

Yingli Spain R&D, Aftersales Service Center BIPV system: one year experience

Workshop “Eco-design from PV to BIPV”
CIEMAT, 14 March 2017

José María Román

Laboratory Director

e-mail: jm.roman@yingli.com

R&D, Aftersales Service Center

Pol. Ind. Sur - Ctra. N-I km 32,1

E-28750 San Agustín del Guadalix (Madrid) Spain



Outline



- Introduction: YGES PV plant
 - West façade
 - South façade
 - Roof-top
- Operation results for 2016
 - West façade
 - South façade
 - Roof-top
- Energy balance generation vs. consumption
- Case studies
- Wrap-up

Introduction: YGES PV Plant



Yingli Green Energy Spain, S.L.U. opened their facilities in San Agustín del Guadalix in Autumn 2011.

This building has been provided with an integrated and attached PV system with an overall power of **182 kW**, divided in three zones:

- West Façade (**12 kW**): 132 modules of type BIPVYL115(14)PQR (glass-glass module), separated in 3 strings
 - 1 inverter SMA Sunny Tripower 12000TL-10: 3 strings of 44 modules.
- South Façade (**85 kW**): 394 modules of type YL260C-30b, separated in 22 strings
 - 5 inverters SMA Sunny Tripower 15000TL-10: 4 strings of 18 modules (2 with 17 modules).
 - 1 inverter SMA Sunny Tripower 10000TL-10: 2 strings of 18 modules.
- Roof-top (**85 kW**): 314 modules of type YL260C-30b and 8 modules of type YL270C-30b separated in 14 strings
 - 4 inverters SMA Sunny Tripower 17000TL-10: 2/3 strings of 23 modules.
 - 1 inverter GreenTech GP20KTO: 4 strings of 23 modules.

A fourth zone, the Outdoor Benches, was added in September 2016 to perform temporary exposure tests, with a size up to **30 kW**.

Main building Roof-top and West façade

- PV glass integration on west façade (12 kW)
- Use of roof-top to include a 85 kW PV system



Main building South façade

- South façade provided with a 85 kW PV system curtain wall

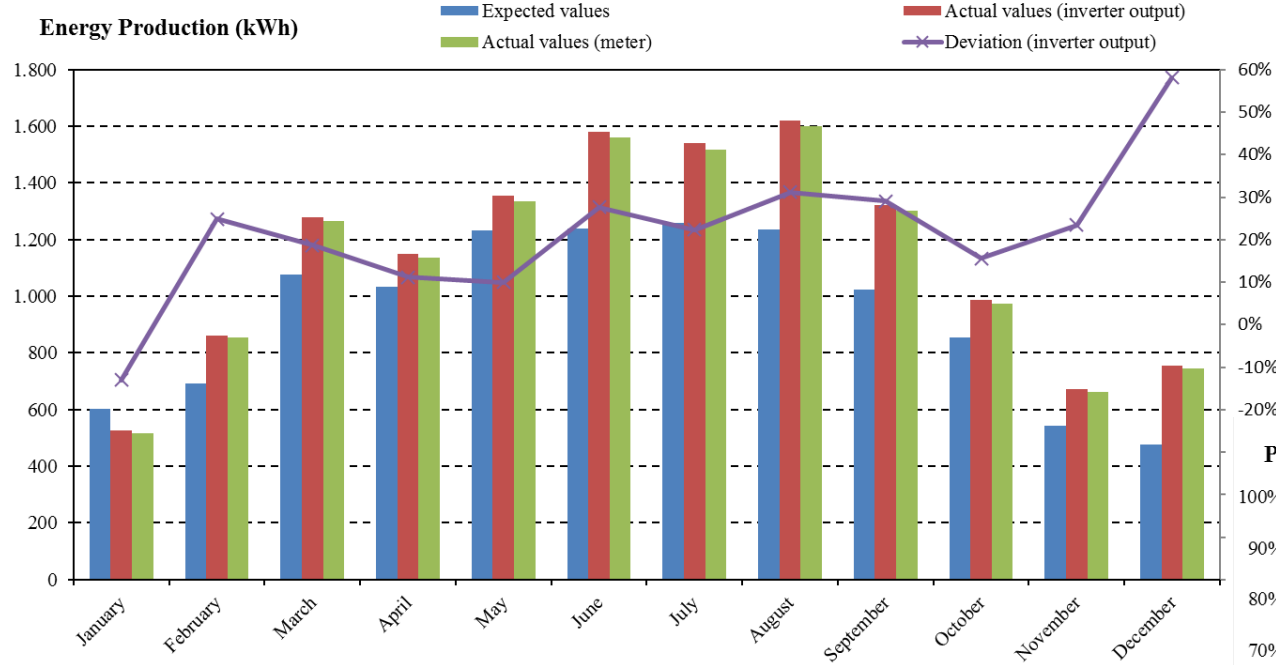


Outdoor benches for temporary tests

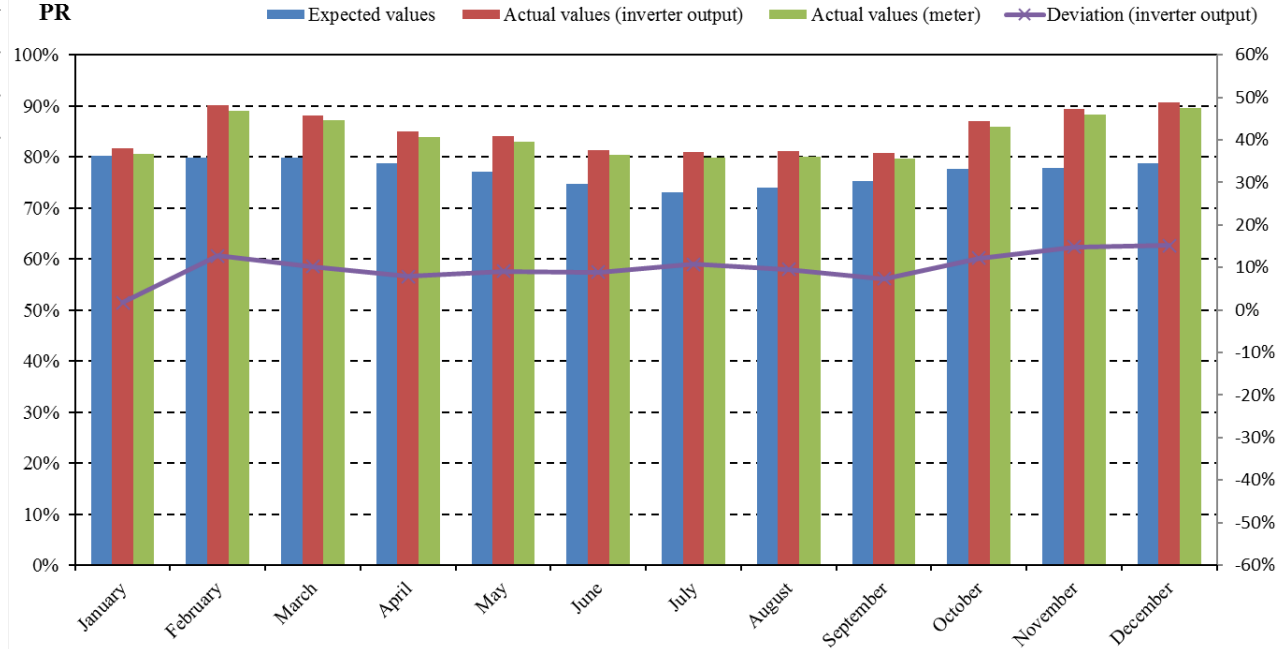


West façade operation 2016

Energy Production (kWh)



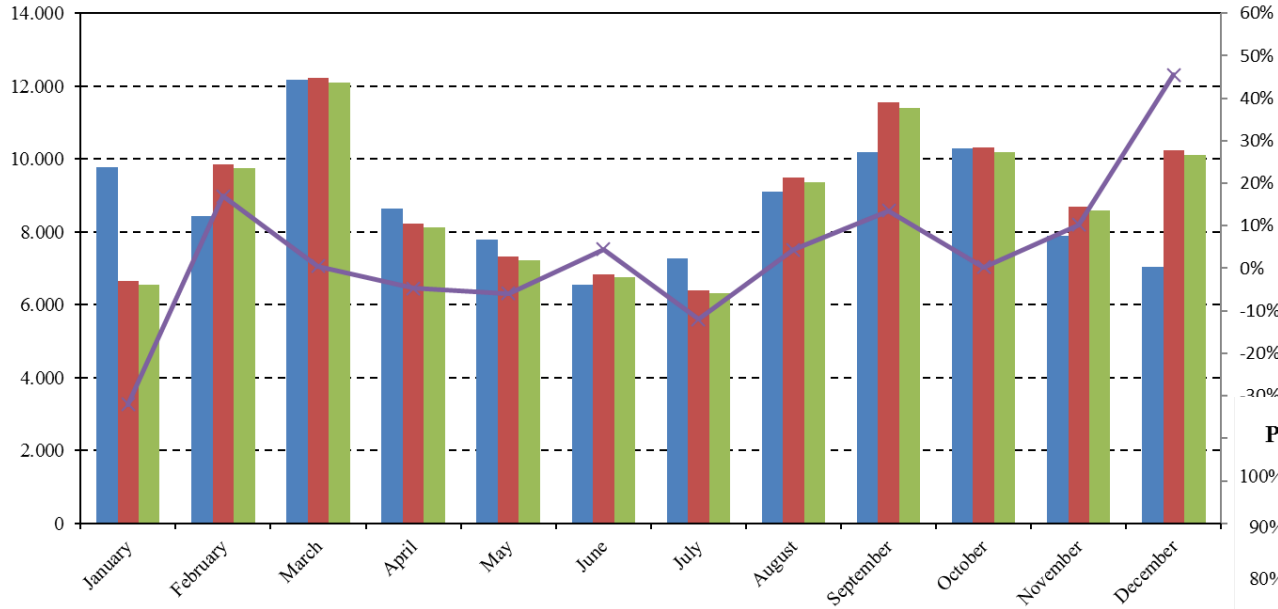
PR



South façade operation 2016

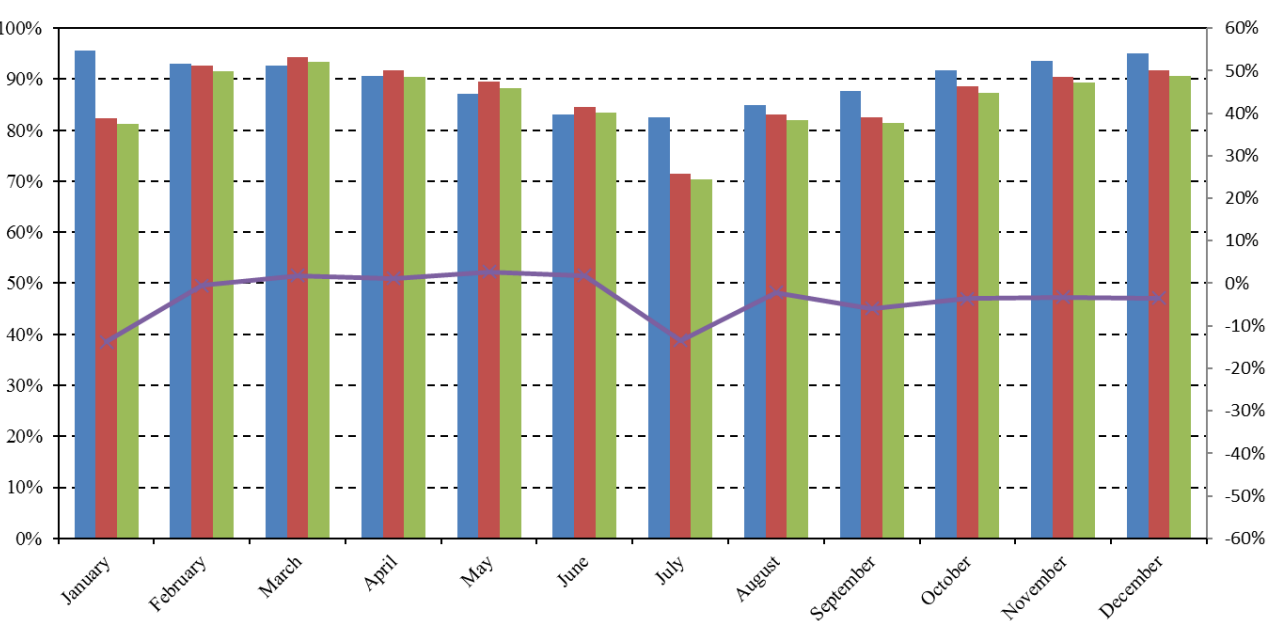
Energy Production (kWh)

Expected values
Actual values (meter)
Actual values (inverter output)
Deviation (inverter output)

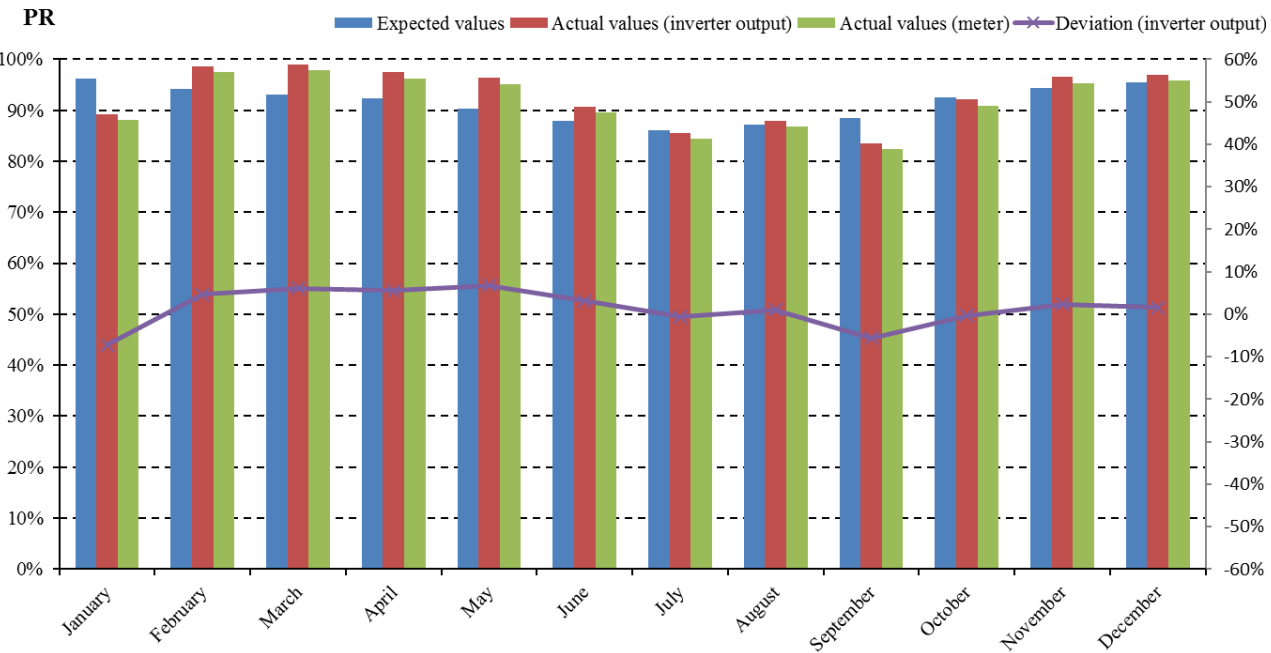
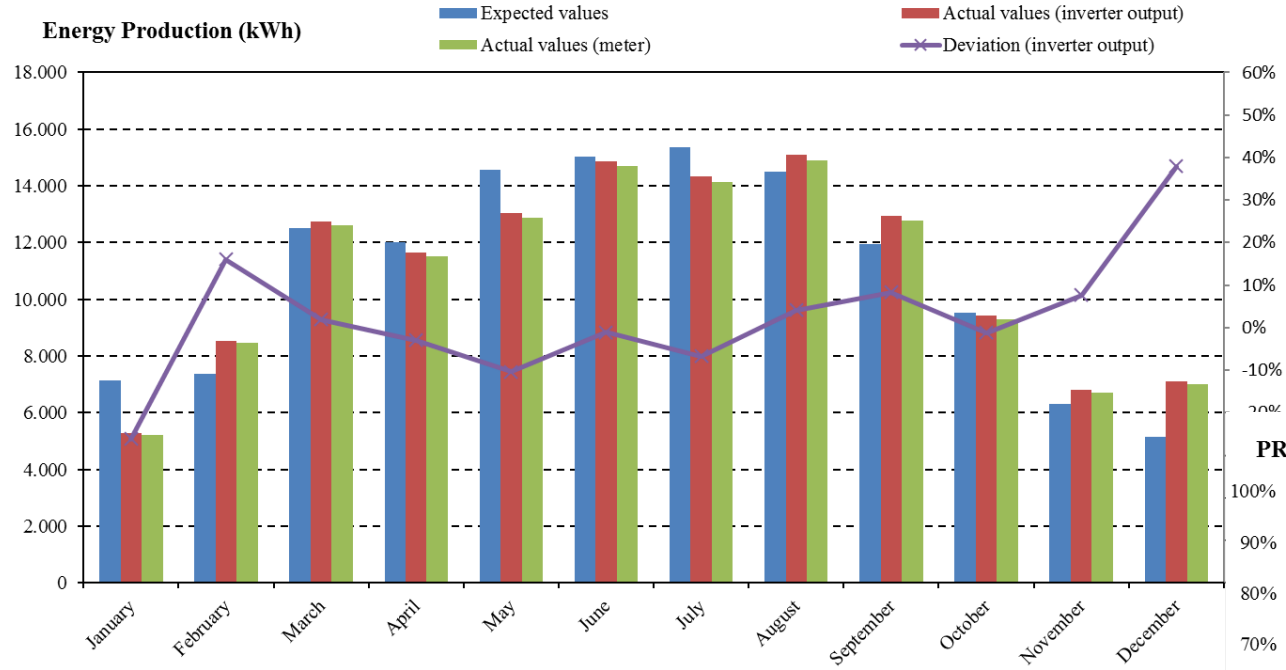


PR

Expected values
Actual values (inverter output)
Actual values (meter)
Deviation (inverter output)



Roof-top operation 2016



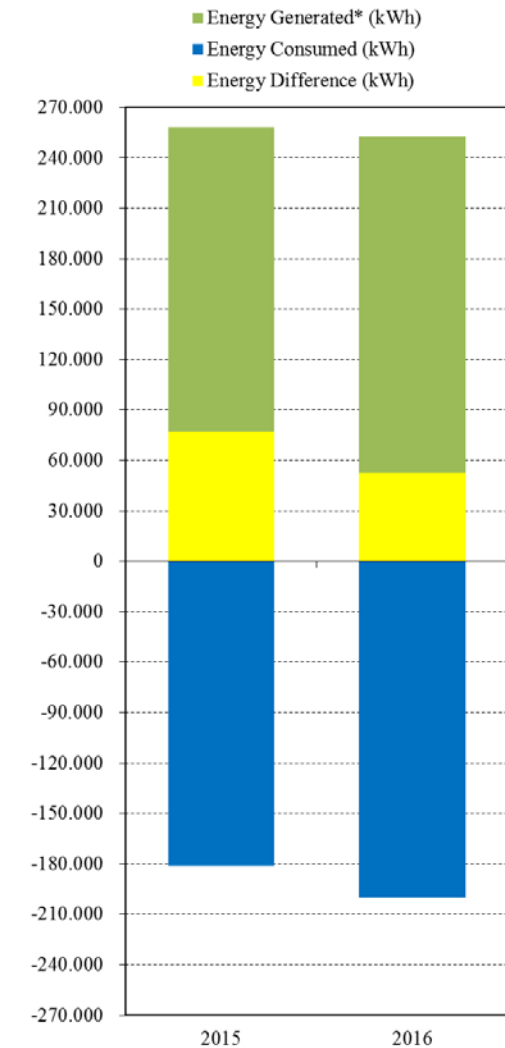
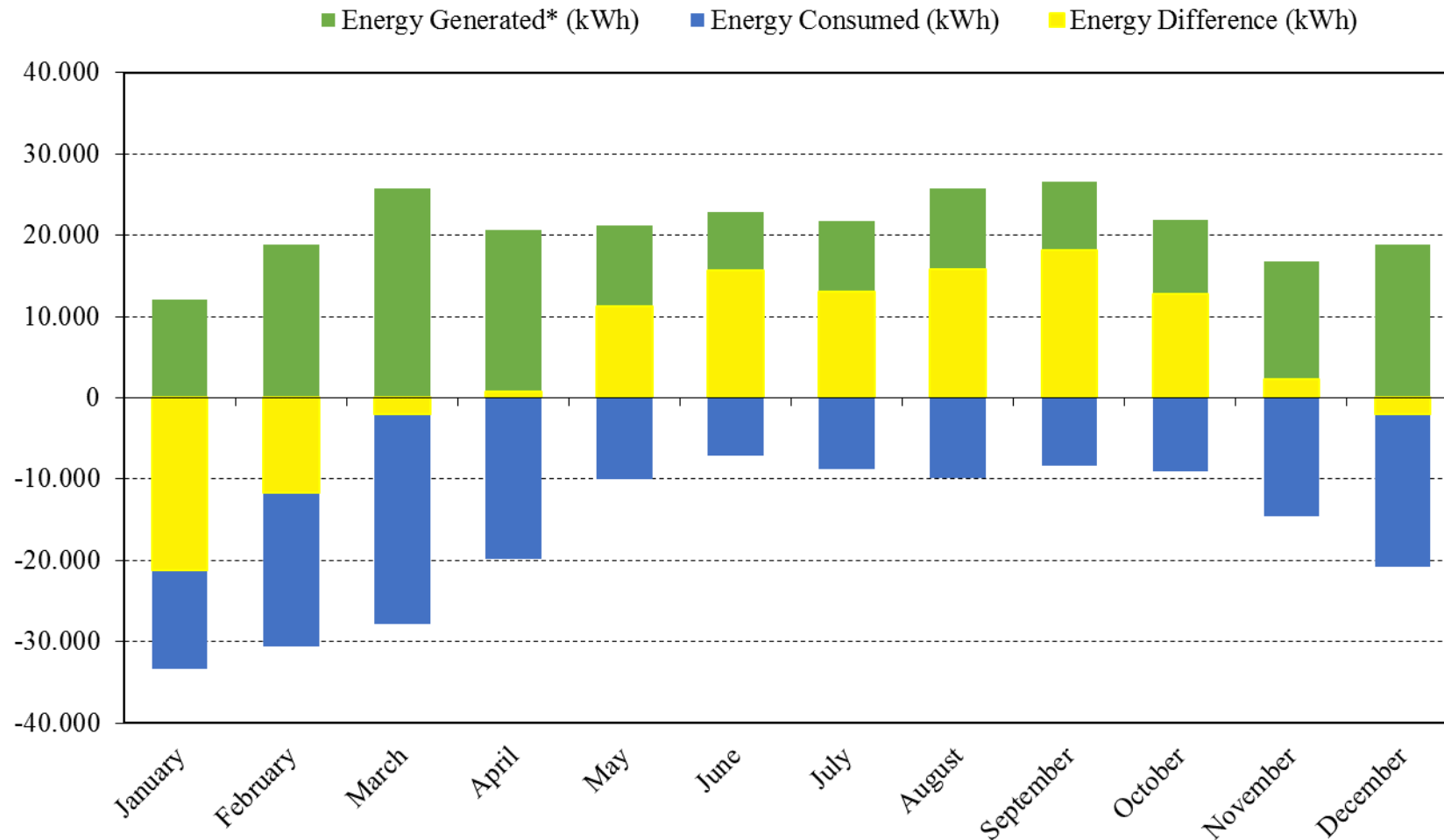
December 2016 zones intercomparison

Daily deviation of PR for each inverter compared to the inverter monthly value																
Day	WF-I01	WF	SF-I02	SF-I03	SF-I04	SF-I05	SF-I06	SF-I07	SF	RT-I08	RT-I09	RT-I13	RT-I11	RT-I12	RT	Overall
01/12/2016	-25.8%	-25.8%	-26.8%	-28.3%	-26.7%	-28.1%	-25.1%	-33.5%	-27.6%	3.8%	-0.5%	4.4%	1.5%	6.4%	3.6%	-8.8%
02/12/2016	5.8%	5.8%	8.2%	7.1%	8.8%	7.3%	7.6%	7.0%	7.7%	5.0%	4.6%	4.9%	5.4%	7.7%	5.5%	8.2%
03/12/2016	5.8%	5.8%	0.6%	-0.2%	1.5%	0.5%	1.2%	-0.1%	0.6%	-1.0%	-1.4%	-1.3%	-1.1%	0.3%	-0.9%	2.3%
04/12/2016	-43.4%	-43.4%	-41.0%	-42.9%	-40.3%	-42.9%	-38.3%	-53.3%	-42.2%	-4.7%	-12.2%	-5.4%	-8.8%	-2.4%	-6.1%	-23.2%
05/12/2016	-11.2%	-11.2%	-13.3%	-15.3%	-13.8%	-14.6%	-12.1%	-16.8%	-14.1%	10.6%	8.0%	9.6%	8.9%	13.8%	10.3%	1.6%
06/12/2016	1.2%	1.2%	0.2%	0.1%	-0.6%	-0.2%	-0.2%	-0.2%	-0.1%	-1.5%	-1.2%	-1.5%	-1.3%	-1.7%	-1.5%	0.1%
07/12/2016	1.2%	1.2%	0.9%	0.1%	0.1%	0.3%	0.0%	-0.4%	0.2%	-0.8%	-0.7%	-0.7%	-0.9%	-1.1%	-0.8%	1.7%
08/12/2016	5.9%	5.9%	2.6%	0.4%	1.9%	0.8%	1.9%	0.7%	1.4%	-0.9%	-1.0%	-0.9%	-0.1%	1.5%	-0.3%	2.8%
09/12/2016	-14.1%	-14.1%	-8.7%	-5.2%	-8.1%	-7.0%	-7.5%	-8.3%	-7.4%	3.0%	2.6%	2.7%	-0.9%	-3.9%	0.9%	-0.3%
10/12/2016	-1.0%	-1.0%	0.0%	-0.2%	0.4%	-0.6%	-0.7%	-0.9%	-0.3%	1.3%	1.4%	1.1%	0.1%	0.4%	0.9%	1.9%
11/12/2016	1.6%	1.6%	0.4%	0.5%	0.5%	0.9%	0.3%	0.7%	0.5%	-1.1%	-0.9%	-1.1%	-0.5%	-1.5%	-1.1%	0.9%
12/12/2016	1.9%	1.9%	0.8%	-0.5%	0.8%	-1.1%	-0.7%	-1.3%	-0.3%	-2.8%	-2.9%	-2.7%	-1.8%	-0.7%	-2.2%	1.4%
13/12/2016	-1.6%	-1.6%	-1.8%	-2.7%	-1.4%	-2.5%	-1.5%	-4.2%	-2.2%	4.7%	3.1%	4.4%	2.9%	5.9%	4.3%	2.9%
14/12/2016	-12.7%	-12.7%	-10.0%	-11.5%	-10.0%	-10.5%	-9.0%	-12.7%	-10.5%	11.4%	8.8%	11.3%	9.5%	14.1%	11.3%	4.7%
15/12/2016	-10.0%	-10.0%	-11.8%	-8.2%	-6.7%	-7.9%	-7.0%	-10.1%	-8.4%	4.2%	2.4%	4.2%	3.6%	6.6%	4.3%	1.5%
16/12/2016	-27.1%	-27.1%	-25.9%	-27.6%	-25.9%	-27.6%	-24.6%	-33.5%	-27.0%	4.8%	0.4%	4.2%	1.5%	7.8%	4.1%	-7.7%
17/12/2016	2.9%	2.9%	1.1%	-0.5%	1.5%	0.5%	2.0%	0.9%	0.9%	1.7%	1.4%	1.2%	1.7%	3.5%	1.9%	3.8%
18/12/2016	0.8%	0.8%	-0.1%	0.2%	-0.3%	0.7%	0.9%	1.2%	0.4%	-0.4%	-0.1%	-0.9%	-0.9%	-2.1%	-0.9%	1.8%
19/12/2016	-0.7%	-0.7%	1.5%	1.0%	1.9%	1.8%	2.0%	2.1%	1.7%	-0.3%	-0.4%	-0.2%	0.1%	1.3%	0.1%	2.1%
20/12/2016	-1.6%	-1.6%	-0.2%	-1.9%	-1.0%	-1.5%	-0.8%	-2.7%	-1.2%	4.7%	3.5%	4.6%	4.2%	5.5%	4.6%	5.5%
21/12/2016	-2.9%	-2.9%	-2.1%	-0.4%	-1.5%	0.1%	-0.6%	0.1%	-0.8%	1.1%	1.1%	1.1%	-0.1%	-1.3%	0.4%	1.8%
22/12/2016	-1.2%	-1.2%	0.9%	-1.0%	-0.2%	-2.0%	-0.1%	-2.2%	-0.6%	0.2%	-0.1%	0.2%	0.2%	2.2%	0.5%	-4.5%
23/12/2016	1.3%	1.3%	0.7%	0.9%	0.7%	0.6%	0.7%	1.2%	0.8%	-0.7%	-0.4%	-0.6%	-0.4%	-1.2%	-0.7%	-4.7%
24/12/2016	0.7%	0.7%	-0.1%	0.5%	-0.2%	0.1%	0.1%	0.8%	0.1%	-1.5%	-0.9%	-1.4%	-1.1%	-2.3%	-1.5%	-5.5%
25/12/2016	0.3%	0.3%	0.6%	0.6%	0.9%	0.8%	0.5%	1.1%	0.7%	-1.0%	-0.7%	-0.9%	-0.3%	-0.6%	-0.7%	-5.2%
26/12/2016	0.4%	0.4%	-0.4%	0.4%	-0.3%	-0.1%	-0.1%	-0.3%	-0.1%	-1.2%	-0.7%	-1.1%	-1.0%	-2.3%	-1.3%	-5.3%
27/12/2016	-0.2%	-0.2%	0.0%	0.4%	0.1%	0.5%	0.1%	0.6%	0.3%	-1.2%	-0.8%	-1.2%	-0.9%	-1.6%	-1.2%	-5.4%
28/12/2016	0.4%	0.4%	0.2%	0.9%	0.3%	0.8%	0.4%	0.9%	0.6%	-1.1%	-0.6%	-0.9%	-0.8%	-1.9%	-1.1%	1.3%
29/12/2016	-0.6%	-0.6%	-0.2%	0.6%	-0.2%	0.3%	-0.5%	0.9%	0.1%	-1.3%	-0.8%	-1.1%	-1.0%	-2.0%	-1.3%	1.0%
30/12/2016	0.4%	0.4%	-0.2%	0.5%	-0.6%	-0.1%	-0.7%	0.8%	-0.1%	-0.8%	-0.3%	-0.4%	-0.3%	-1.3%	-0.7%	1.1%
31/12/2016	0.2%	0.2%	0.2%	0.9%	0.1%	0.7%	-0.2%	1.0%	0.4%	-0.2%	0.1%	0.0%	0.0%	-1.1%	-0.2%	2.2%

Energy balance generation vs. consumption 2016



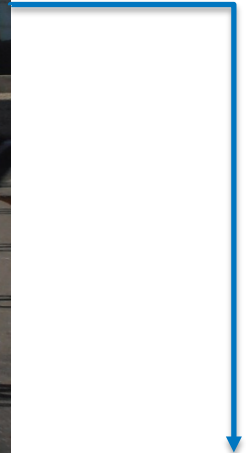
Power Your Life



Case studies



Power Your Life



Objective: long-term data compilation

Module reliability analysis

- Data from PV modules and PV system operation, incorporated into a database. It allows for comparison between module types, evolution through time, etc. The longer the data build-up is continued the more reliable the conclusions obtained.

O&M of the YGES Facilities PV plant

- Monitoring of production and performance of the PV modules installed in the YGES Facilities, located in 3 zones: Glass-Glass module West-Façade, South Façade and Roof-Top (both with monocrystalline silicon PV modules).

Case studies

- Intended for residential use and self-consumption.
- Off-grid installation of 20 PV modules connected to a batteries system managed by a grid generator.
- 8 PV modules each connected to single micro-inverters.

R&D, Aftersales Service Center Yingli Spain

Visit us on 17 March 2017!!!

