MASLOWATEN

MArket uptake of an innovative irrigation Solution based on LOW WATer-ENergy consumption

Electric pump units selection and sizing in Photovoltaic Irrigation Systems

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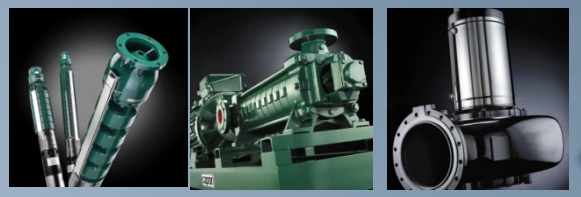
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No640771

CAPRARI SPA:
Center of excellence for Pumps & Electric Pumps



- PRIVATELY OWNED COMPANY
- 700 EMPLOYEES

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Subsidiaries

CAPRARI PUMPS
Australia

BOMBAS CAPRARI
Spain

CAPRARI FRANCE
France

CAPRARI TUNISIE
Tunisie

CAPRARI PUMPS SHANGHAI CO.
China

CAPRARI HELLAS
Greece

CAPRARI PUMPS
United Kingdom

CAPRARI PUMPEN
Germany

CAPRARI PORTUGAL LDA
Portugal

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Network

DOMESTIC NETWORK

- Caprari Headquater
- Milan Branch office
- 17 Service Centres

INTERNATIONAL NETWORK

- 9 Subsidiaries
- +40 International strategic sales and service partners
- +20 Exclusive Distributors

A strong network of distributors, agents and partners engaged for over 50 years in 96 countries

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For all the **professionals** of the **Integrated Cycle of Water**, Caprari is :

- The benchmark for **high reliability** and **high efficiency** for clean water
- The leading **specialist** in surface and deep well clean water **pumping systems**
- **Reference in agricultural applications worldwide**
- The **choice** of **value** in sewage pumping and drainage
- **Specialized** partners in heavy duty applications

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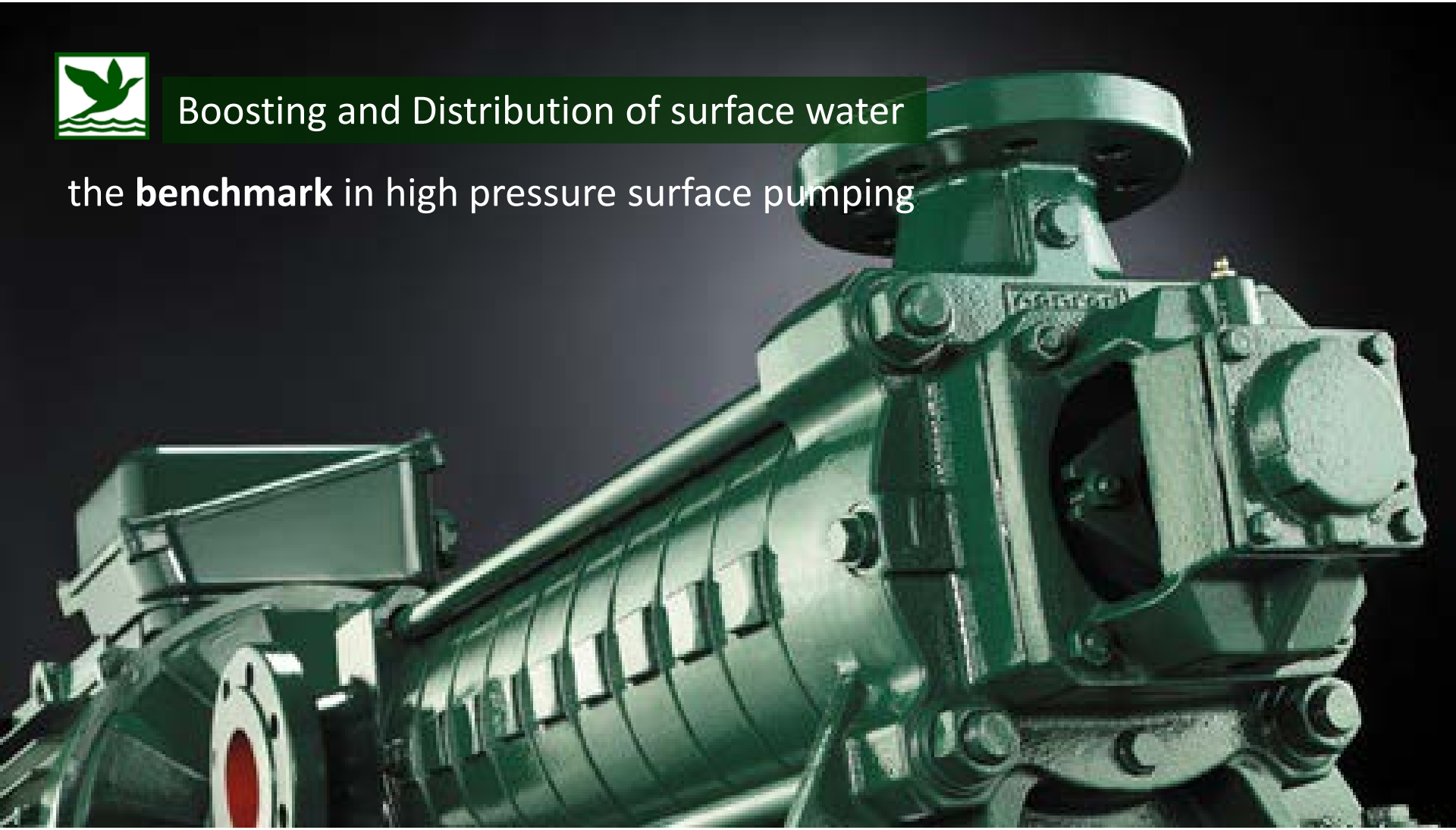

Boosting and Distribution of surface water

the **benchmark** in high pressure surface pumping

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Wastewater Transport and Treatment

the **choice of value** in sewage pumping

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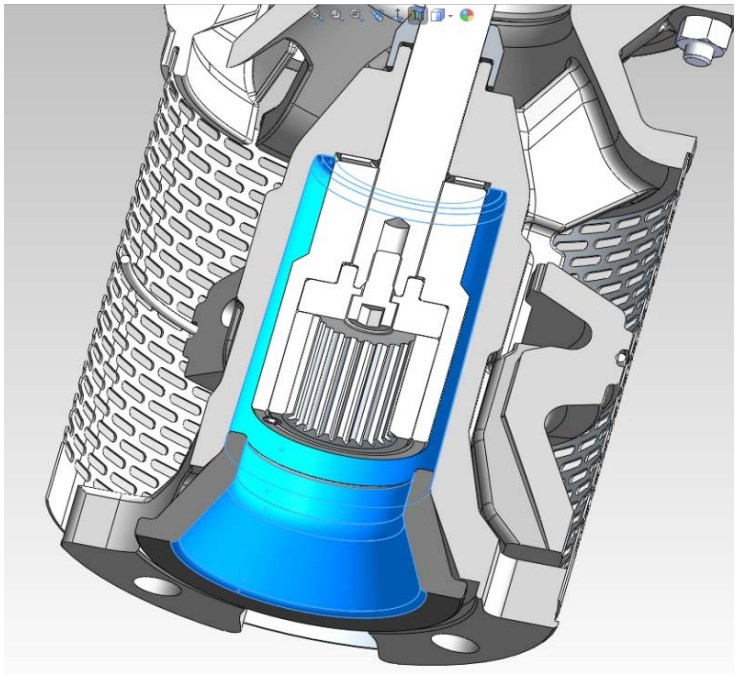
Product innovation

Improving life

corrosion inhibitor



sand wear protection

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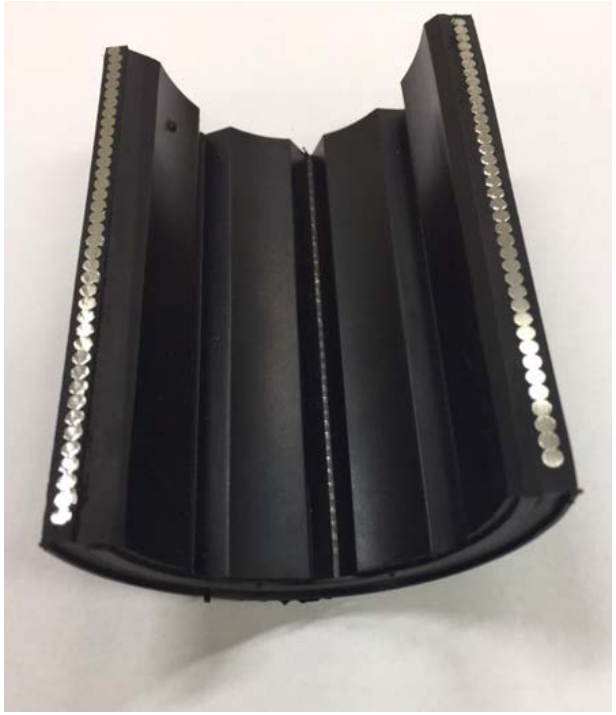
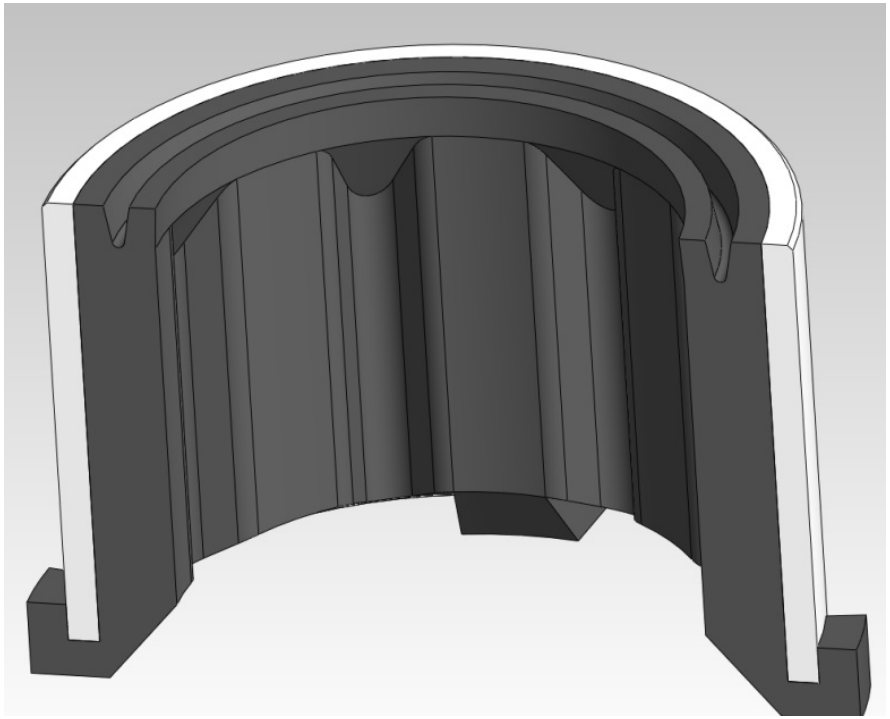
Product innovation

Improving reliability



improving maintenance & reliability



improving efficiency & reliability

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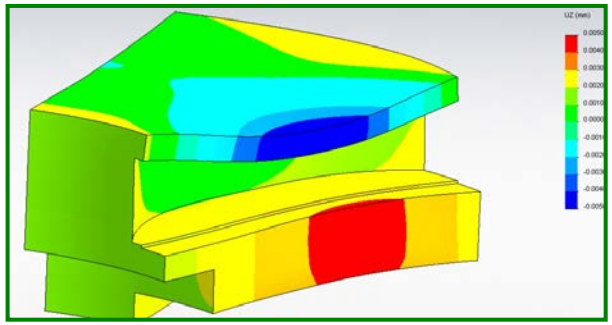
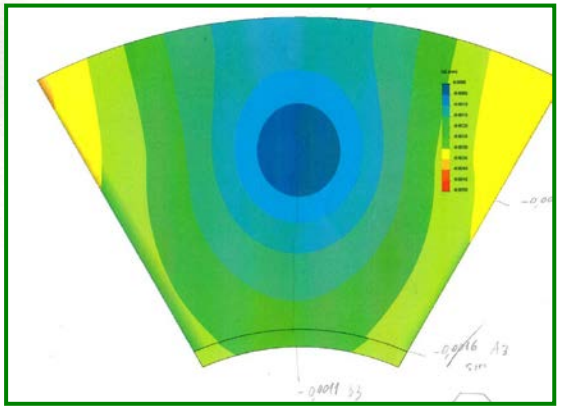
Product innovation

Improving performances & reliability



old/standard design

new design



high thrust axial bearing

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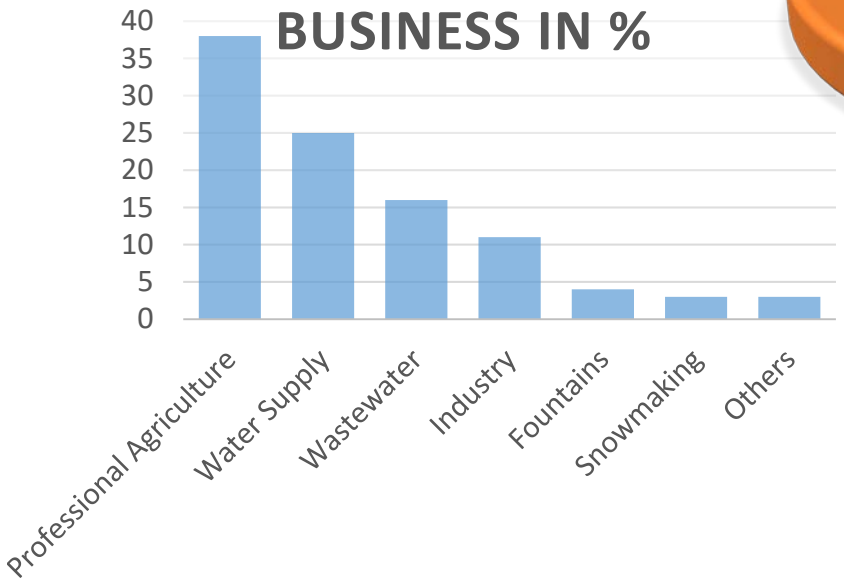
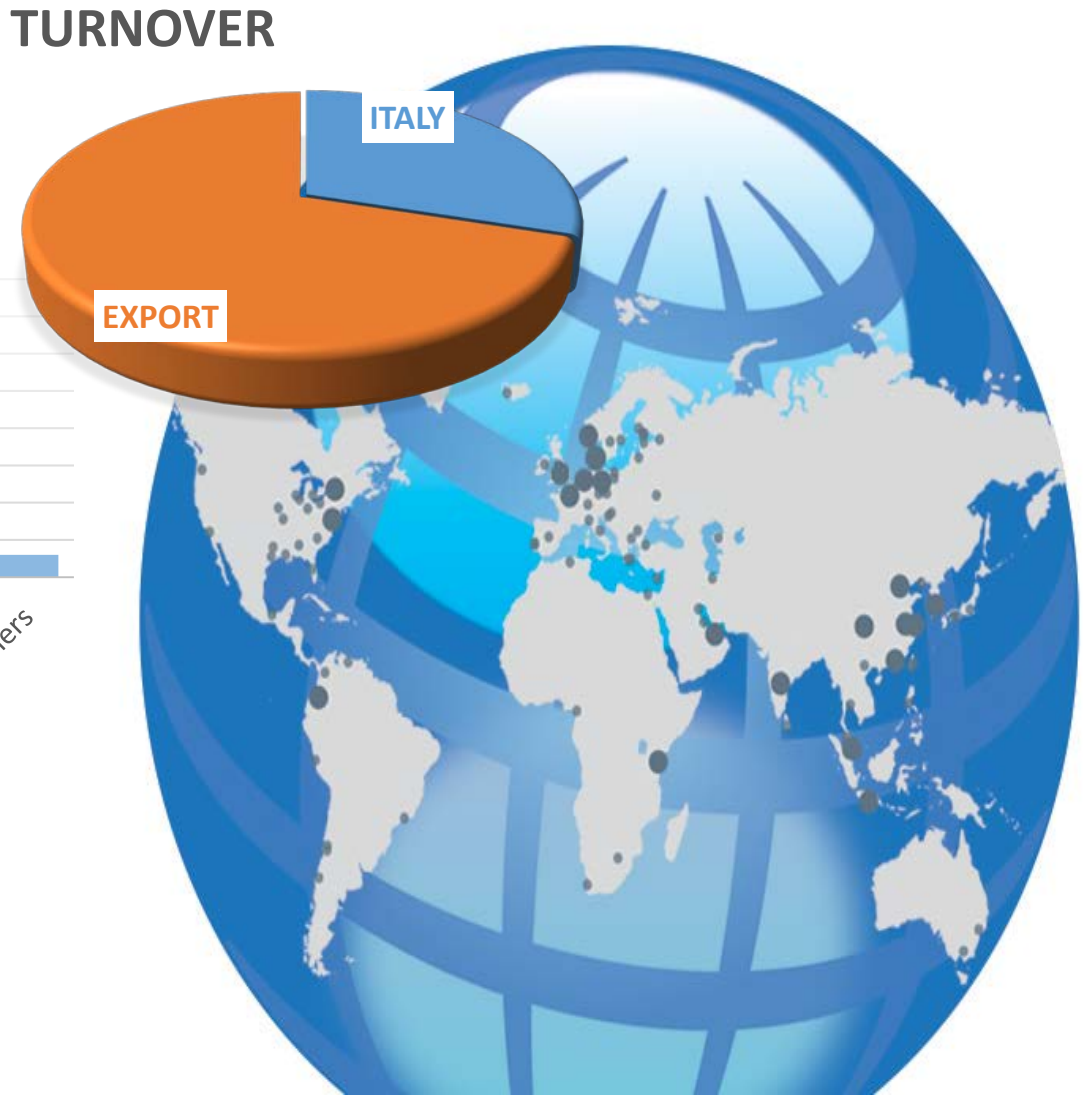
Business





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MASLOWATEN PROJECT

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OPPORTUNITIES	CHALLENGES	PUMPING SYSTEM
Photovoltaic energy (PHe) is free	PHe is not constant in the day and in the seasons ⇒ oversized plants (higher investment costs)	The choice of the **PV orientation system** (fixed / east-west) determines the choice and management of the electric pump
Variable frequency (Hz) of the PH network	The electric pumps must be selected at variable speed to use the greatest amount of PHe	The joint evaluation of the **slope of the pump's Q / H curve** and of the **system resistive curve** are fundamental
Scalability of plants / investments	The introduction of a PH system can be studied in sectors / blocks	The use of several **pumps in parallel** meets many needs
Possibility of integration with traditional energy systems (Diesel / Grid)	Integration must be easy to manage	Pumps and asynchronous motors of **robust construction** and **high energy efficiency** facilitate integration
Analysis of present and future context	Plants must be efficient even after changes in the context	The **variable speed** makes possible to size the electric pumps, also providing for changed operating conditions

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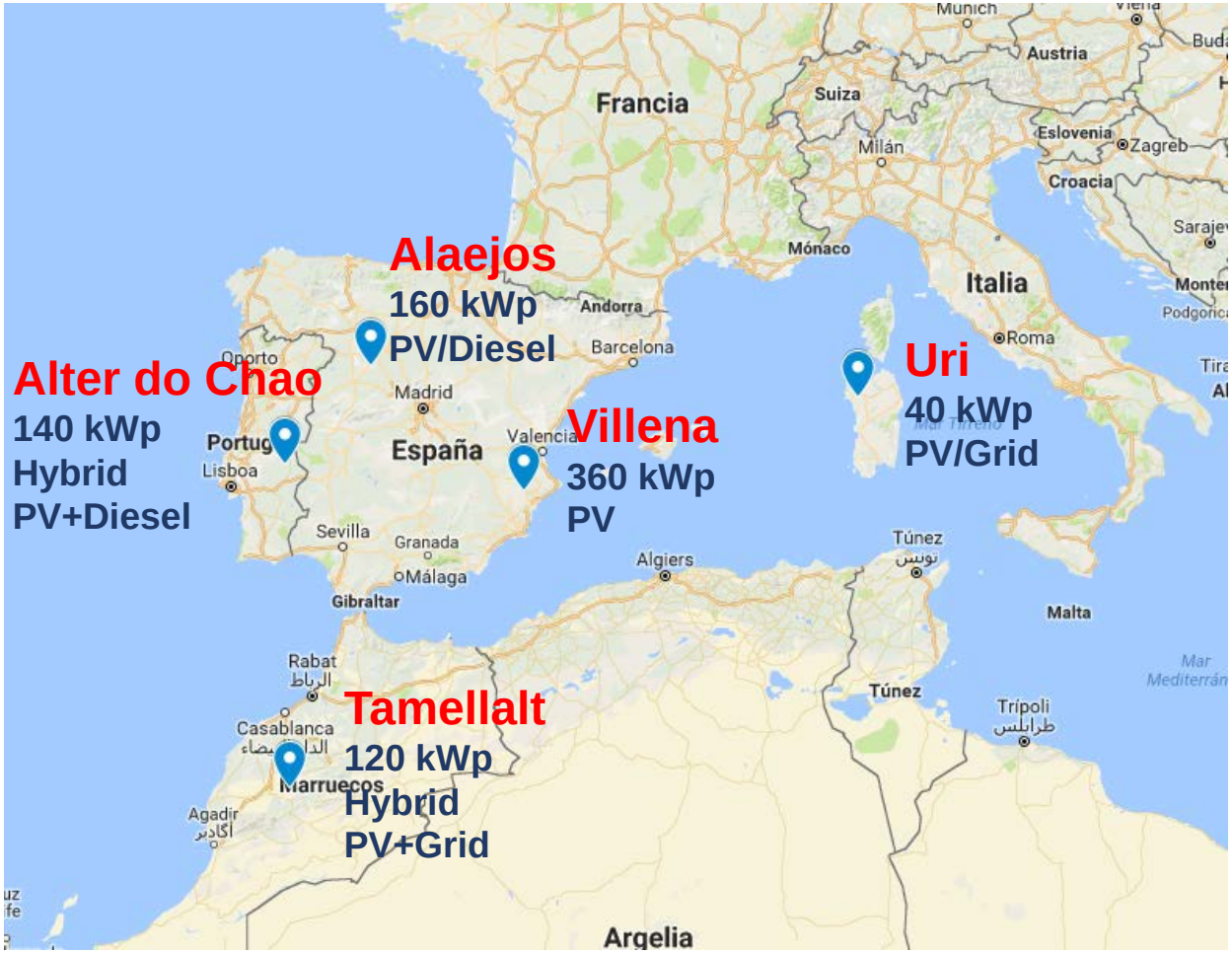
Five demonstrators



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The electric pump units

Alter do Chao: PORTUGAL	**Hybrid PV+Diesel**
n.1 unit ESOB+M (PV) drip i.	
n.1 unit ESOB+M (PV-Gen) drip i.	n.3 MEC-MR100/2D+45kW
n.1 unit ESOB+M (Gen) drip i.	
Tamellalt: MOROCCO	**Hybrid PV+Grid**
n.1 unit ESOB+M (PV-Gen) drip i.	
n.1 unit ESOB+M (PV-Gen) drip i.	n.2 MEC-A4/125C+45kW
Alaejos-Valladolid: SPAIN	**Hybrid PV+Diesel**
n.1 unit MSS (PV-Gen) tank	n.1 E8P135-8/10C+MAC8125
n.1 unit ESOB+M (PV-Gen) pivot	n.1 MEC-A2/80A+30kW
Villena-Alicante: SPAIN	**PV**
n.1 unit MSS (PV) tank	n.1 E12S42-12/5A+MAC12300/1C
Uri-Sassari: ITALY	**Hybrid PV+Grid**
n.1 unit MSS (PV-Grid) tank	n.1 E4XP30/21+MCK43-8V
n.1 unit MSS (PV-Grid) tank	n.1 E6SX50-6/14A+MACX625/2B
n.1 unit ESOB+M (PV-Grid) sprinkler	n.1 MDT50+7,5kW

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Alter do Chao: PORTUGAL – Hybrid PV+Diesel

Owner : ELAIA (Herdade sao Bernabe)

Annual water needs : 334.000 m^3
HMT : 70 m
Flow : 2x 34 l/s

System Configuration

PV Generator: 140 kWp
PV Trackers : 1 x H1250 multi-row (7 axes)
Inverter : 3 x 55 kW
Pumps : **n.3 x Caprari MEC-MR100/2D+45 KW**
Irrigation System : already exist (drip)
Expected water production : 300.000 m^3 (80% FV- 20% DIESEL)

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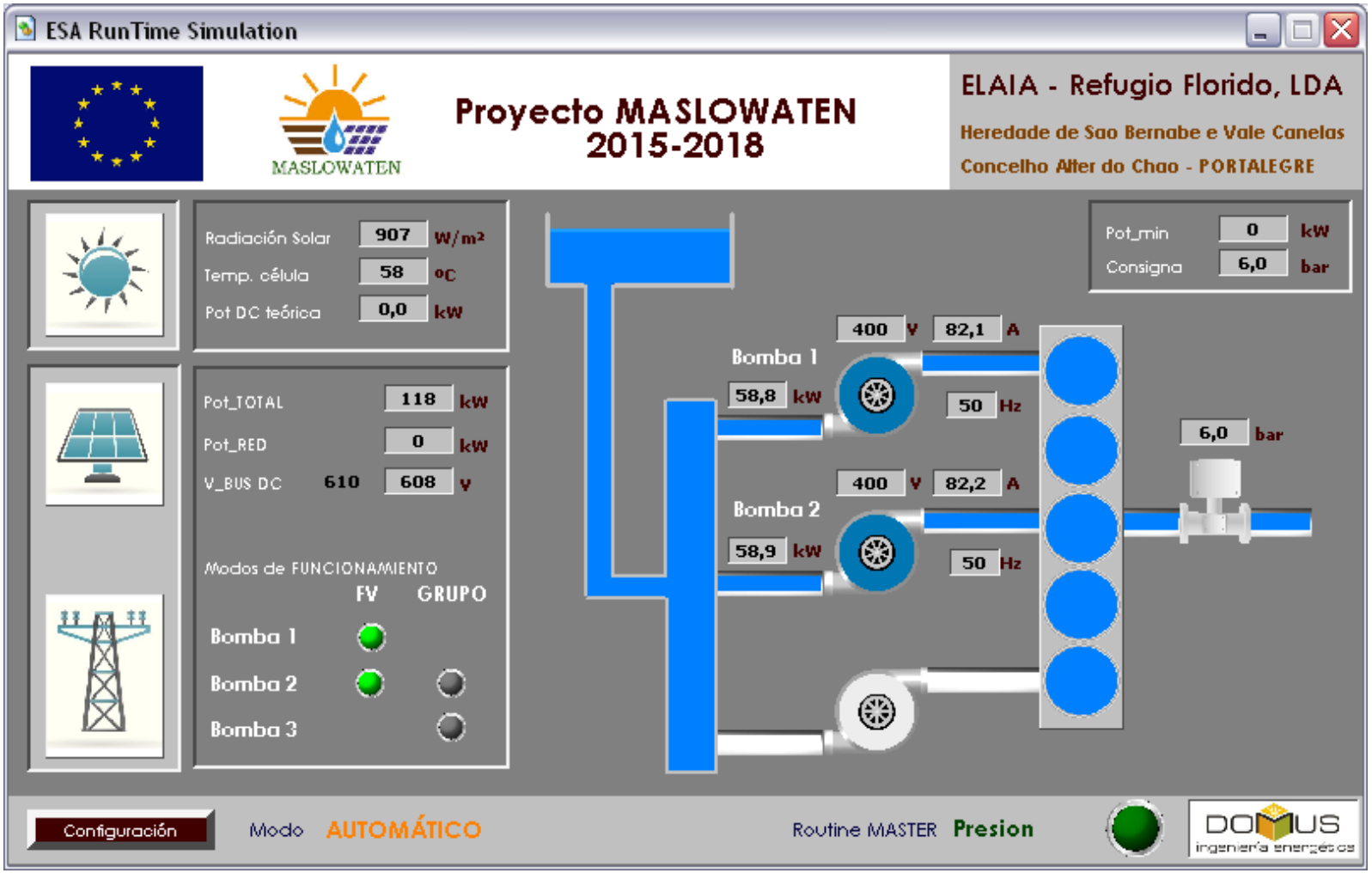
Alter do Chao: PORTUGAL – Hybrid PV+Diesel



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Alter do Chao: PORTUGAL – Hybrid PV+Diesel

CAPRARI MEC-MR100/2D

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Tamellalt: MOROCCO – Hybrid PV+Grid

Owner : ELAIA (Soprolives)

Annual water needs : 694.000 m^3
HMT : 43 m
Flow : 2x 53 l/s

System Configuration

PV Generator: 120 kWp
PV Trackers : 1 x H1250 multirow (6 axes)
Inverter : 2 x 55 kW
Pumps : **2 x MEC-ARBHZ4/125C+45kW**
Irrigation System : already exist (drip)
Expected water production : 545.000 m^3 (80% FV- 20% GRID)

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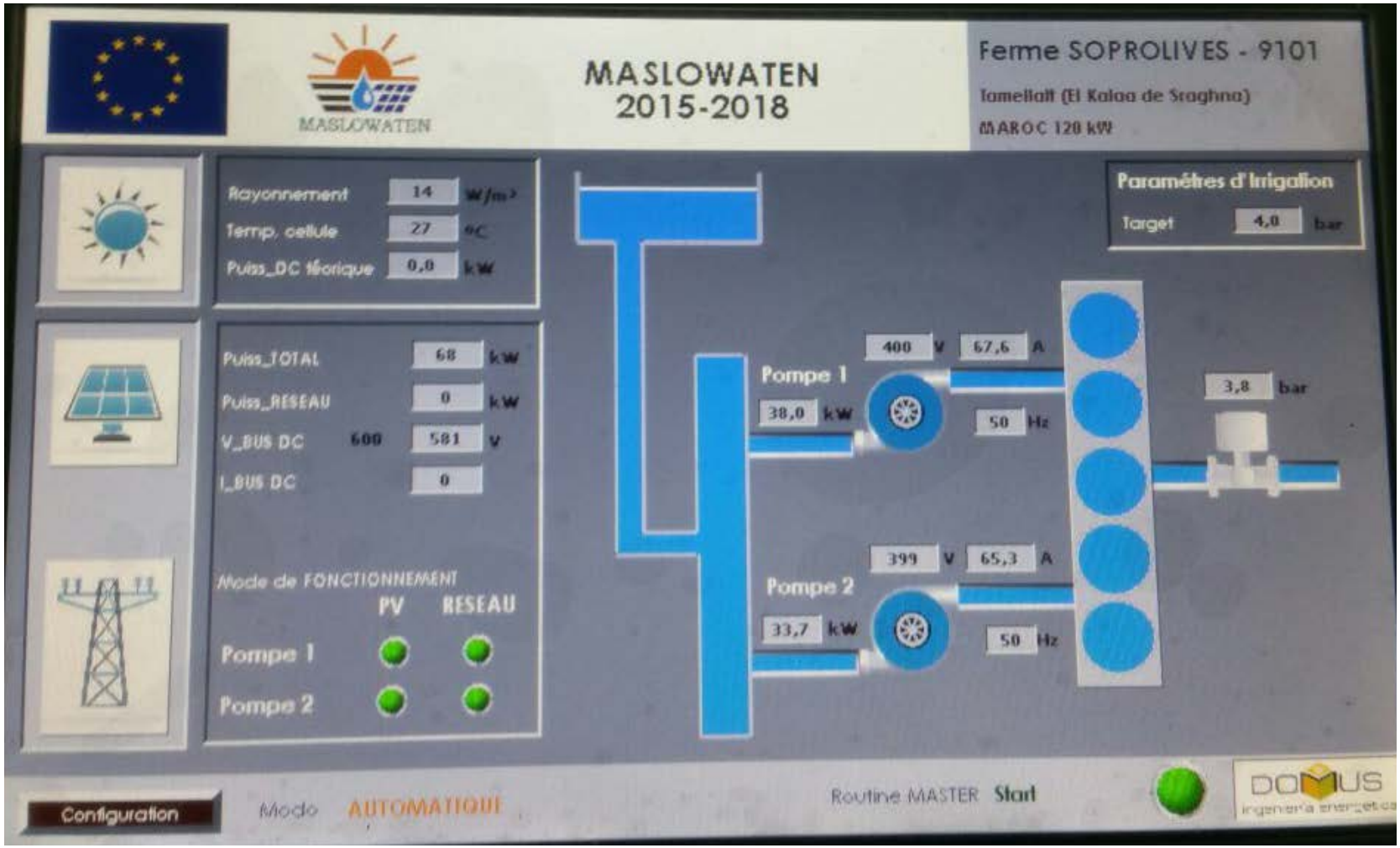
Tamellalt: MOROCCO – Hybrid PV+Grid



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Tamellalt: MOROCCO Hybrid PV+Grid

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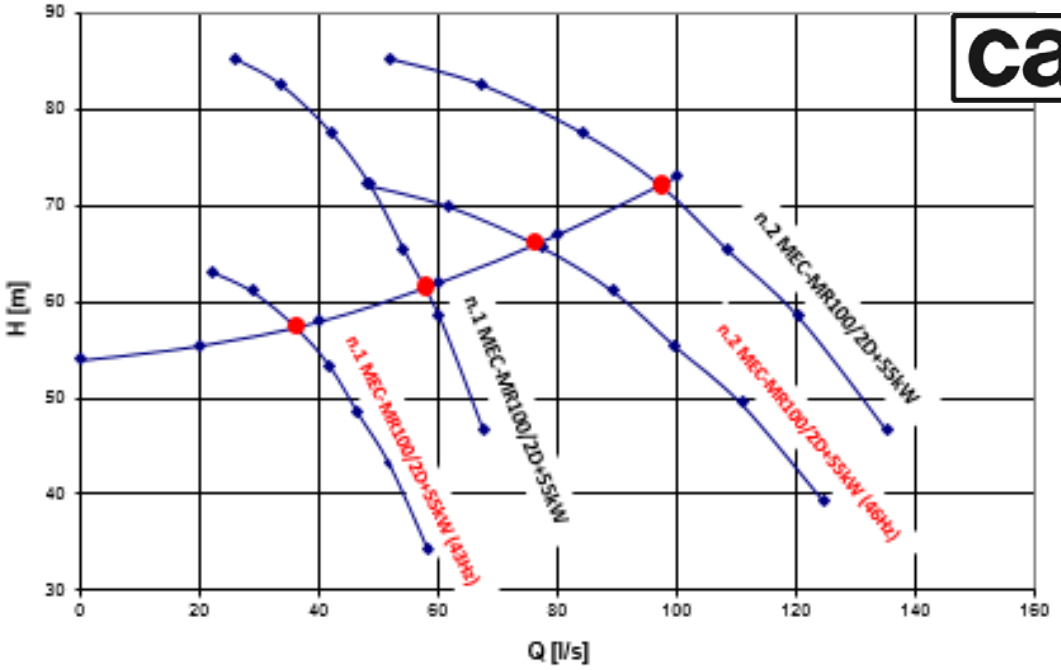
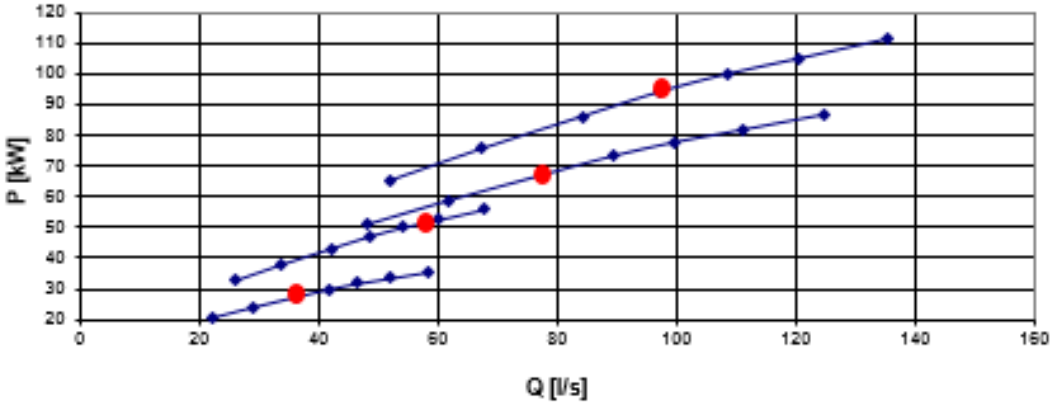
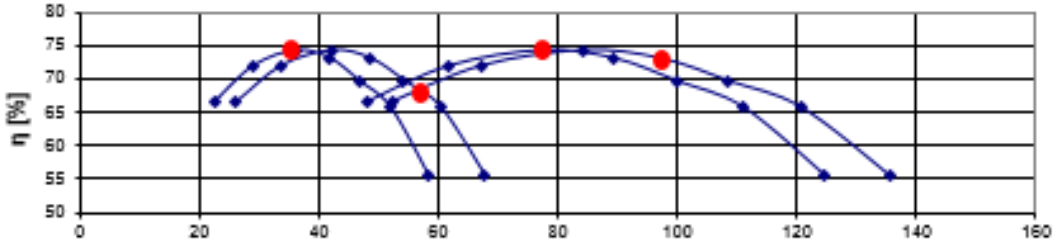
parallel pumps + frequency variation

with 110kW of maximum installed power it's possible to start work with 20kW and 43Hz

plant can be irrigated in sectors: 40-60-80-100 l/s







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research and innovation programme

Alaejos: SPAIN – PV / Diesel

Owner : Coop. La Estrella de San Juan
Annual water needs : 360.000 m^3
New well : tested in Nov-15
HMT : 140 m
Flow : 45 l/s (162 m^3/h)

System Configuration

PV Generator: 160 kWp (MARTIFER)
PV Trackers : 1 x H1250 multi-rows (6 axes) and
2 x H160 single-row (1 axe)
Inverter : 2 x 110 kW (ND) and 2 x 37 kW (OMRON)
Pumps : 92 KW submersible vertical electro-pump (CAPRARI)
n.1 E8P135-8/10C+MAC8125
30 kW centrifugal surface horizontal axe (CAPRARI)
n.1 MEC-A2/80A+30kW
Water tank : 1000 m3
Pivot: 5 towerS (RKD)
Irrigation System : 22 electro-valves and 4 pivots (PROGRÉS + KOMET)
Expected water production : 363.000 m^3

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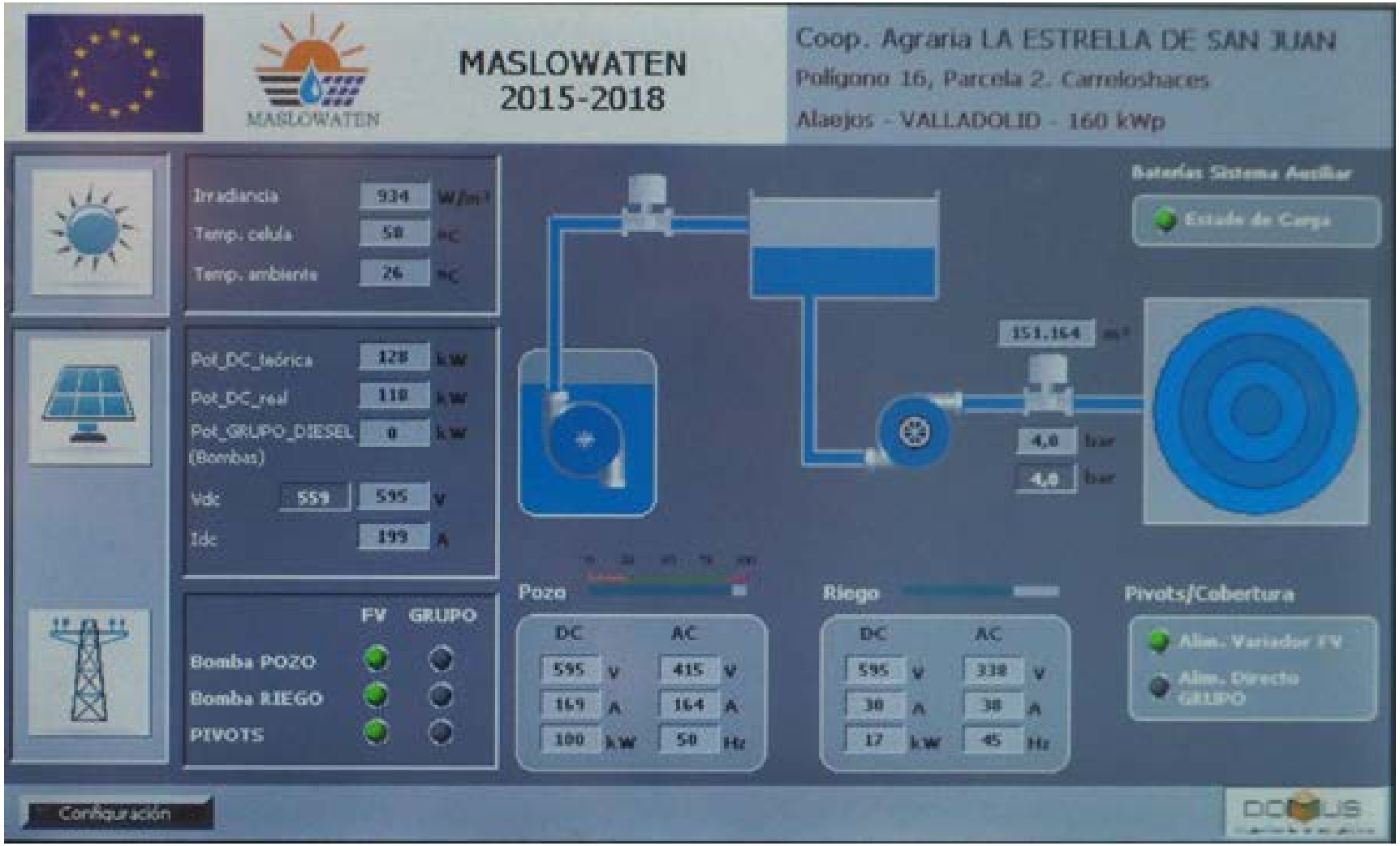
Alaejos: SPAIN – PV / Diesel



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Alaejos: SPAIN – PV / Diesel

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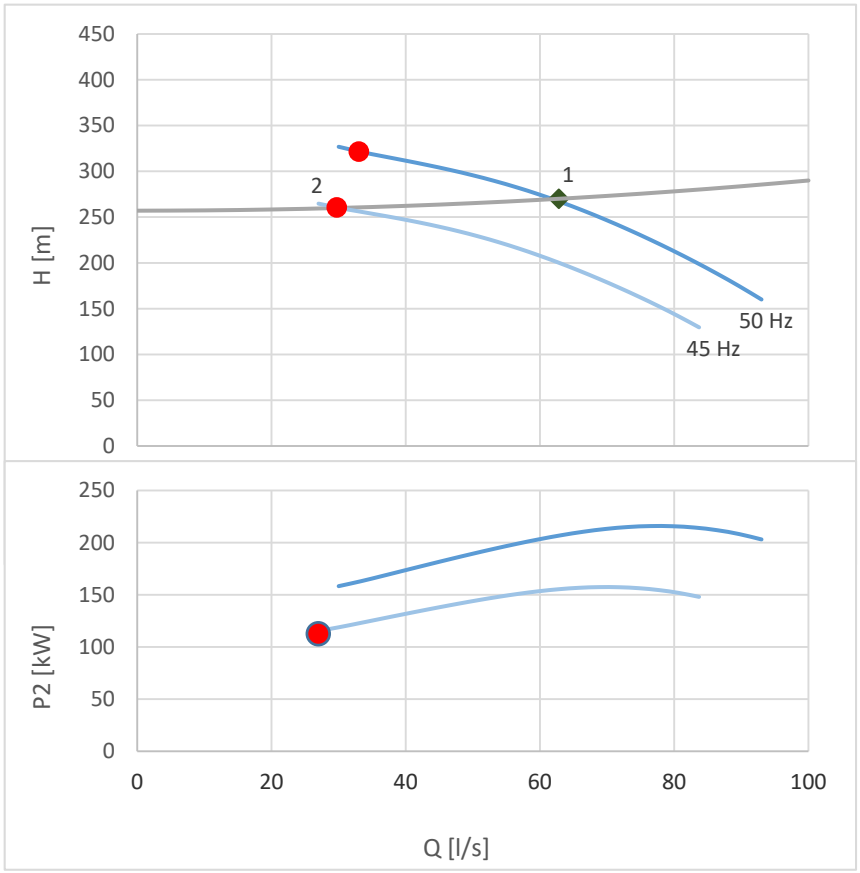
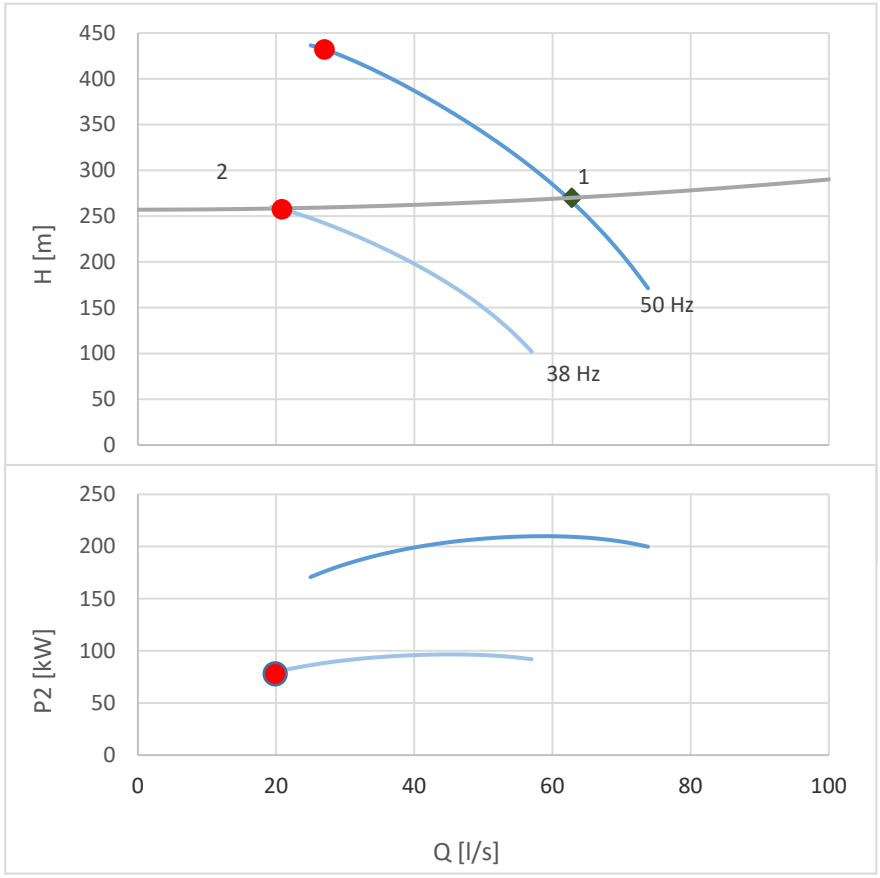
E12S55/8A+MAC12300C-8V



E10S55/14A+MAC12300C-8V



Importance of the slope/field of the Performance Q/H curve

…….. choosing the biggest pump is not always the best choice

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Villena: SPAIN – PV

Owner : CGUAV

Annual water needs : 650.000 m^3 /22.000.000 m^3
New well: completed in April-16
HMT : 288 m
Flow : 63 l/s (227 m^3/h)

System Configuration

PV Generator: 360 kWp (MARTIFER)
PV Trackers : 2x H1250 multi-rows (8 axes) and
2x H160 single-row (1 axe)
Inverter : 355 kW (ND) (OMRON)
Pump : 250 KW (P2) submersible vertical electro-pump (CAPRARI)
E12S42X-12/5A+MAC12300/1C
Expected water production : 663.000 m^3

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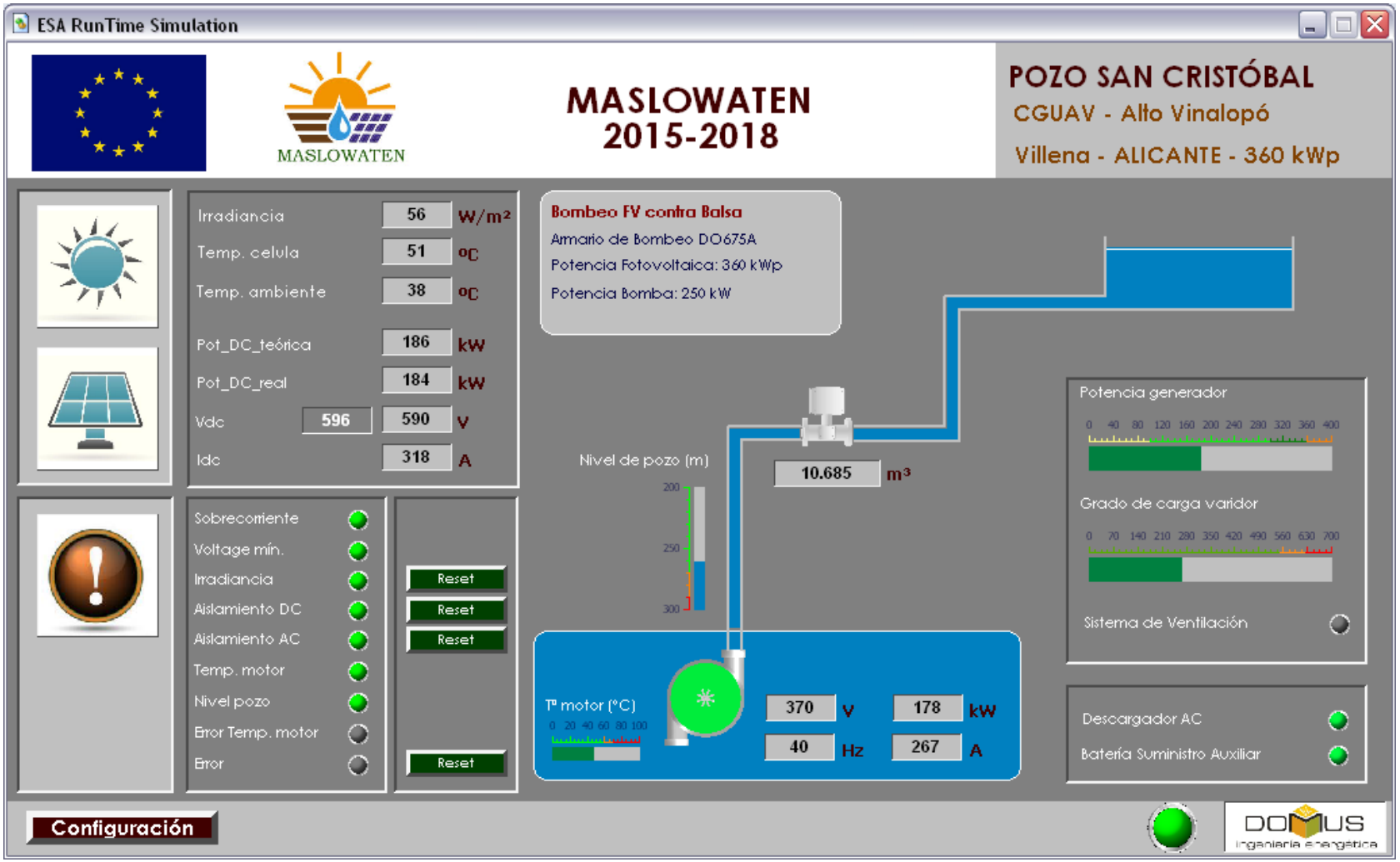
Villena: SPAIN – PV



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Villena: SPAIN – PV

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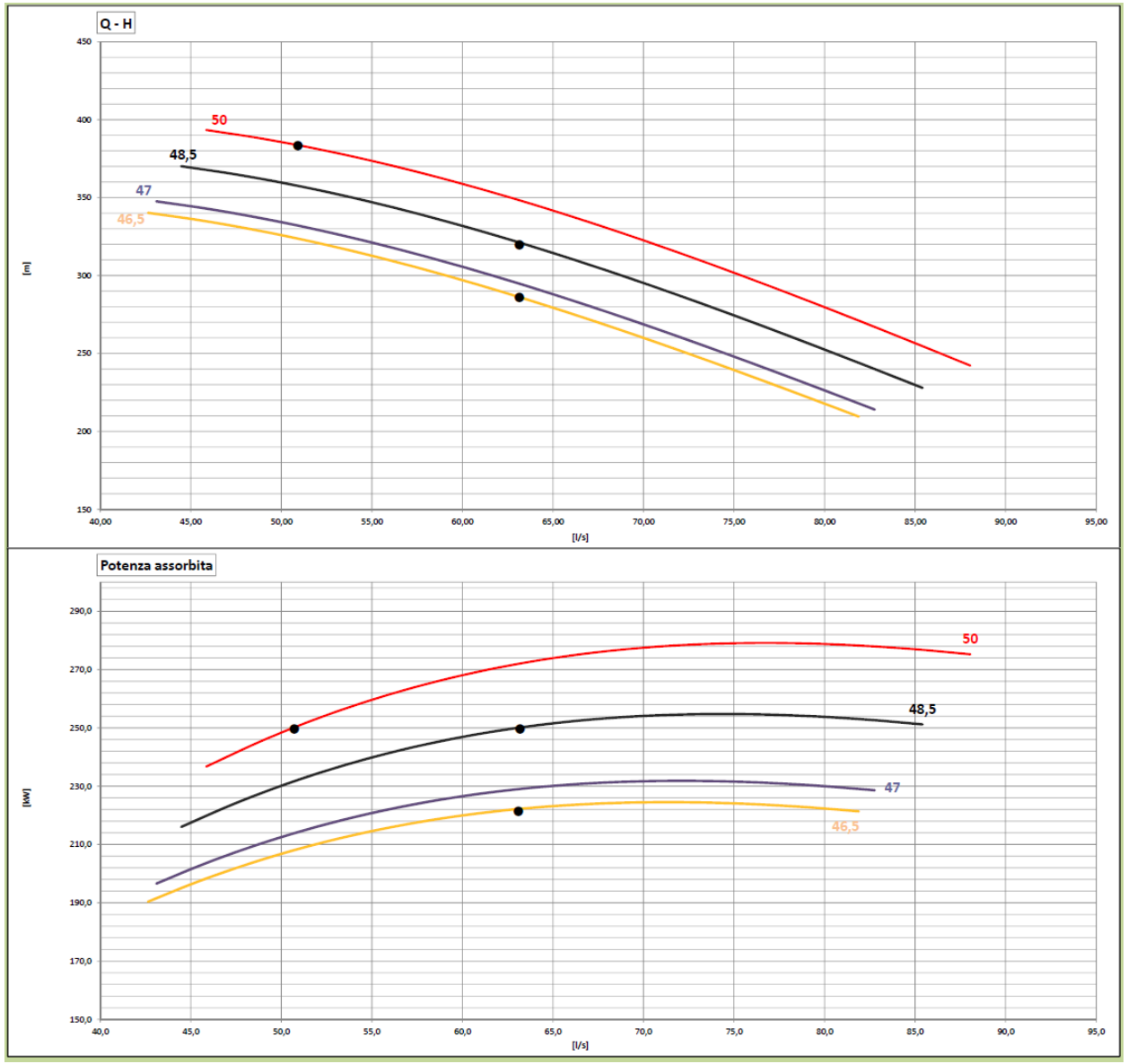
Importance of seeking maximum flexibility and adaptability to the context



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Uri: ITALY – PV / Grid

Owner : Roberto Simula

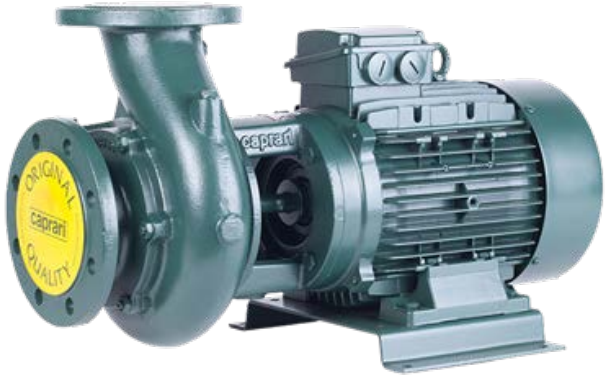
Annual water needs : 100.000 m^3

Two wells : tested in Nov-15

HMT 1 and 2 : 90 m

Flow : Well-1 → 5-10 l/s

Well-2 → 3 l/s



System Configuration

PV Generator: 40 kWp (MARTIFER)

PV Trackers : 2 x H160 single-row (1 axe)

Inverter : 1 x 22 kW (ND) / 1x 5,5 kW and 1x 11 kW (OMRON)

Pumps : Well1- 18,5 KW submersible vertical electro-pump (CAPRARI)

n.1 E6SX50-6/14A+MACX625/2B

Well 2 - 3 KW submersible vertical electro-pump (CAPRARI)

n.1 E4XP30/21+MCK43

Irrigation 7,5 kW centrifugal surface horizontal axe (CAPRARI)

n.1 MDT50+M300752111

New Irrigation System : Agronic 2500 and meteorological station (PROGRÉS)

Sprinckles (KOMET)

Expected water production : 104.000 m^3

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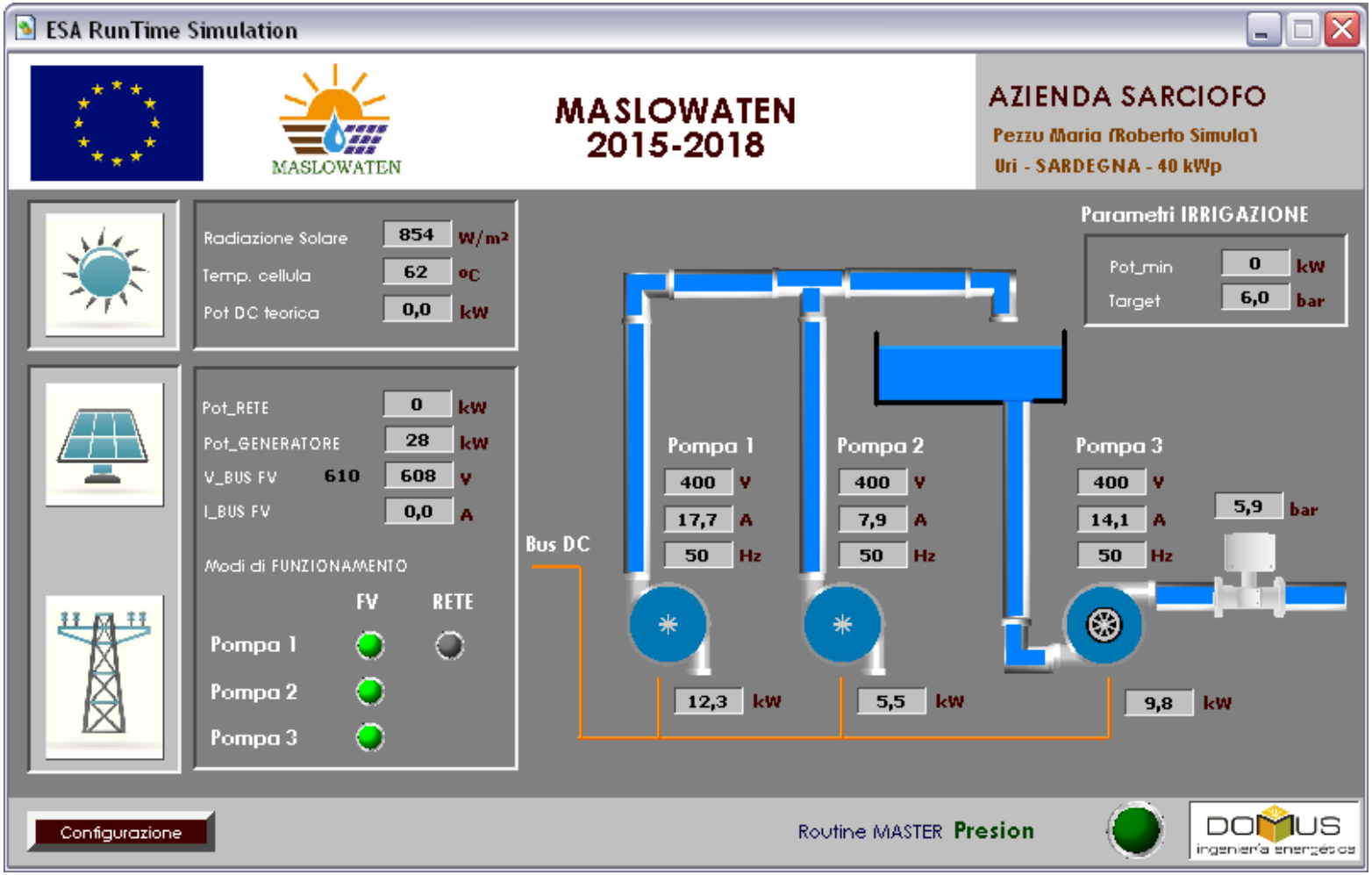
Uri: ITALY – PV / Grid



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Uri: ITALY – PV / Grid

CAPRARI MEC-MR100/2D

CAPRARI E6SX50/14A+MAC625/2B

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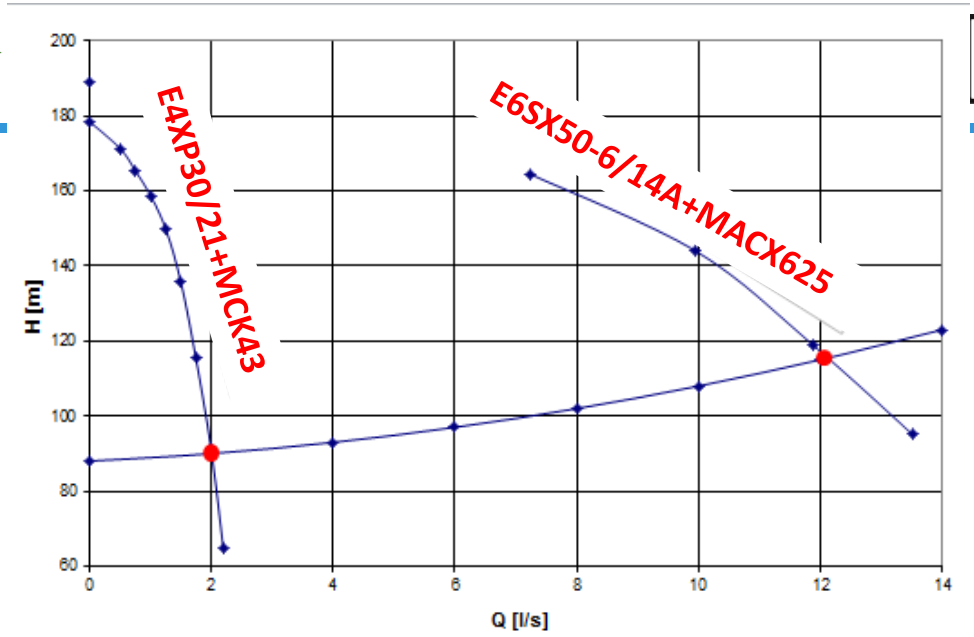
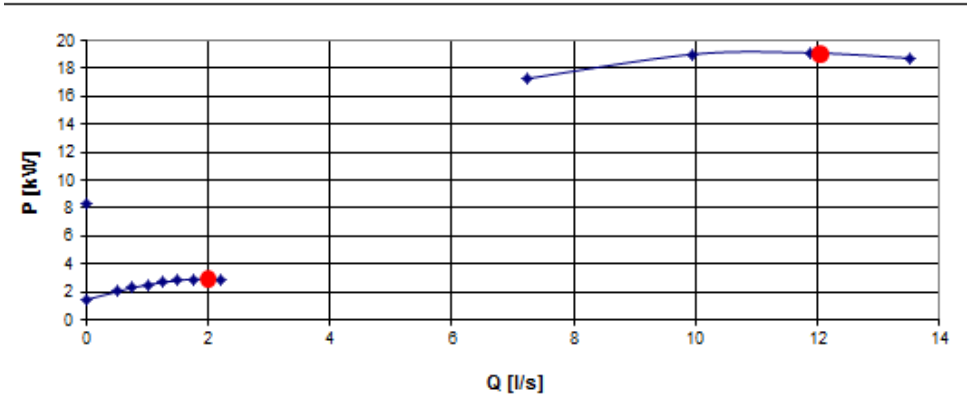
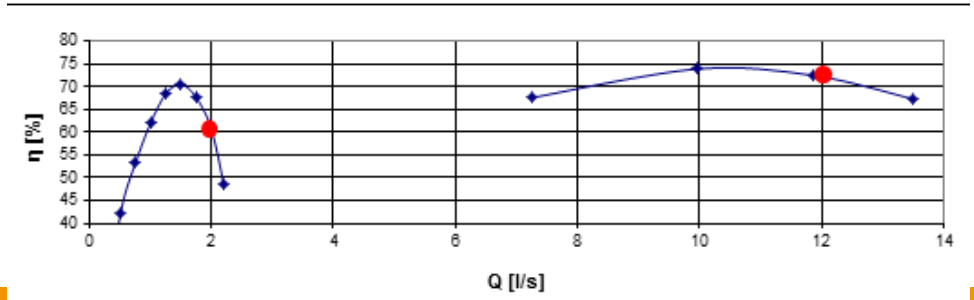
Importance of the size of the electric pump







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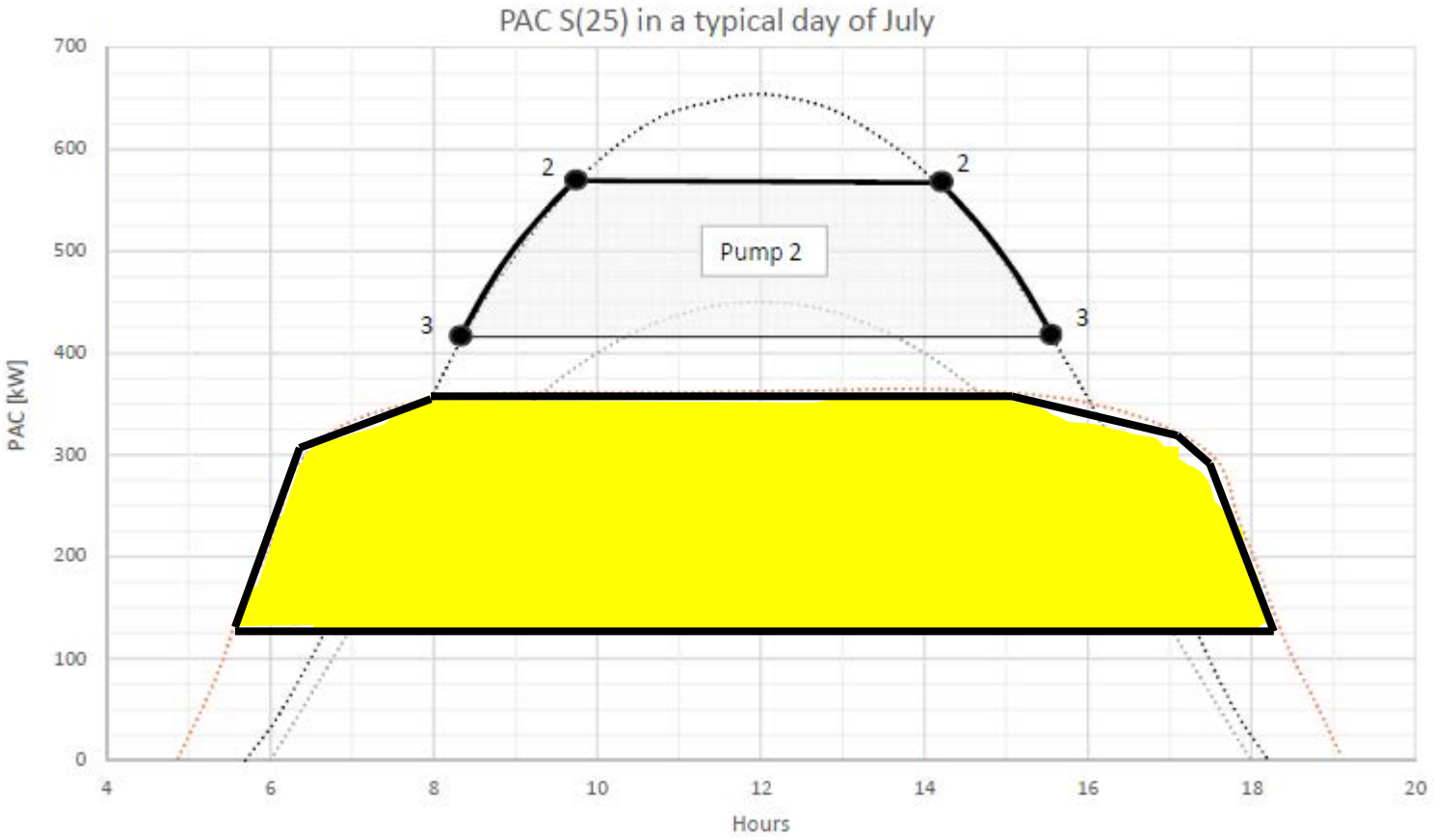
Last but …… not least



Importance of the PV orientation system type

single axis tracker / multi-axis tracker **/ fixed orientation**

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to obtain all this ⇒ competence and appropriate tools

caprari
pumping power

iPump

PumpTutor NG
NEXT GENERATION

Innovative on-line software designed by Caprari for selection, configuration and quotation

&

POLITÉCNICA

CAMPUS DE EXCELENCIA INTERNACIONAL

Universidad Politécnica de Madrid

Instituto de energía solar

SISIFO

SISIFO is a free web framework for simulating Photovoltaic Systems

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Thanks for your attention, for more information please visit:

www.maslowaten.eu
www.caprari.com

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