the capacity measurement using IEC 61724-2	**°C**	**20**	Y Y Y Y
CommentsPowerMeasurement	Additional information needed to explain Capacity measurement	**text field - up to 400 characters**	**Wind speed for test was specified to be 1 m/s**	C C C C
Other parameters relative to completion of plant as documented by OD-401				
ArrayCapacityAsBuiltDC	The DC rating as measured by the flash data	**kW**	**1000321**	Y C Y C
Data entered when 61724-3 (one-year energy test) is executed				
StartDateElectricalEnergyTest	time stamp indicating first day of IEC 61724-3 test, administered under OD-402	**yyyy.mm.dd**	**2015.05.21**	Y Y Y C
EndDateElectricalEnergyTest	time stamp indicating final day of IEC 61724-3 test, administered under OD-402	**yyyy.mm.dd**	**2015.05.21**	Y Y Y C
REIBName	RE Inspection body completing annual test	**Name**	**DNVGL**	Y Y Y Y
MeasurementClassIEC	Measurement class per IEC 71724	**Class type**	**A**	Y Y Y Y
PerformanceModelModified	Has performance model been modified relative to previous test?	**y/n**	**Y**	Y Y Y Y
Parameters associated with meteorological data				
OneYearinPlaneMeasuredIrradiation	One-year in-plane irradiation, Hi, as described in IEC 61724-1 Ed. 2 (Class A, B, or C, as appropriate for U1, U2, U3, or U4) in Table 10, Section 9.3 and Table 3, section 7 and as tabulated under the guidance of IEC 61724-3. A class C measurement allows use of satellite data for irradiance.	**kWh/m2**	**1500**	Y Y Y Y
ExpectedEnergyatRevenueMeter	Expected Active Electrical Production at the revenue meter for indicated time period, Eout (kWh) per IEC 61724-3 using measured weather data during times of availability and including adjustments for parasitic losses. See Section 6.6.6 of IEC 61724-3.	**kWh/a**	**60000**	Y Y Y Y

Name of data field	PV definitions	Data format	Data example	U1	U2	U3	U4
Metadata entered when OD-403 is completed; may be updated when other OD is completed							
ExpectedEnergyUnavailableTimes	Calculated from measured weather during times of unavailability as per IEC 61724-3 section 6.6.5 (see Section 8.13(ii)).	**kWh**	**1000**	Y	C	Y	C
ExpectedEnergyUnavailableTimesExternal	Calculated from measured weather during times of unavailability that have been identified to be caused by external events as per IEC 61724-3 section 6.6.5 (see Section 8.13(ii)).	**kWh**	**1000**	Y	C	Y	C
TotalExpectedEnergyRevenueMeter	Sum of expected energies for both times of availability and unavailability (Expected_energy_revenue_meter+expected_energy_unavailable_times)	**kWh**	**1010**	Y	C	C	C
Parameters associated with plant performance data							
MeasuredEnergyInclParasitics	Active (real) energy measured for the indicated time period according to IEC 61724-3 sec 6.7 including adjustment for parasitic losses	**kWh**	**1000**	Y	Y	Y	Y
MeasuredEnergyAvailability	Measured Energy Availability for the indicated time period calculated from the measured weather data and observed availability according to IEC 61724-3, section 6.8. may be obtained by dividing "Expected_energy_revenue_meter" by "Expected_energy_Unavailable_Times"	**ratio, dimensionless**	**1**	Y	C	Y	C
ExternalCauseExcludedEnergyAvailability	Actual Energy Availability For the Year excluding time of external or other outage causes per IEC 61724-3 section 6.8.1	**ratio, dimensionless**	**0.99**	Y	C	Y	C
AllInEnergyPerformanceIndex	Active (real) energy performance index including times when the system is not functioning as in IEC 61724-3 section 6.8.	**ratio, dimensionless**	**0.9**	Y	C	C	C
InServiceEnergyPerformanceIndex	Active (real) Energy Performance Index during times when the system is functioning (offline times removed) as in IEC 61724-3 section 6.8	**ratio, dimensionless**	**0.9**	Y	C	C	C
ParasiticLossMeasured	Are parasitic losses measured in the test?	**Yes/No**	**No**	Y	C	Y	C
MeasurementProcedureDeviations	Test Procedure pertains to IEC 61724-3	**Yes/No**	**No**	Y	C	Y	C
CapacityFactorIEC	Active (Real) energy generation of plant relative to energy that would have been generated if the plant was operating continuously at its AC rated power, per IEC 61724-3 section 6.8.2	**dimensionless**	**0.25**	Y	C	C	C
MeasurementUncertainityBasis	Standard method used to calculate Uncertainity of measurement	**Method Used**	**ISO/IE Guide 98-1:2009**	Y	C	Y	C

Name of data field	PV definitions	Data format	Data example	U1	U2	U3	U4
Metadata entered when OD-403 is completed; may be updated when other OD is completed							
StatedUncertaintyValueExpectedEnergy	Uncertainty in expected energy arising from uncertainty in the measured weather data	**Percentage**	**±3**	Y	C	Y	C
StatedUncertainityValueEnergyMeasured	Value Quantification of Total Uncertainity (including bias and precision)of Energy Measured	**Percentage**	**±3**	Y	C	Y	C
ExpectedO&MCost	Cost of ownership for system based on the Predicted_O&M_Cost, but with the expected value for the particular time period used for this test.	**currency/W**	**1**	Y	C	Y	C
MeasuredO&MCost	Cost of ownership for system based on documented expenses for the particular time period used for this test.	**currency/W**	**1**	Y	C	Y	C
ActualCostUnavailabilityDrivenLostEnergy	Cost for lost revenue from lost energy generation during year-long test	**currency/W**	**1**	Y	C	Y	C
ActualCostPenaltiesLostEnergy	Cost of penalties for loss of performance during yearlong test	**currency/W**	**1**	Y	C	Y	C
ActualCostLowPerformanceDrivenLostEnergy	Cost of imperfect performance during annual test	**currency/W**	**1**	Y	C	Y	C
ActualCostPenaltiesAvailLostEnergy	Cost of penalties due to unavailability during period of test	**currency/W**	**1**	Y	C	Y	C
Parameters expected to help understand the future health of the plant							
RPN	Risk Priority Number	**dimensionless**	**1**	C	C	C	C
PQL	Plant Quality Level	**dimensionless 1-10**		C	C	C	C
Table financial identifiers							
FinancingName		**Name**		Y	Y	Y	Y
FinancingLoanNumber		**alphanumeric**		Y	Y	Y	Y
FinancingName2		**Name**		Y	Y	Y	Y
FinancingLoanNumber2		**alphanumeric**		Y	Y	Y	Y
FinancialSecurityName		**alphanumeric**		Y	Y	Y	Y
FinancialSecurityNumber		**alphanumeric**		Y	Y	Y	Y
PerformanceInsuranceName		**Name**		Y	C	Y	C
InsurancePolicyNumber		**alphanumeric**		Y	C	Y	C
InsuranceName2		**Name**		Y	C	Y	C
InsurancePolicyNumber2		**alphanumeric**		Y	C	Y	C
Extended financial parameters (optional)							
Predicted OperatingExpenses		**currency/W**		C	C	C	C
Predicted AssetManagementCosts		**currency/W**		C	C	C	C
Predicted GeneralInsuranceExpense		**currency/W**		C	C	C	C
Predicted ExciseAndSalesTaxes		**currency/W**		C	C	C	C
Predicted RealEstateTaxExpense		**currency/W**		C	C	C	C
Predicted UtilitiesCosts		**currency/W**		C	C	C	C
Predicted OtherExpenses		**currency/W**		C	C	C	C

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
Predicted AuditingFee		**currency/W**		cccc
Predicted TaxPreparationFee		**currency/W**		cccc
Predicted OtherAdministrativeFees		**currency/W**		cccc
Predicted SiteLeasePayment		**currency/W**		cccc
Predicted CurrentFederalTaxExpenseBenefit		**currency/W**		cccc
Predicted CurrentStateAndLocalTaxExpenseBenefit		**currency/W**		cccc
Predicted OtherTaxExpenseBenefit		**currency/W**		cccc
Predicted CostsAndExpenses		**currency/W**		cccc
Predicted PaymentsForRent		**currency/W**		cccc
Predicted ElectricalGenerationRevenue		**currency/W**		cccc
Predicted PBIRevenue		**currency/W**		cccc
Predicted RECRevenue		**currency/W**		cccc
Predicted RebateRevenue		**currency/W**		cccc
Predicted OtherIncome		**currency/W**		cccc
Predicted Revenues		**currency/W**		cccc
Predicted CostOfServicesDepreciationAndAmortization		**currency/W**		cccc
Predicted PrincipalAmountOutstandingOnLoansManagedAndSecuritized		**currency/W**		cccc
Predicted InvestedCapital		**currency/W**		cccc
Predicted TotalOfAllProjectAccountBalances		**currency/W**		cccc
Predicted UnleveredInternalRateOfReturn		**Percentage**		cccc
Predicted All-inYield		**Percentage**		cccc
Predicted PropertyPlantAndEquipmentUsefulLife		**yyyy.mm.dd.hh.mm.ss**		cccc
Predicted PropertyPlantAndEquipmentSalvageValue		**currency/W**		cccc
Predicted Tax-EquityCashDistributions		**currency/W**		cccc
Predicted OtherPaymentsToFinanciers		**currency/W**		cccc
Predicted HypotheticalLiquidationAtBookValueBalance		**currency/W**		cccc
Predicted PartnershipFlipDate		**yyyy.mm.dd.hh.mm.ss**		cccc
Predicted PartnershipFlipYield		**Percentage**		cccc
Predicted All-inYield		**Percentage**		cccc

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
Predicted DebtInstrumentPeriodicPaymentPrincipal		**currency/W**		cccc
Predicted DebtInstrumentPeriodicPaymentInterest		**currency/W**		cccc
Predicted DeficitRestorationObligation		**currency/W**		cccc
Predicted DeficitRestorationObligationLimit		**currency/W**		cccc
Actual OperatingExpenses		**currency/W**		cccc
Actual AssetManagementCosts		**currency/W**		cccc
Actual GeneralInsuranceExpense		**currency/W**		cccc
Actual ExciseAndSalesTaxes		**currency/W**		cccc
Actual RealEstateTaxExpense		**currency/W**		cccc
Actual UtilitiesCosts		**currency/W**		cccc
Actual OtherExpenses		**currency/W**		cccc
Actual AuditingFee		**currency/W**		cccc
Actual TaxPreparationFee		**currency/W**		cccc
Actual OtherAdministrativeFees		**currency/W**		cccc
Actual SiteLeasePayment		**currency/W**		cccc
Actual CurrentFederalTaxExpenseBenefit		**currency/W**		cccc
Actual CurrentStateAndLocalTaxExpenseBenefit		**currency/W**		cccc
Actual OtherTaxExpenseBenefit		**currency/W**		cccc
Actual CostsAndExpenses		**currency/W**		cccc
Actual PaymentsForRent		**currency/W**		cccc
Actual ElectricalGenerationRevenue		**currency/W**		cccc
Actual PBIRevenue		**currency/W**		cccc
Actual RECRevenue		**currency/W**		cccc
Actual RebateRevenue		**currency/W**		cccc
Actual OtherIncome		**currency/W**		cccc
Actual Revenues		**currency/W**		cccc
Actual CostOfServicesDepreciationAndAmortization		**currency/W**		cccc
Actual PrincipalAmountOutstandingOnLoansManagedAndSecuritized		**currency/W**		cccc
Actual InvestedCapital		**currency/W**		cccc
Actual TotalOfAllProjectAccountBalances		**currency/W**		cccc
Actual UnleveredInternalRateOfReturn		**Percentage**		cccc
Actual All-inYield		**Percentage**		cccc
Actual PropertyPlantAndEquipmentUsefulLife		**yyyy.mm.dd.hh.mm.ss**		cccc

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
Actual PropertyPlantAndEquipmentSalvageValue		**currency/W**		cccc
Actual Tax-EquityCashDistributions		**currency/W**		cccc
Actual OtherPaymentsToFinanciers		**currency/W**		cccc
Actual HypotheticalLiquidationAtBookValueBalance		**currency/W**		cccc
Actual PartnershipFlipDate		**yyyy.mm.dd.hh.mm.ss**		cccc
Actual PartnershipFlipYield		**Percentage**		cccc
Actual All-inYield		**Percentage**		cccc
Actual DebtInstrumentPeriodicPaymentPrincipal		**currency/W**		cccc
Actual DebtInstrumentPeriodicPaymentInterest		**currency/W**		cccc
Actual DeficitRestorationObligation		**currency/W**		cccc
Actual DeficitRestorationObligationLimit		**currency/W**		cccc
PowerCustomerName		**Name**		cccc
PercentMerchantPowerSales		**Percentage**		cccc
GeneralPartnerMember0		**Name**		cccc
LimitedPartnerMember1		**Name**		cccc
LimitedPartnerMember2		**Name**		cccc
LimitedPartnerMember3		**Name**		cccc
LimitedPartnerMember4		**Name**		cccc
LimitedPartnerMember5		**Name**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPManagingMemberOrGeneralPartnerOwnershipInterest0		**Percentage**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPMembersOrLimitedPartnersOwnershipInterest1		**Percentage**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPMembersOrLimitedPartnersOwnershipInterest2		**Percentage**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPMembersOrLimitedPartnersOwnershipInterest3		**Percentage**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPMembersOrLimitedPartnersOwnershipInterest4		**Percentage**		cccc
LimitedLiabilityCompanyLLCOrLimitedPartnershipLPMembersOrLimitedPartnersOwnershipInterest4		**Percentage**		cccc

Name of data field	PV definitions	Data format	Data example	UUUU 1234
Metadata entered when OD-403 is completed; may be updated when other OD is completed				
IncomeTaxExpenseBenefitIntraperiodTaxAllocation0		**currency/W**		cccc
IncomeTaxExpenseBenefitIntraperiodTaxAllocation1		**currency/W**		cccc
IncomeTaxExpenseBenefitIntraperiodTaxAllocation2		**currency/W**		cccc
IncomeTaxExpenseBenefitIntraperiodTaxAllocation3		**currency/W**		cccc
IncomeTaxExpenseBenefitIntraperiodTaxAllocation4		**currency/W**		cccc
IncomeTaxExpenseBenefitIntraperiodTaxAllocation5		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid0		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid1		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid2		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid3		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid5		**currency/W**		cccc
DistributionMadeToLimitedPartnerCashDistributionsPaid4		**currency/W**		cccc
EquityMethodInvestmentOwnershipPercentage0		**Percentage**		cccc
EquityMethodInvestmentOwnershipPercentage1		**Percentage**		cccc
EquityMethodInvestmentOwnershipPercentage2		**Percentage**		cccc
EquityMethodInvestmentOwnershipPercentage3		**Percentage**		cccc
EquityMethodInvestmentOwnershipPercentage4		**Percentage**		cccc
EquityMethodInvestmentOwnershipPercentage5		**Percentage**		cccc

INTERNATIONAL ELECTROTECHNICAL RENEWABLE COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
info@iec.ch
www.iec.ch

IEC SYSTEM FOR CERTIFICATION TO STANDARDS RELATING TO EQUIPMENT FOR USE IN ENERGY APPLICATIONS (IECRE SYSTEM)

IECRE Secretariat c/o IEC
3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
secretariat@iecre.org
www.iecre.org