## Sub Working Group: Power Systems (5.1.2.)

## Task Register Reference

* 5.1.2 - Review of IALA documents (ref ENG1 input paper on document ownership).

## Summary

Follow a review of the input documents at ENG2 on solar sizing, the results of the models were compared and contrasted. The differences were identified leading to further actions intercessionally and possible activities for the IALA LITE and BATT workshop.

## Activity

### Introduction

During ENG1, Task Group 2 identified that a review and combining of a number of guidelines on power systems is needed. This was to start with a comparison of solar sizing techniques to be able to update the IALA model. Members were requested to use their own models and submit the results for comparisons and discussion. Trinity House was to provide the load, location, battery and solar module data.

### Variation in Design Strategy

Trinity House, RET & IALA

* Need to meet the day’s reserve.
* Increase the battery capacity and balance this against the number of solar panels
* Balance solar panel count and battery size to physical site constraints.

IALA

* 1 Hour switch level: exhibit the light 1 hour before sun set and 1 hour after sun rise.

Trinity House

* The goal is to have no more than 60% discharged (40% remaining) with a recovery charge of about 3 months.
* If a fault occurs only 90% capacity of the battery is used as the load is disconnected.

CEREMA

* In normal operation, the batteries are only discharged to a maximum of 50%
* All solar gain calculation for the whole year is based on the worst month’s irradiance (Jan).
* The total nightly energy consumption is recharged each day.
* Need to have sufficient solar panels to recover the battery discharge within a minimal time.

RETScreen

* The goal is to have a maximum discharge of 80% and recovery within 3 months.
* Always use the minimum historical level of solar irradiance
* 7 Days of no sun or reserve
* If a fault occurs the full 100% capacity of the battery is used

### Results

Comparison of fixed sites

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Batteries** | **Solar Modules** | **Autonomy** | **Comments** |
| IALA | 1 x 1363 Ah | 10 | 21 |  |
| Trinity House | 1 x 1363 Ah | 10 | 23 |  |
| CEREMA | 1 x 1363 Ah | 47 | 21 | Size of panels to recharge the batteries within a minimal time |
| RETScreen | 1 x 655Ah | (14) 6.4m2 | 21 | Variation is due to solar irradiance and strategy |

Table 1 - Comparison of results

### Observations

In completing and comparing the approaches to solar modelling a number of key factors need to be considered and included within any calculations to ensure effective performance at the end of life.

|  |  |
| --- | --- |
| **Batteries** | **Panels** |
| * Minimal battery capacity * Battery efficiency * Battery capacity de-rating due to temperature * Aging factor for batteries | * Aging of solar panel * PV array losses due to high temperature. * Bird fowling de-rating * An afloat de-rating factor |

Table 2 - Factors

In addition there are a number of other observations that have been identified that should be encompassed within the IALA solar model:

* The ability to include equipment that is operational during low visibility
* Seasonal loads e.g. Racon operational during summer months only
* Use of new technology such as Maximum Power Point Tracking (MPPT) regulators and their impact on solar calculations.

## Intercessional Actions

* Comparison of [RETscreen](http://www.retscreen.net/)© based and the IALA based solar systems to understand the reason for the differences found. Jorg Unterderweide, Leif Larsen
* Re-run a solar model for a buoy on all 4 systems. Peter Dobson, Jorg Unterderweide, Leif Larsen, Ronan Autret.
  + Peter Dobson to provide the model data.
* Feedback to the group about how MPPT regulation work and provide a comparison Peter Dobson
* Compare and contrast at ENG3

## Actions for the IALA LITE and BATT workshop

* Presentation of experiences of using fuel cells or other hybrid systems and how these are integrated into a solar model.
* Include in the IALA solar model all of the above factors identified in Table 2 - Factors
* Updating of Guideline 1039 Ed1 Designing Solar Power Systems for Aids to Navigation