Project co-financed by the European Regional Development Fund

WP3: Testing, Activity 3.16

RES in rural environments - Biovilla

Deliverable 3.16.1: Renewables for development of Biovilla

Final version, December 2018

European Union
European Regional Development Fund

Project co-financed by the European Regional Development Fund

WP3 (TESTING) LEADER
Technical University of Crete, School of Environmental Engineering, Renewable and Sustainable Energy Systems Lab (TUC ReSEL)

RESPONSIBLE PARTNER: Energy and Environment Agency Arrabida (ENA)

DELIVERABLE 3.16.1: Renewables for development of Biovilla
FINAL VERSION, December 2018

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Table of Contents

1. INTRODUCTION

Biovilla is a project integrated into a rural area, aiming the social, economic and environmental development of its region. The vision and motives of the pilot operator/beneficiary are the establishment of a living lab that will be used for demonstrating the viability and success of RES and EE in rural areas.

The buildings' energy is already produced by solar PV system but there is a need for a sustainable and environmentally friendly processing system for vegetables and fruits produced in the area and also for water pumping. The pilot intended to demonstrate the viability and success of RES and EE in rural areas among the local community, contributing for the valorisation of local resources.

For the project implementation they were analysed the main opportunities:

- ✓ Large variety of RES
- ✓ High electricity and fossil fuel prices
- ✓ RES and EE directives and National Strategic Plans
- ✓ Lack of connection to the local electrical grid

and the main challenges and barriers:

- ✓ Insufficient awareness of the RES and EE benefits for rural communities
- ✓ Low adhesion of local stakeholders
- ✓ Insufficient investment capacities of rural communities
- ✓ Technological issues

To solve the need for water pumping it was purchaeed and installed a solar water puping system with estimated energy savings equal to 1.5 MWh/year.

To widen the sustainability of the vegetables' production and selling, instead of the cold system the solutions is dehydration system, being purchased and installed a solar dehydrator, a solar griller and a solar stove, contributing all these systems for energy saving and CO_2 emissions reduction related to food conservation, once the production will be dehydrated.

It was obtained an increase of at least 2% of sustainable products distributed in the local market, as a result of the energy consumption amount and costs' reduction of Biovilla and the possibility to raise investment in the production processes.

At least 80% of Palmela Municipality inhabitants were involved in awareness raising campaign and dissemination actions, being aware of the pilot-project objectives and activities.

Also at least 80% of rural entrepreneurs involved in the project dissemination events and aware of the investment opportunities in EE and RES.

Picture 1 – Installation of solar panel on a well

2. MAIN LESSONS LEARNT

The Biovilla project is targeted not only to the local community but also to all citizens from Portugal and other countries that search for knowledge, exchange of experience and innovation in the human approach to sustainability.

The Municipality of Palmela is the most rural Municipality of ENA's territory and Biovilla plays an important role in the sustainability capacity building of the local community.

By implementing the technical solutions of the COMPOSE project using the Living Lab concept, ENA and Biovilla are involving the community in the learning process of the RES and EE technologies and their transferability to other rural entrepreneurs and projects.

In order to promote the sustainability of rural entities based on the Biovilla's pilot project replicability, it was essential to identify the usable renewable energy sources, to understand how they could meet the energy needs of the organization and whether they were suitable for use.

In the case of Biovilla, sun was widely available, and after the identification of the rural exploitation's specific objectives, it was tailored the use of energy to ensure the maximization of this renewable source.

The creation of a Local Action Group involving the main local entities, among which were some rural entrepreneurs and rural associations, was the best way to reach the target audience, allowing to transmit objectives and solutions of the COMPOSE pilot project aiming at the replication in rural communities.

For the implementation of the concepts and solutions of the Biovilla pilot, they were identified the following:

Barriers/Challenges: Financing; Lack of knowledge / time and availability; High cost of solutions; Resistance to change; Rural investment; Lack of knowledge about equipment and techniques as well as installation companies; Average age (aging population); Lack of rural identity; Energy illiteracy; Cultural barriers; Resistance to change; Lack of resources of the entities to carry out awareness raising actions (dissemination); Prejudices; Ancestral Habits; Financing doubts; Lack of interest and motivation; Difficulty in replication; Resistance to change (see to believe); Costly dissemination of good practices; Lack of knowledge about other projects; Lack of information for planning investments; Lack of sensitivity to sustainability issues.

and **Opportunities:** Local availability of energy renewable resources (sun, wind, biomass, geothermic);Need for alternative energy solutions; Isolated rural areas; Feeble energy grid connection; Sustainability awareness among rural entrepreneurs, especially the younger; Interested politicians and decision makers; Local, regional and national strategies and specific goals in energy and environmental issues; Energy and environment agencies and other sustainability entities with skills and willing to support the transition process; Available European and national financing programmes; Available financing instruments.

Once the rural entrepreneurs and policy decision makers were involved in the Local Action Group meetings, training session and capitalization Workshops, it was possible to identify and use the **transferable elements**: The concept of local renewable resources' utilisation in rural areas; methodological approach; main results/outcomes, and the **Replicable elements:** Technical systems installed; the community's involvement and the decision makers' participation.

Although during the pilot project implementation it was difficult to find market availability for the technical solutions that were implemented, the social impact of the project is very important, resulting from the potential replication among the rural community and, thus, from the reduction of energy costs, raise of income from new activities and raise of economical availability.

Also the contribution of this project, by showing to the local community an example of Circular Economy, is crucial to create among the rural entrepreneurs the curiosity and availability to learn and implement, in their areas, the new knowledge and solotions.

The positive aspects that will impact on social development are the following:

- Better knowledge and awareness raising among the community and the potential for sustainability development.
- Availability and strong interest of rural entrepreneurs for sustainable energy solutions and financial solutions.
- Raise of local politicians' commitment on RES and EE investment in rural communities, resulting from participating in the awareness raising, capitalisation and training events.

3. REPLICABILITY RECOMMENDATIONS AND IMPACT ASSESSMENT

Previously to the definition of the equipment it is fundamental to measure and characterise in detail the energy consumption pattern. It is important to fine-tune information on local RES potential and the possibility of creating a production-distribution chain. The tendering processes must be prepared and launched as earlier as possible during the process of equipment purchase and installation, considering more than three entities.

The following best practices, methods, tools used in Biovilla can be replicated in other different territories:

- Energy audits
- Energy consumption profiles development
- PV installation for water pumping
- Energy metering systems
- Solar dehydrators
- Solar stoves
- Memorandum of understanding among stakeholders

The specific Biovilla pilot project involved costs around 22 000,00€ in small scale investments and equipment) and 40 762,50€ in staff, external expertise and administrative costs, reaching 64 128 inhabitants of whose 33 190 were reached at the beginning of the pilot transferability activities.

The impact assessment is being implemented. It will be saved 2.8 MWh/year of energy related with pumping system.

The amount of energy that will be saved in food conservation will be 2 000 kWh/y due to the solar dehydration process. With the monitoring system the average amount of energy saved is 480 kWh/y.

ANNEXES

ANNEX I: Photos of the Equipment installed (PV pumping system, solar dehydrators, etc.)

Picture 2– Installation of solar panel on a well

Picture 3 – Solar panel installed for water pumping

Picture 4 – Interreg MED sign on solar pump

Picture 5 – Solar dehydrator with Interreg MED sign

ANNEX II: Technical Study – Biovilla

Introduction

Biovilla Biovilla is located in Herdade do Pinhal Basto, located in Vale de Barris, near Palmela and in the Natural Park of Serra da Arrábida, where several innovative activities are developed in rural areas strongly related to sustainability and the search for sustainable development in its different pillars, namely:

- Food production;

- Accommodation in rural areas;

- Environmental education.

Picture 6 – Location of Biovilla

Picture 7 – Biovilla

2. Assessment of needs

Analyzing the energy needs of Biovilla, the following were identified:

- Hot water for showers, for Biovilla users;

- Pumping water for irrigation;

- Food preservation and preparation;

- Electric energy for use in the different activities of Biovilla.

By evaluating each of the energy needs in detail, there is a distribution network of very dispersed hot water and, given Biovilla's location in the heart of the Arrábida Natural Park, the impossibility of constructing new fixed structures which could accommodate, for example, biomass boilers.

Biovilla is practically self-sufficient from the electrical point of view, given the photovoltaic power plant installed, so there is no point in increasing installed capacity.

Although the agricultural production techniques used seek to reduce water consumption to a minimum, some consumption is necessary, particularly in the summer period. There are 4 wells with reduced capacity but still sufficient to irrigate the crops installed. They are currently used by internal combustion engines, it is intended to install of photovoltaic pumping.

The preparation of food for visitors, but particularly the conservation of products produced for future placing on the market, is carried out using conventional methods. It is intended to take advantage of the energy made available by the sun for food preparation, but above all for its conservation by a process of dehydration. The use of these techniques not only reduce the carbon emissions associated with the process, but also processed products as well as the use of these processes as a means of training and awareness raising.

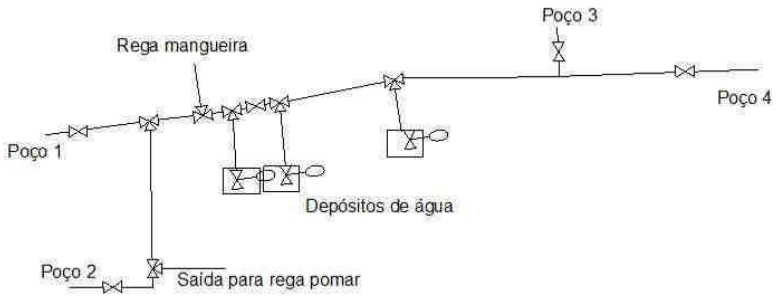
After evaluating all the characteristics / constraints associated with Biovilla's energy needs, the installation of two photovoltaic pumping systems and solar confection and dehydration systems appear to be the ones that can best contribute to the entity's sustainability.

3. Characterization of the photovoltaic pumping system

In Biovilla there are 4 small water wells that accumulate water coming from the slopes where it is located. Each well has a reduced capacity, so none of them is able to deliver the total amount of water needed for irrigation throughout the summer period.

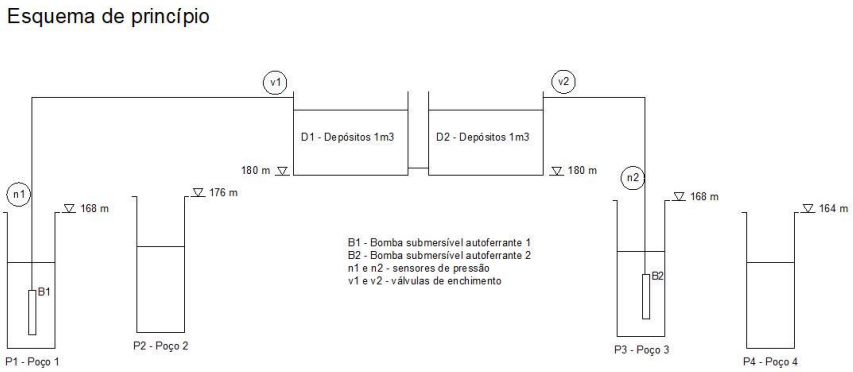
In order to rationalize costs and the sustainability of the solution, they were installed two groups of solar pumps and photovoltaic panels that can be moved and, thus, take advantage of all the water stored in the 4 wells.

Picture 8 - Pumping system location in Biovilla

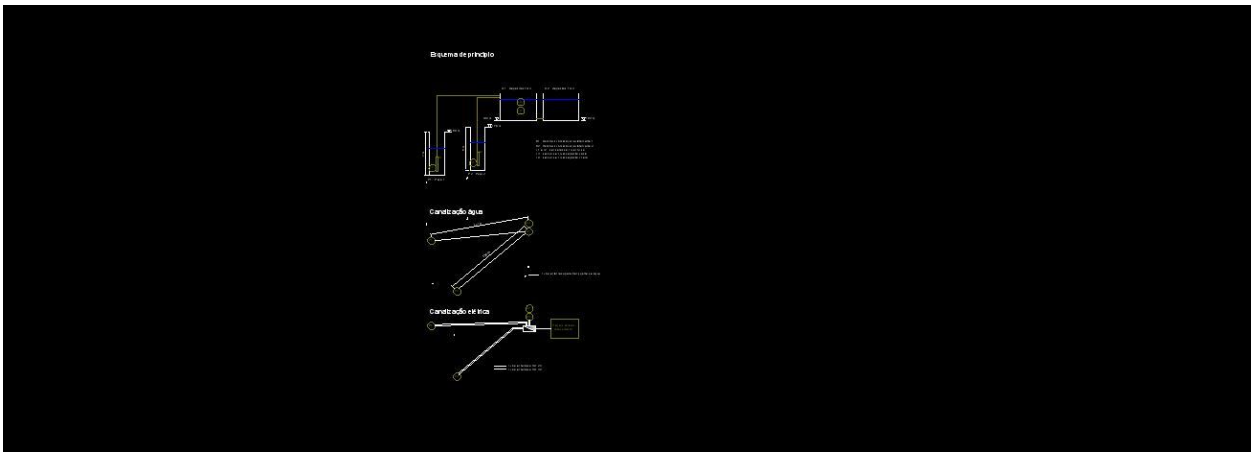


Picture 9 –Installation of the pumping system fed by the solar panels

One of the pumping systems is installed alternately in well 1 or well 2 and the other installed in well 3 or well 4. Considering the system's load losses and water supply pumps to be installed, as well as the photovoltaic system for the energy production, it will be installed equipment with adequate dimensions.



Picture 10 - Pumping system scheme 1



Picture 11 - Pumping system scheme 2

4. Characterization of the dehydrator, solar grill and stove

Considering the expected production of vegetables and their surpluses, it was purchased a dehydrator with the following characteristics:

- Solar drying system Kit Solar-Vent-Plus, model SVP-IN-LINE-INDUSTRIE or equivalent;

- Fans to force air circulation in the system, sized for the maximum flow of insufflation of 300 m3 / h and static pressure of 100Pa;

- Insulated air line for the introduction of hot air into the drying chamber and extraction of stale air;

- Battery of resistors for compensation of solar heating system;

- Automatic temperature control system;

- Drying chamber, built in sandwich panel, with insulation of 40 mm thickness at least, aluminum structure, with the following dimensions: 2,000 x 1,000 x 2,300 mm.



Pictures 12, 13 and 14 – Inside of the dehydrator, solar grill and stove

5. Monitoring

The monitoring of the energy consumed in Biovilla is carried out through a system with the following features:

<u>Concentrator</u>

The concentrator is of modular construction in order to allow future expansion of the measuring points. This concentrator allows simultaneous use of such as KNX, MODBUS RTU, DMX512, X10, ZiGBEE to communicate with various types of measuring devices. Concentrators with wireless communication measuring devices.

The hub should communicate with the online management platform using the Ethernet interface with support for the TCP / IP protocol, ensuring a bidirectional communication and in real time.

Mediation devices

The installed measuring devices are capable of measuring the energy consumed in one or more distribution board's circuits of the electrical installation.

Online management platform

The online platform has the following characteristics:

- Analyses any type of consumption or variable, including electricity;

- Proceeds to multilocal management;

- Provides information in real time (sampling frequency not exceeding 5 seconds) and historical data with a resolution of up to 5 minutes. There is no limit to the data historic;

- It is unlimited in terms of the number of devices to be measured;

- It controls On / Off devices and analog devices;

- Has the ability to establish rules in the analysis by crossing several variables and alerts in function of the state of a variable or a value composed of several variables;

- Allows the sending of notifications via synoptic, E-mail, SMS and voice;

- Allows the creation of cost centers;

- Is compatible with all new generation web browsers and have interfaces for equipment Desktop and Mobile, is compatible with Smart TVs or other devices with "web" navigation;

- Is able to be personalized with regard to the creation of synoptic;

- Is able to create automatic reports;

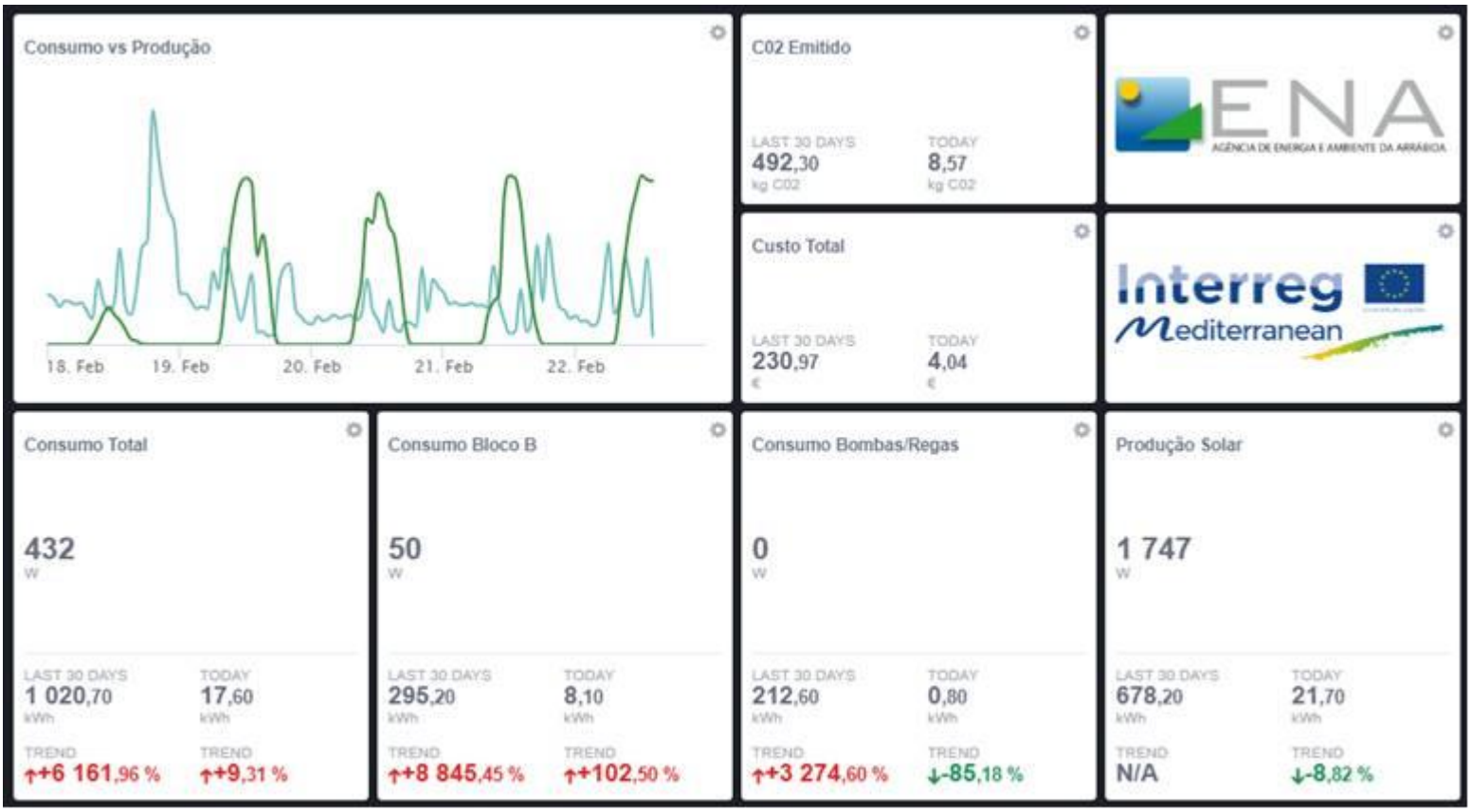
- Is able to manage different levels of access for different types of user;

- It is hosted in the cloud with a high level of connectivity;

- Has protection systems that allow the replacement of information in case of failure.

Monitor

The monitor displays a synoptic that will report locally on the evolution of energy (Picture 15). This high-resolution monitor (at least 1280 X 800) and color (at least 16 million colors), be at least 15 "diagonal).



Picture 15 – Dashboard with data produced through the monitoring system

ANNEX III: Plan of PV pumping system

Plan of Pumps 1 and 2

Specifications for Pump 1

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quarta-feira, 23 de maio de 2018

ENA - Biovilla, Palmela Bomba1

Projeto de bombagem solar

Parâmetro

Local:	Portugal, Palmela (38° Norte; 9° Oeste)	Água, temperatura:	25 °C		
Rendimento diário necessário:	10 m³; Dimensionamento para média mês	Perda por sujidade:	8,0 %	Cabo do motor:	15 m
Tipo de tubagem:	plastic, drawn/pressed, new: 0,007 mm	Nível de água estático:	20 m	Comprimento da tubulação:	200 m

Produtos	Quantidade	Detalhes
PS2-200 C-SJ3-9	1 pç.	Sistema de bombagem submersível com controlador com DataModule, motor e extremidade de bomba
SW 320	1 pç.	320 Wp; 1 x 1 módulos; 30 ° inclinado
Cabo do motor	15 m	4 mm² Cabo trifásico para a corrente e cabo monofásico para o aterramento
Tubagem	200 m	40 mm (diâmetro interno) Tubagem
Acessórios	1 conjunto	Well Probe, Liquid Pressure Sensor, Surge Protector, PV Disconnect 440-40-1, Sun Sensor Module, Flow Sleeve for C-SJ Pumps

Sun Sensor setting in PumpScanner — **min. 200 W/m²**

Rendimento diário em média mês — **9,8 m³**

Val. diários	Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez	Méd.
Saída [m³]	6,9	8,8	11	12	12	12	12	12	11	8,8	6,6	5,5	9,8
Energia [kWh]	1,0	1,3	1,6	1,7	1,8	1,8	1,9	1,8	1,6	1,3	1,0	0,88	1,5
Irradiação [kWh/m²]	3,5	4,4	5,6	6,2	6,5	6,9	7,0	7,0	6,0	4,6	3,5	3,0	5,4
Chuva [mm]	3,0	2,6	2,2	1,9	1,5	0,63	0,13	0,17	0,90	2,4	3,0	3,3	1,8
Temp. ambiente [°C]	10	11	14	16	19	23	26	25	23	18	14	12	18

Val. horários	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
Saída [m³/h]	0	0,12	0,51	0,99	1,3	1,4	1,4	1,4	1,2	0,94	0,48	0,1	0
Energia [kWh]	0,010	0,040	0,090	0,14	0,17	0,20	0,20	0,19	0,17	0,13	0,087	0,039	0,009
Irradiação [kWh/m²]	0,032	0,14	0,31	0,48	0,63	0,72	0,75	0,72	0,63	0,48	0,31	0,14	0,032
Temp. ambiente [°C]	13	13	14	16	18	20	22	23	23	23	23	22	22

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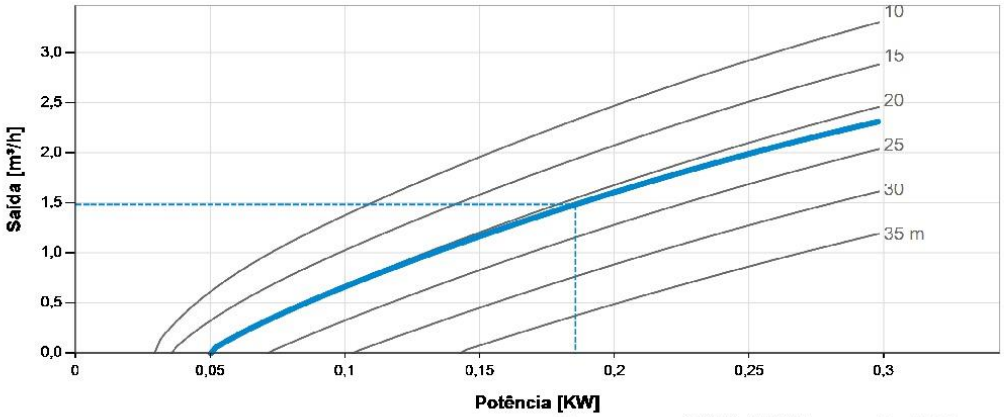
ENA - Biovilla, Palmela Bomba1

Projeto de bombagem solar

Características do sistema



			Min.	800 W/m², 20 °C	Max./STC*
Gerador PV	Temperatura da célula	[°C]		46	25
	Perda térmica	[%]		9,0	-
	Perda por sujidade	[%]		8,0	-
	Pmax	[Wp]		215	320
	Vmp	[V]		33	37
	Imp	[A]		6,4	9
	Voc	[V]		42	46
	Isc	[A]		7,0	9
	Pout	[W]		191	-
	Vout	[V]		37	-
	Iout	[A]		5,2	-
Cabo do motor	Perda de potência	[%]	0,81	1,9	2,2
Sistemas de bombagem	Potência do motor	[W]	50	186	298
	Tensão do motor	[V EC]	29	36	42
	Corrente do motor	[A]	1,8	5,1	7,1
	Velocidade do motor	[rpm]	1.760	2.015	2.205
	Taxa de fluxo	[m³/h]	0	1,5	2,3
	Eficiência	[%]	0	45	45
Tubagem	Velocidade de fluxo	[m/s]	0	0,33	0,51
	Perda por fricção	[m]	0,003	0,80	1,7

*STC: Condições de teste padrão para módulos fotovoltaicos, irradiação solar de 1000 W/m², temperatura da célula 25 °C

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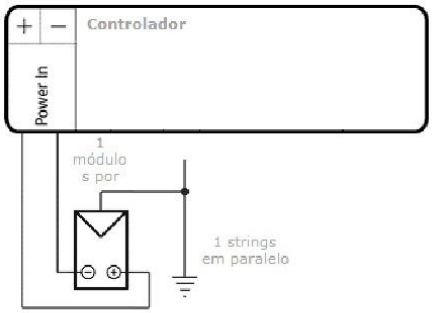
Projeto de bombagem solar

Esquema elétrico



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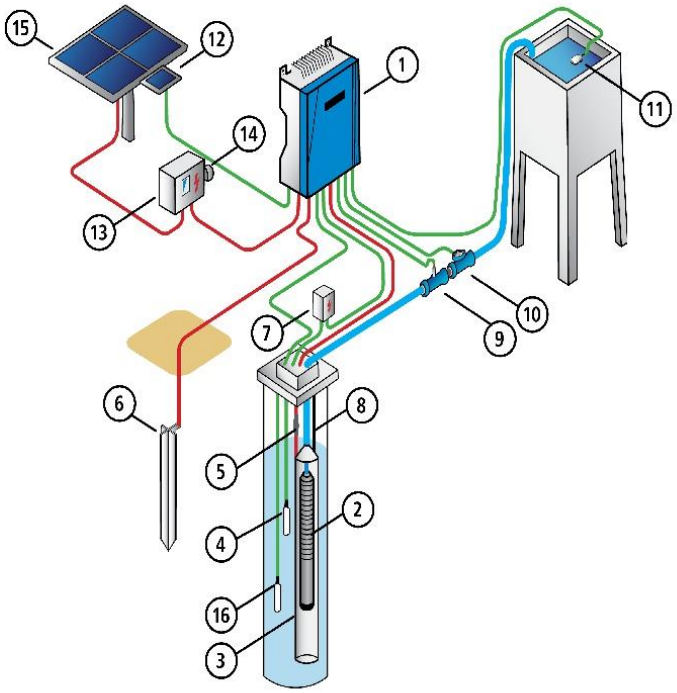
ENA - Biovilla, Palmela Bomba1

Projeto de bombagem solar

System Layout



1: PS2 Controller	**11:** Float Switch
2: Submersible Pump	**12:** Sun Switch
3: Flow Sleeve	**13:** PV Disconnect
4: Well Probe	**14:** Lightning Surge Protector
5: Cable Splice Kit	**15:** PV Generator
6: Grounding Rod	
7: Surge Protector*	
8: Safety Rope	
9: Water Meter	
10: Pressure Sensor	

*É recomendável instalar um protetor de picos de tensão em cada entrada de sensor do controlador.

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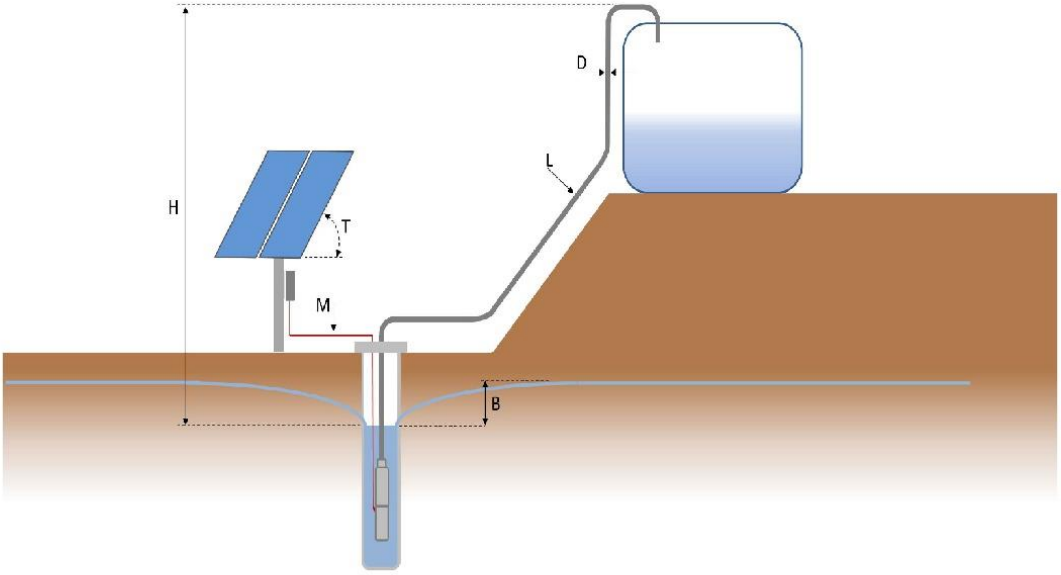
ENA - Biovilla, Palmela Bomba1

Projeto de bombagem solar

Traçado



H (Nível de água estático):	Altura vertical desde o nível de água dinâmico até ao ponto de entrega mais elevado.
B (Descida no nível de agua):	Diferença de nível de agua subterranea, dependendo de recuperação do poço.
D (Diâmetro interior da tubagem)	
L (Comprimento da tubulação):	Tubagem completa da saída da bomba até ao ponto de entrega. Têm de ser adicionados cotovelos e guarnições de comprimento equivalente à tubagem.
M (Cabo do motor):	Cabo entre o controlador e a unidade de bombagem.
T (Ângulo de inclinação):	Ângulo entre o painel PV gerador e o painel horizontal.

Specifications for Pump 2

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quinta-feira, 24 de maio de 2018

ENA - Biovilla, Palmela Bomba2

Projeto de bombagem solar

Parâmetro

Local:	Portugal, Palmela (38° Norte; 9° Oeste)	Água, temperatura:	25 °C		
Rendimento diário necessário:	10 m³; Dimensionamento para média mês	Perda por sujidade:	8,0 %	Cabo do motor:	15 m
Tipo de tubagem:	plastic, drawn/pressed, new: 0,007 mm	Nível de água estático:	25 m	Comprimento da tubulação:	450 m

Produtos	Quantidade	Detalhes
PS2-200 C-SJ3-9	1 pç.	Sistema de bombagem submersível com controlador com DataModule, motor e extremidade de bomba
LX-195M	2 pç.	390 Wp; 2 x 1 módulos; 30 ° inclinado
Cabo do motor	15 m	4 mm² Cabo trifásico para a corrente e cabo monofásico para o aterramento
Tubagem	450 m	40 mm (diâmetro interno) Tubagem
Acessórios	1 conjunto	Well Probe, Liquid Pressure Sensor, Surge Protector, PV Disconnect 440-40-1, Sun Sensor Module, Flow Sleeve for C-SJ Pumps

Sun Sensor setting in PumpScanner — **min. 250 W/m²**

Rendimento diário em média mês — **9,3 m³**

Val. diários	Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez	Méd.
Saída [m³]	6,1	7,8	10	11	11	12	12	12	10	7,9	5,8	4,6	9,3
Energia [kWh]	1,3	1,6	1,9	2,1	2,2	2,2	2,3	2,2	2,0	1,6	1,2	1,1	1,8
Irradiação [kWh/m²]	3,5	4,4	5,6	6,2	6,5	6,9	7,0	7,0	6,0	4,6	3,5	3,0	5,4
Chuva [mm]	3,0	2,6	2,2	1,9	1,5	0,63	0,13	0,17	0,90	2,4	3,0	3,3	1,8
Temp. ambiente [°C]	10	11	14	16	19	23	26	25	23	18	14	12	18

Val. horários	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
Saída [m³/h]	0	0,056	0,41	0,88	1,2	1,4	1,5	1,4	1,2	0,84	0,38	0,044	0
Energia [kWh]	0,012	0,049	0,11	0,17	0,21	0,24	0,25	0,24	0,21	0,16	0,11	0,047	0,011
Irradiação [kWh/m²]	0,032	0,14	0,31	0,48	0,63	0,72	0,75	0,72	0,63	0,48	0,31	0,14	0,032
Temp. ambiente [°C]	13	13	14	16	18	20	22	23	23	23	23	22	22

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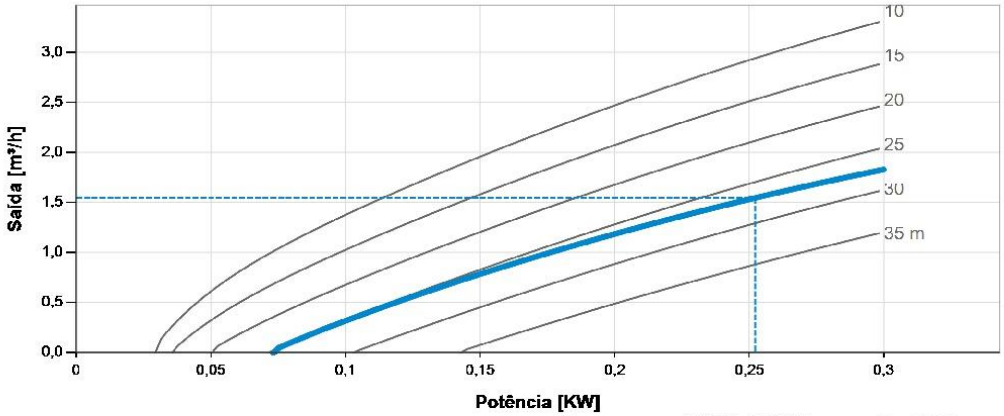
quinta-feira, 24 de maio de 2018

ENA - Biovilla, Palmela Bomba2

Projeto de bombagem solar

Características do sistema



			Min.	800 W/m², 20 °C	Max./STC*
Gerador PV	Temperatura da célula	[°C]		46	25
	Perda térmica	[%]		9,7	-
	Perda por sujidade	[%]		8,0	-
	Pmax	[Wp]		260	390
	Vmp	[V]		68	75
	Imp	[A]		3,8	5
	Voc	[V]		82	90
	Isc	[A]		4,2	6
	Pout	[W]		260	-
	Vout	[V]		68	-
	Iout	[A]		3,8	-
Cabo do motor	Perda de potência	[%]	0,90	2,0	2,2
Sistemas de bombagem	Potência do motor	[W]	73	252	300
	Tensão do motor	[V EC]	33	41	43
	Corrente do motor	[A]	2,2	6,2	7,0
	Velocidade do motor	[rpm]	1.970	2.260	2.320
	Taxa de fluxo	[m³/h]	0	1,5	1,8
	Eficiência	[%]	0	44	45
Tubagem	Velocidade de fluxo	[m/s]	0	0,34	0,40
	Perda por fricção	[m]	0,005	1,9	2,6

*STC: Condições de teste padrão para módulos fotovoltaicos, irradiação solar de 1000 W/m², temperatura da célula 25 °C

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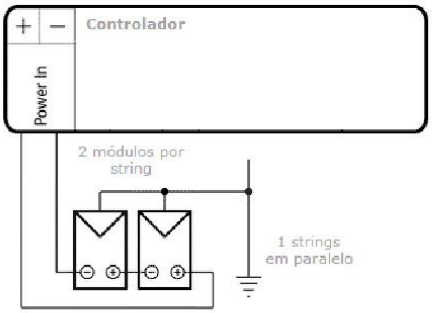
quinta-feira, 24 de maio de 2018

ENA - Biovilla, Palmela Bomba2

Projeto de bombagem solar

Esquema elétrico



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quinta-feira, 24 de maio de 2018

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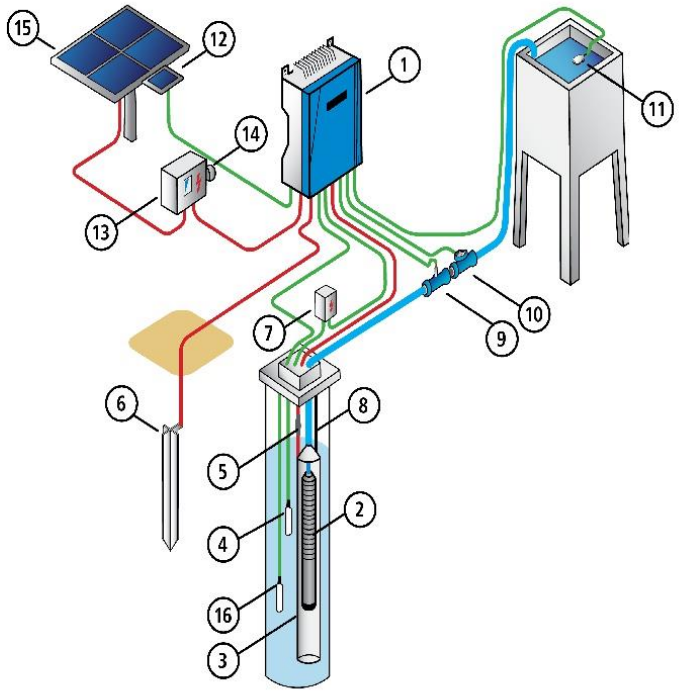
Projeto de bombagem solar

System Layout



1: PS2 Controller	**11:** Float Switch
2: Submersible Pump	**12:** Sun Switch
3: Flow Sleeve	**13:** PV Disconnect
4: Well Probe	**14:** Lightning Surge Protector
5: Cable Splice Kit	**15:** PV Generator
6: Grounding Rod	
7: Surge Protector*	
8: Safety Rope	
9: Water Meter	
10: Pressure Sensor	

*É recomendável instalar um protetor de picos de tensão em cada entrada de sensor do controlador.

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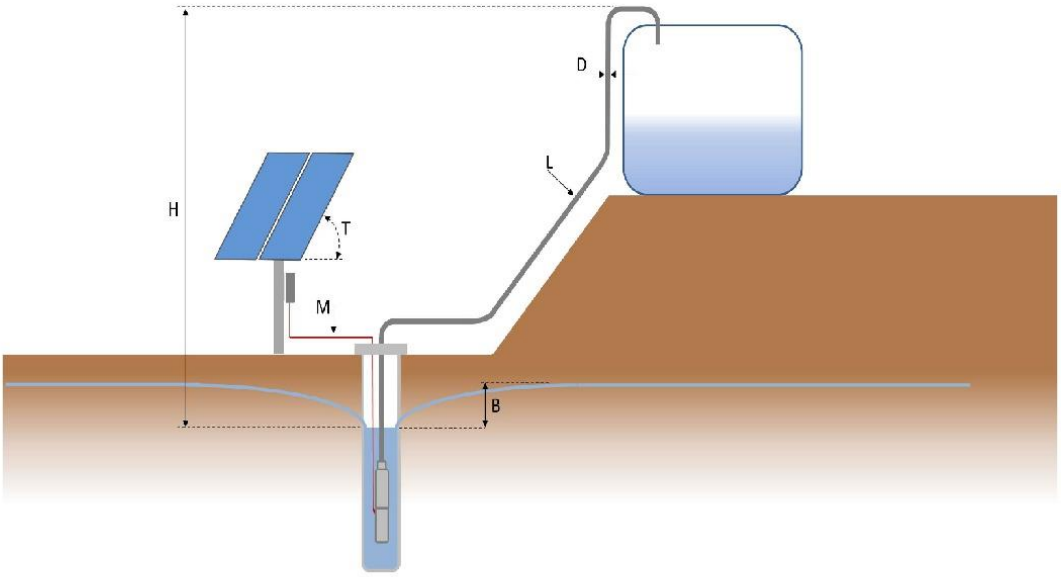
Projeto de bombagem solar

Traçado



H (Nível de água estático):	Altura vertical desde o nível de água dinâmico até ao ponto de entrega mais elevado.
B (Descida no nível de agua):	Diferença de nível de agua subterranea, dependendo de recuperação do poço.
D (Diâmetro interior da tubagem)	
L (Comprimento da tubulação):	Tubagem completa da saída da bomba até ao ponto de entrega. Têm de ser adicionados cotovelos e guarnições de comprimento equivalente à tubagem.
M (Cabo do motor):	Cabo entre o controlador e a unidade de bombagem.
T (Ângulo de inclinação):	Ângulo entre o painel PV gerador e o painel horizontal.

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System characteristics for Pumps 1 and 2

PS2-200 C-SJ3-9

Sistema de bombagem submersível a energia solar para poços de 4"

Gama de sistemas

Nível	max. 35 m
Taxa de fluxo	max. 3,3 m³/h

Dados técnicos

Controlador PS2-200

- Controlo e monitorização
- Entradas de controlo para proteção contra funcionamento a seco, controlo remoto, etc.
- Protegido contra inversão de polaridade, sobrecarga e sobreaquecimento
- MPPT (Maximum Power Point Tracking) integrado
- Alimentação por bateria: proteção integrada contra descarga total

Potência	max. 0,30 kW
Tensão de entrada	max. 100 V
Ótimo Vmp**	> 34 V
Corrente do motor	max. 11 A
Eficiência	max. 98 %
Temp. ambiente	-40...50 °C
Classe do invólucro	IP68

Motor ECDRIVE 200-C

- Motor de CC sem escovas isento de manutenção
- Água, enchimento
- Materiais de primeira, aço inoxidável: AISI 304/316
- Sem componentes eletrónicos no motor

Potência nominal	0,3 kW
Eficiência	max. 92 %
Velocidade do motor	900...3.300 rpm
Classe de isolamento	F
Classe do invólucro	IP68
Submersão	max. 150 m

Extremidade de bomba PE C-SJ3-9

- Válvula de retenção
- Materiais de primeira, aço inoxidável: AISI 304
- Opcional: proteção contra funcionamento a seco
- Centrifugal pump

Eficiência	max. 52 %

Unidade de bombagem PU200 C-SJ3-9 (Motor, Extremidade de bomba)

Diâmetro do furo	min. 4,0 in
Água, temperatura	max. 50 °C

Padrões

CE 2006/42/EC, 2004/108/EC, 2006/95/EC

IEC/EN 61702:1995

Os logótipos mostrados refletem as homologações concedidas a esta gama de produtos. Os produtos são encomendados e fornecidos com as homologações específicas para poderem cumprir os requisitos do mercado em questão.

**Vmp: Tensão MPP em condições de teste padrão (STC): radiação solar de 1000 W/m², temperatura da célula de 25 °C

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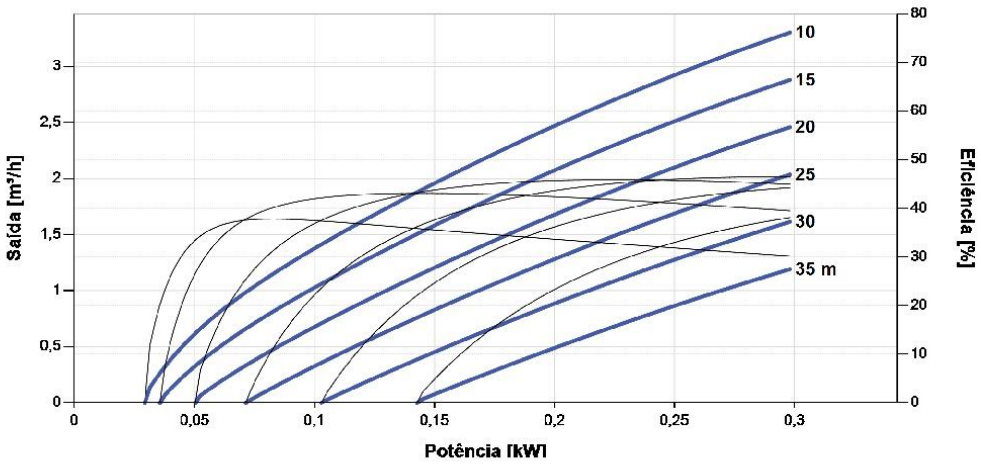
PS2-200 C-SJ3-9

Sistema de bombagem submersível a energia solar para poços de 4"

Diagrama de bombagem

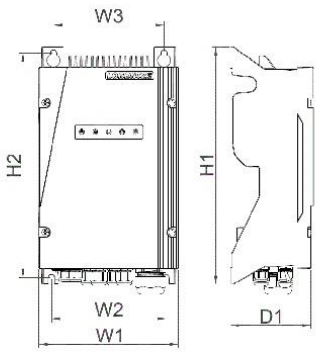
Vmp* > 34 V



Dimensões e pesos

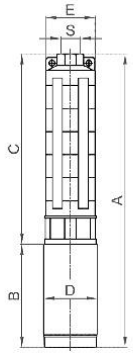
Controlador

H1 = 352 mm
H2 = 333 mm
W1 = 207 mm
W2 = 170 mm
W3 = 164 mm
D1 = 124 mm



Unidade de bombagem

A = 545 mm
B = 185 mm
C = 360 mm
D = 96 mm
E = 98 mm
S = 1,25 in



	Peso líquido
Controlador	5,6 kg
Unidade de bombagem	12 kg
Motor	7,0 kg
Extremidade de bomba	4,5 kg

*Vmp: Tensão MPP em condições de teste padrão (STC): radiação solar de 1000 W/m², temperatura da célula de 25 °C

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Well Probe

Mechanically Activated Device for Dry Run Protection in Applications with LORENTZ Solar Pump Systems

The switch can be used to detect the water level within a well. When the water level in the well dropped below the level of the well probe, the LORENTZ Controller will stop the pump and indicates Source Low LED.

ORDER INFORMATION

- **Item no.:** 19-000000 **product name:** Well probe sensor

FEATURES

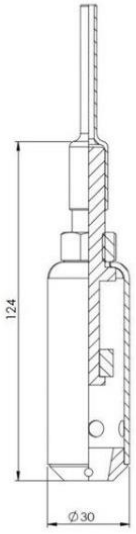
- Reliable dry run protection
- Simple to install
- Trouble free operation
- Corrosion-free
- Splicing kit included

TECHNICAL DATA

- Max. operating temperature 55 °C
- Enclosure class: IP68
  Submersion depth: max 50 m
- Cable length: 1.5m
- Wire size: 2x 0.75mm² or AWG 19, waterproofed
- Mounted in vertical position
- Meets the requirements for CE

DIMENSION/WEIGHT

- Packaging dimensions: 260 x 170 x 40 mm
  10.3 x 6.7 x 1.6 in
- Total weight: 0.1 kg / 0.2 lbs



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Liquid Pressure Sensor

Sensor for measuring the pressure of liquid in a pipe or vessel

USE / PURPOSE

The sensors are commonly used to measure the pressure in the delivery pipeline or in a vessel. The pressure signal is used with a suitable LORENTZ pump controller to measure pressure and for pressure switching or constant presure applications. The liquid pressure sensor must be used with a compatible LORENTZ Controller (see requirements).

FEATURES

- Gauge pressure sensor, pressure measurement relative to atmosphere
- For measuring pressure in a pipe or vessel
- Accurate, robust sensor
- For use with LORENTZ PumpScanner and pumpMANAGER

REQUIREMENTS

- LORENTZ PS2 controller , LORENTZ PSk2 controller or PS Controller equipped with a licensed PS DataModule
- Care must be taken to position the sensor without turbulent water to ensure accurate measurement
- G1/4" or G1/2" female threaded filling / air vent hole is required to mount the sensor

TECHNICAL DATA

- Sensor type: 2 wire gauge sensor
- Enclosure class: IP65
- Sensor housing : stainless steel
- Connects to LORENTZ PS DataModule
- 5m (16 ft) cable length
- Overpressure: 1.5x full scale
- Output signal : 4-20 mA
- Voltage : 11-28 VDC
- Application temp.: -30 to 80°C
  -22 to 176°F
- Accuracy class : 0.5% full scale
- Thread type: G1/2" male (G1/4" with adapter)
- Meets the requirements for CS

ORDER INFORMATION

Item #	Product	Pressure range
19-004450	Liquid Pressure Sensor, LPS-500	0-500 kPa 0 to 50 m / 0 to 160 ft 0 to 5 bar / 0 to 72.5 psi
19-004460	Liquid Pressure Sensor, LPS-1000	0-1000 kPa 0 to 100 m / 0 to 330 ft 0 to 10 bar / 0 to 145 psi

DIMENSION/WEIGHT

- Packing dimensions: 190 x 180 x 80 mm
  7.5 x 7.1 x 3.2 in
- Weight: 0.6 kg / 1.3 lbs

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Surge Protector

Device to Protect LORENTZ Pump Accessories from Voltage Spikes

ORDER INFORMATION

- **Item no.:** 19-000280 **product name:** Surge Protector

FEATURES

- Reliable surge protection for all LORENTZ pump accessories
- Can be installed inside the PS Controller

TECHNICAL DATA

- Max. voltage: 14 VDC
- Max current 8/20µs: 500 A
- Enclosure class: IP65
- Ambient temperature: max. 50°C
- Wire size: 2x 1.5mm² or AWG 16
- Meets the requirements for CE

DIMENSION/WEIGHT

- Packing dimensions: 70 x 45 x 20 mm
  2.8 x 1.8 x 0.8 in
- Total weight 0.1 kg / 0.2 lbs

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PV Disconnect 440-40-1

Box with DC Disconnect Switch and optional lightning surge protection

ORDER INFORMATION

- **Item no.:** 19-000137 **product name:** PV Disconnect 440-40-1
- **Item no.:** 19-002120 **product name:** MNSPD-115
- **Item no.:** 19-002130 **product name:** MNSPD-300
- **Item no.:** 19-002140 **product name:** MNSPD-600

Lightning surge protectors must be ordered separately

FEATURES

- Designed for PS150 – PS4000
- For professional installation of pumping systems

TECHNICAL DATA

- DC rated disconnect switch enclosed
- Enclosure class IP 54
- Meets the requirements for CE

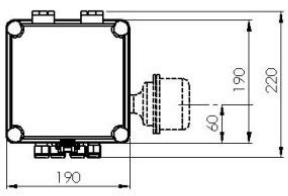
PV Disconnect 440-20-1	
Max. voltage	440 V DC
Max. current	40 A
String cable size	4 - 10 mm²
Output cable size	4 - 10 mm²

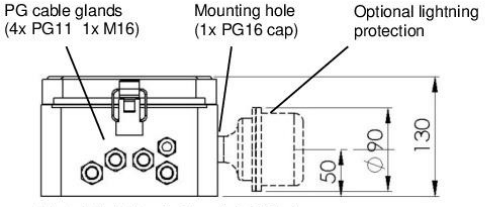
Optional lightning surge protector

- Connects through an existing mounting hole in the PV connect housing
- Proper grounding of the device is mandatory to achieve protection

Controller	MidNite surge protector
PS150 – PS200	MNSPD115
PS600 – PS1800	MNSPD300
PS4000	MNSPD600

DIMENSION/WEIGHT [mm]





Net. Weight: 1,4kg (+0,35kg)

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Sun Sensor

Irradiation measurement module and software

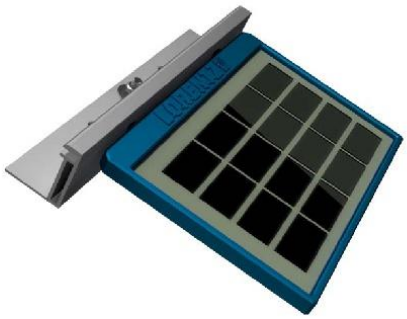
The LORENTZ Sun Sensor module and software allow the PS2 controller to accurately estimate irradiation levels and control the pump based on this.

The Sun Sensor function can be configured to offer the pump mechanical protection from repeated stop starts. The Sun Sensor function can also be configured to switch external devices via the PS2 output terminals.

Each module is tested and specially calibrated for use with the PS2 system. The Module also includes a software license to use the features which is accessed via the item serial number.

This Sun Sensor module is included with any PS2-1800 or PS2-4000 controller.

For PS controllers (non PS2) refer to the SunSwitch Datasheet.



ORDER INFORMATION

- **Item no.:** 19-005030
- **Product name:** Sun Sensor module

TECHNICAL DATA

- Open circuit voltage V_{oc} = 10.2 V
- Short circuit current I_{sc} = 0.19 A
- Wire size: 3x 1.0mm² or AWG 18, waterproofed
- Mount close to the solar array
- PS2 manual with further information is available in PartnerNet
- Meets the requirements for CE

DIMENSION/WEIGHT

- Packaging dimensions: 180 x 205 x 60 mm
  7.08 x 8.07 x 2.36 in
- Total weight: 0.6 kg / 1.33 lbs

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Flow Sleeve for C-SJ Pumps

Device to protect the pump from dirt and for motor cooling

A flow sleeve is a sleeve that goes around the pump body and motor. It has two functions:

1. **A flow sleeve reduces the amount of dirt in the pump.** Where water sources contain sand or have the potential for dirt falling into them (uncapped wells) a flow sleeve is recommended to protect the pump from dirt. Due to the large inner diameter of the flow sleeve the water rises very slowly and dirt deposits at the bottom of the well. Subsequently, water with less sediments enters the pump which increases its lifetime.

2. **A flow sleeve cools the motor.** In open water, tanks or pools there is no natural flow of water across the motor which can lead to heat build-up. The tube enforces water flow across the motor which has a cooling effect.

ORDER INFORMATION (please compare (1), (2) etc. with the sample flow sleeve)

Item no.	Product name	Scope of delivery	Suitable for
19-000230	Flow Sleeve Kit for 4" C-SJ Pumps with 4" Motor	(1) 1 x adaptor (2) 2 x hose clamp (3) 2 x cable strip (4) 1 x PVC tube: D140x4, 0.5 m length	All 4" C-SJ pump ends with 4" motor
19-000250	Flow Sleeve Adaptor for 4" C-SJ Pumps with 4" Motor	(1) 1 x adaptor (2) 2 x hose clamp (3) 2 x cable strip A PVC tube D140x4mm (4) is not part of the scope of delivery.	All 4" C-SJ pump ends with 4" motor
19-000255	Flow Sleeve Adaptor for C-SJ17-X/30-X with 4" motor	(1) 1 x adaptor (2) 2 x screw 4.2x16 (3) 1 x hose clamp A PVC tube D160x4mm (4) is not part of the scope of delivery.	All C-SJ17-X/30-X with 4" motor
19-005170	Flow Sleeve Kit for C-SJ42-X Pumps	(1) 1 x adaptor (2) 2 x hose clamp d =190-210 mm (3) 2 x hose clamp d= 150-170 mm (4) 1 x PVC tube: D200x5, 1.4 m length	All C-SJ42-X pumps
19-005180	Flow Sleeve Adaptor for C-SJ42-X Pumps	(1) 1 x adaptor (2) 2 x hose clamp d=190-210 mm (3) 2 x hose clamp d=150-170 mm A PVC tube D200x5mm (4) is not part of the scope of delivery.	All C-SJ42-X pumps

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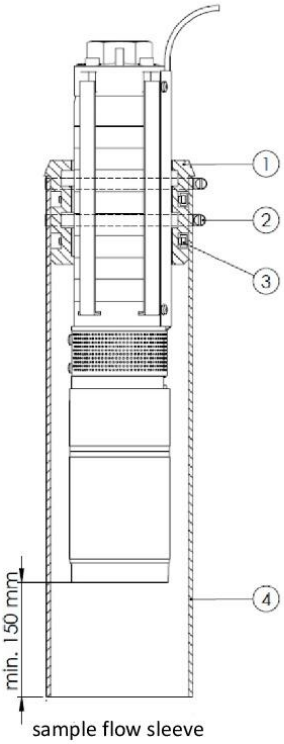
FEATURES

- Due to the large inner diameter of the flow sleeve the water rises very slowly allowing dirt to settle at the bottom of the well
- The life expectancy of the pump is increased due to less sand entering the pump
- Simple installation
- The flow sleeve must be selected according to the pump system (see table)
- The required borehole diameter depends on the diameter of the flow sleeve



sample flow sleeve

DIMENSIONS/WEIGHT

Flow Sleeve Kit for 4" C-SJ Pumps with 4" Motor (19-000230):

- Packaging dimensions: 590 x 150 x 130 mm
  23.2 x 6.0 x 5.1 in
- Total weight: 3.3 kg / 7.3 lbs

Flow Sleeve Adaptor for 4" C-SJ Pumps with 4" Motor (19-000250, without tube):

- Packaging dimensions: 165 x 165 x 110 mm
  6.5 x 6.5 x 4.3 in
- Total weight: 1.2 kg / 2.6 lbs

Flow Sleeve Adaptor for C-SJ17-X/30-X with 4" motor (19-000255, without tube):

- Packaging dimensions: 165 x 165 x 110 mm
  6.5 x 6.5 x 4.3 in
- Total weight: 1.2 kg / 2.6 lbs

Flow Sleeve Kit for C-SJ42-X Pumps (19-005170):

- Packaging dimensions: 1500 x 205 x 215 mm
  59.0 x 8.1 x 8.5 in
- Total weight: 9.3 kg / 20.6 lbs

Flow Sleeve Adaptor for C-SJ42-X Pumps (19-005180, without tube):

- Packaging dimensions: 230 x 230 x 130 mm
  9.1 x 9.1 x 5.1 in
- Total weight: 1.9 kg / 4.2 lbs

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Plan of solar panel

Sunmodule®
SW 320 - 325 XL mono

SOLARWORLD
REAL VALUE

Data Sheet

Quality modules made in Germany

Produced in Germany,
the center for solar technology

TÜVRheinland CERTIFIED
www.tuv.com
ID 0000039351

TUV Power controlled:
Lowest measuring tolerance in industry

-0/+5 Wp

Sunmodule Plus:
Positive performance tolerance

25 years WARRANTY

25 year linear performance warranty and
10 year product warranty

SolarWorld AG relies on Germany as its technology location, thereby ensuring sustainable product quality.

The TUV Rheinland Power controlled inspection mark guarantees that the nominal power indicated for solar modules is inspected at regular intervals and thus ensured. The deviation to TUV is maximum 2 percent.

The positive power tolerance guarantees utmost system efficiency. Only modules achieving or exceeding the designated nominal power in performance tests are dispatched. The power tolerance ranges between -0 Wp and +5 Wp.

With its linear performance warranty covering a period of 25 years, SolarWorld guarantees a maximum performance degression of 0.7% p.a., a significant added value compared to the two-phase warranties common in the industry. Therefore, the service certificate offers comprehensive protection for your investment in the long term.

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Sunmodule®
SW 320 - 325 XL mono

SOLARWORLD
REAL VALUE

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

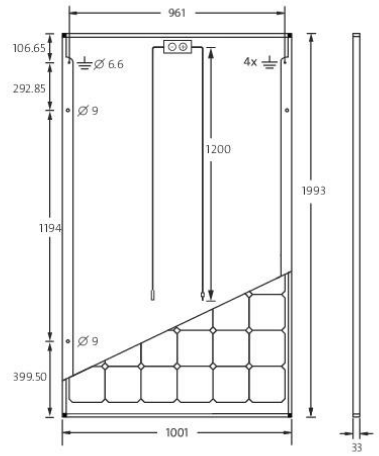
		SW 320	SW 325
Maximum power	P_{max}	320 Wp	325 Wp
Open circuit voltage	U_{oc}	45.9 V	46.1 V
Maximum power point voltage	U_{mpp}	36.7 V	37.0 V
Short circuit current	I_{sc}	9.41 A	9.48 A
Maximum power point current	I_{mpp}	8.78 A	8.84 A
Module efficiency	η_m	16.04 %	16.29 %

Messtoleranz (P_{max}) rückführbar auf TÜV Rheinland: +/- 2% (TÜV Power controlled) *STC: 1000W/m², 25°C, AM 1.5

PERFORMANCE AT 800 W/m², NOCT, AM 1.5

		SW 320	SW 325
Maximum power	P_{max}	244.4 Wp	247.7 Wp
Open circuit voltage	U_{oc}	40.1 V	40.2 V
Maximum power point voltage	U_{mpp}	33.8 V	34.0 V
Short circuit current	I_{sc}	7.82 A	7.88 A
Maximum power point current	I_{mpp}	7.23 A	7.28 A

Minor reduction in efficiency under partial load conditions at 25°C: at 200 W/m², 97% (+/-3%) of the STC efficiency (1000 W/m²) is achieved.



COMPONENT MATERIALS

Cells per module	72
Cell type	Mono crystalline
Cell dimensions	156 mm x 156 mm
Front	Tempered safety glass (EN 12150)
Back	Film, white
Frame	Clear anodized aluminum
J-Box	IP65
Connector	H4

DIMENSIONS / WEIGHT

Length	1993 mm
Width	1001 mm
Height	33 mm
Weight	22.5 kg

THERMAL CHARACTERISTICS

NOCT	46 °C
TK I_{sc}	0.042 %/K
TK U_{oc}	-0.304 %/K
TK P_{mpp}	-0.43 %/K

PARAMETERS FOR OPTIMAL SYSTEM INTEGRATION

Power sorting	-0 Wp / +5 Wp
Maximum system voltage SC II	1000 V
Maximum reverse current	25 A
Load / dynamic load	2.4 / 2.4 kN/m²
Number of bypass diodes	3
Operating range	-40 °C to +85 °C

ORDERING INFORMATION

Order number	*Description*
82000126	Sunmodule SW 320 XL mono
82000128	Sunmodule SW 325 XL mono

SolarWorld AG reserves the right to make specification changes without notice. This data sheet complies with the requirements of EN 50380.

90002405 | 2016-04-06 EN

ANNEX IV: National Event REPORT

Event title: Seminar "Territorial Cooperation: Energy and Environment Agencies as project promoters with local communities"

Type of event: Seminar with national scope

Date:	6th December 2017
Venue:	Municipal Theater João Mota, Sesimbra
Organiser:	ENA, Energy and Environment Agency of Arrábida
Key topics presented/ discussed:	✓ Local and global cooperation in climate change mitigation and adaptation ➢ Presentation of the COMPOSE project ✓ Participation of Energy and Environment Agencies in Territorial Cooperation Projects ➢ Presentation of the COMPOSE pilot projects and other 6 Interreg projects ✓ Community Programs that encourage cooperation among local communities
Key speakers:	• Francisco Jesus, Mayor of Sesimbra Municipality • Fernanda Pésinho, President of the Board of Administration of ENA • Carlos Santos, Chairman of the General Assembly Board of RNAE • Carlos Martins, Secretary of State for Environment • Lučka Kajfež Bogataj, Liubljana University, IPCC, Ambassador of COMPOSE project • Veronika Valentar, Slovene Chamber of Agriculture and Forestry - Institute of Agriculture and Forestry Maribor, COMPOSE coordinator • Zdravko Kozinc, Slovene Chamber of Agriculture and Forestry - Institute of Agriculture and Forestry Maribor, COMPOSE coordinator • Theocharis Tsoutsos, Crete Technical University • Carla Martins, Directorate-General for Energy and Geology • Gil Penha-Lopes, Science Faculty of Nova University, Lisbon • Vitor Aleixo, Network of Municipalities for Local Adaptation to Climate Change • Francisco Ferreira, Zero: Association Sustainable Earth System • Representatives of Energy Agencies ENA, AEdoAVE, Oeste Sustentável, AGENEAL, AREANATejo, AREAL and AREAM • Raquel Rocha, AD&C - Agency for Development and Cohesion, I.P. • Rodrigo Gonçalves, APA - Portuguese Environment Agency, I.P. • Cristina Gouveia, GPPQ – Cabinet for the RTD Framework Programme

	• Helena Moura, IAPMEI – Agency for Competitiveness and Innovation, I.P. • Joaquim Borges Gouveia, Chairman of the Shareholder's General Meeting of RNAE • Representative of the Secretary of State for Energy
Target Participants:	Approximately 160 participants from ➢ Energy and environment Agencies ➢ Municipalities ➢ Environmental and sustainability NGOs and Associations ➢ Companies ➢ Schools ➢ Universities ➢ R&D Centres ➢ Entrepreneurs

Event's Minutes

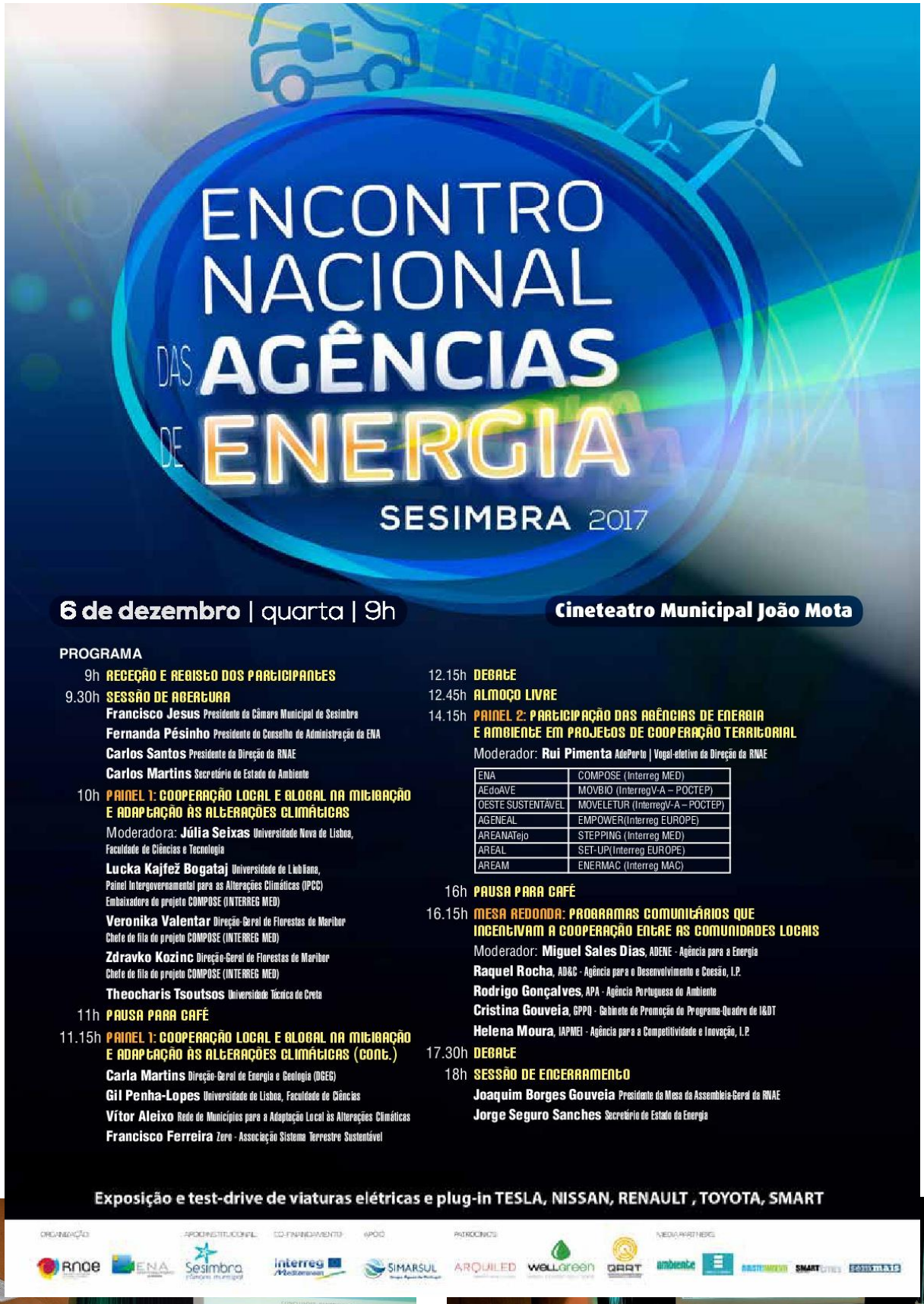
Important topics were discussed such as the contribution of territorial cooperation in mitigation and adaptation to climate change, community programs that encourage cooperation between local communities, as well as projects developed by energy and environment agencies, which reinforce their role in delivering solutions at with repercussions at global level.
Cooperation will enable us to achieve the objectives set out in the Europe 2020 strategy for smart, sustainable and inclusive growth, when we consider the different characteristics of the territories and the diversity of development opportunities in the different regions.
The diversity of territories is a potential for development, and the distinctive identities of local and regional communities are fundamental. On the other hand, the inclusive, sustainable and efficient use of Europe's territory and resources is a key element for cohesion, contributing to the development of economies; for equity in access to services, infrastructure and public goods; for the proper management of natural and cultural assets.
Two challenges stand out as a matter of intervention by the energy and environment agencies, and are considered as a potential for the sustainable and harmonious development of the territory:

- ✓ Energy, as a factor that differentiates regional competitiveness and
- ✓ Climate change and environmental risks, due to geographically diverse impacts.

The link between these two challenges leads us to realize that there is no doubt that the climate changes we are experiencing, cannot be explained without considering that a substantial part of the responsibility in this phenomenon stems from the activity of man and the consequent emission of greenhouse gases (GHG).
Local governments need to strengthen their capacity for action, build strong partnerships, and, above all, make commitments to inclusive Sustainable Development that leaves nothing behind. When implementing sustainability processes, they must be proactive in strengthening their powers, using the responsibility assigned to them to insist on greater autonomy in energy and environment.
As Energy and Environment Agencies are the Municipalities' unquestionable partners in the scope of sustainable development, they meet the appropriate technical and human conditions to support the political decision makers.
Through their work at the local level and in cooperation with other territories, the agencies contribute to the implementation of linking policies between public entities, companies and research centers from different regions, creating environment for investment in skills that result in

economic growth , notably by increasing the efficiency of the use of resources, contributing to the reduction of unemployment, poverty and social exclusion.

Invitation - Agenda



Picture 16 – First panel speakers

Picture 17 – Prof. Theocharis Tsoutsos presentation

Picture 18 – Coffee break and exhibition during the Seminar