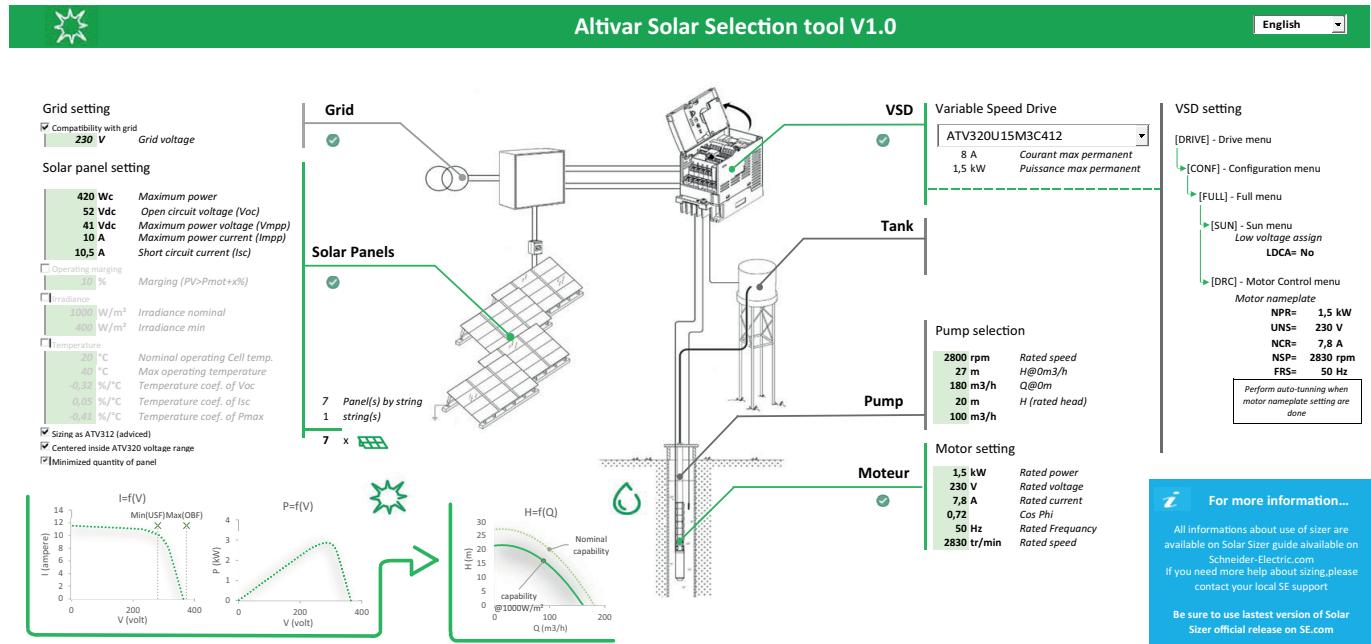


Altivar Solar Sizer Tool

Technical Note

BQT88034.01

10/2024



Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

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Safety Information

Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

! DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

! WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

! CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used. All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

Intended Use

This product is intended for industrial use according to this manual.

The product may only be used in compliance with all applicable safety standard and local regulations and directives, the specified requirements and the technical data. The product must be installed outside the hazardous ATEX zone. Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented. Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design). Any use other than the use explicitly permitted is prohibited and can result in hazards.

Product Related Information

Read and understand these instructions before performing any procedure with this drive.

! DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and fully understand the contents of the present manual and all other pertinent product documentation and who have received all necessary training to recognize and avoid hazards involved are authorized to work on and with this drive system.
- Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Only use properly rated, electrically insulated tools and measuring equipment.
- Do not touch unshielded components or terminals with voltage present.
- Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- Insulate both ends of unused conductors of the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors or the braking resistor terminals.

Failure to follow these instructions will result in death or serious injury.

! DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Before performing work on the drive system:

- Disconnect all power, including external control power that may be present. Take into account that the circuit breaker or main switch does not de-energize all circuits.
- Place a "Do Not Turn On" label on all power switches related to the drive system.
- Lock all power switches in the open position.
- Wait 15 minutes to allow the DC bus capacitors to discharge.
- Verify the absence of voltage. (1)

Before applying voltage to the drive system:

- Verify that the work has been completed and that the entire installation cannot cause hazards.
- If the mains input terminals and the motor output terminals have been grounded and short-circuited, remove the ground and the short circuits on the mains input terminals and the motor output terminals.
- Verify proper grounding of all equipment.
- Verify that all protective equipment such as covers, doors, grids is installed and/or closed.

Failure to follow these instructions will result in death or serious injury.

(1) Refer to the Verify the Absence of Voltage section in the installation manual of the product.

About the Book

Validity Note

Original instructions and information given in the present document have been written in English (before optional translation).

This documentation is valid for the Altivar Solar ATV320 drives.

The characteristics of the products described in this document are intended to match the characteristics that are available on www.se.com. As part of our corporate strategy for constant improvement, we may revise the content over time to enhance clarity and accuracy. If you see a difference between the characteristics in this document and the characteristics on www.se.com, consider www.se.com to contain the latest information.

Step	Action
1	Go to the Schneider Electric home page www.se.com .
2	In the Search box type the reference of the product or the name of a product range. <ul style="list-style-type: none"> Do not include blank spaces in the reference or product range. To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the Product Datasheets search results and click on the reference that interests you. If you entered the name of a product range, go to the Product Ranges search results and click on the product range that interests you.
4	If more than one reference appears in the Products search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click Download XXX product datasheet .

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Related Documents

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on www.se.com.

The internet site provides the information you need for products and solutions:

- The whole catalog for detailed characteristics and selection guides,
- The CAD files to help design your installation, available in over 20 different file formats,
- All software and firmware to maintain your installation up to date,
- A large quantity of White Papers, Environment documents, Application solutions, Specifications... to gain a better understanding of our electrical systems and equipment or automation,
- And finally all the User Guides related to your drive, listed below:

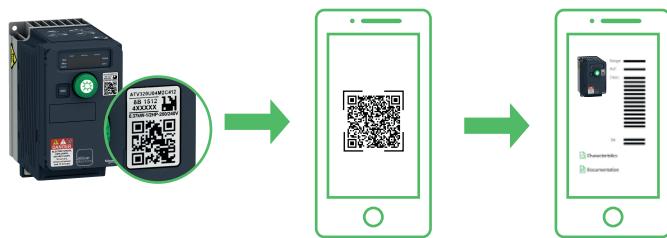
Title of Documentation	Reference Number
ATV320 Solar Catalog	DIA2ED2231101EN (English), DIA2ED2231101FR (French)
ATV320 Solar Getting Started	PKR42507 (English and French)
ATV320 Solar Getting Started Annex (SCCR)	PKR39141 (English)
Video: ATV320 Solar Getting Started	FAQ000257728 (English)
ATV320 Solar User Manual	PKR47019 (English), PKR47020 (French)
ATV320 Installation manual	NVE41289 (English), NVE41290 (French), NVE41291 (German), NVE41292 (Spanish), NVE41293 (Italian), NVE41294 (Chinese), NVE41289PT (Portuguese), NVE41289TR (Turkish)
ATV320 Programming manual	NVE41295 (English), NVE41296 (French), NVE41297 (German), NVE41298 (Spanish), NVE41299 (Italian), NVE41300 (Chinese)
ATV320 Modbus Serial Link manual (embedded)	NVE41308 (English)
ATV320 Modbus TCP - Ethernet IP manual (VW3A3616)	NVE41313 (English)
ATV320 Communication Parameters	BQT67538 (English)
ATV312 to ATV320 Migration Manual	QGH39563 (English)
ATV320 Safety Functions manual	NVE50467 (English), NVE50468 (French), NVE50469 (German), NVE50470 (Spanish), NVE50472 (Italian), NVE50473 (Chinese)
BMP Synchronous Motor manual	0198441113981-EN (English), 0198441113982-FR (French), 0198441113980-DE (German), 0198441113984-ES (Spanish), 0198441113983-IT (Italian), 0198441113985-ZH (Chinese)
ATV320 ATV Logic manual	NVE71954 (English), NVE71955 (French), NVE71957 (German), NVE71959 (Spanish), NVE71958 (Italian), NVE71960 (Chinese)
ATV320 ATEX manual	NVE41307 (English)
SoMove: FDT	SoMove_FDT (English, French, German, Spanish, Italian, Chinese)
ATV320: DTM	ATV320_DTM_Library (English, French, German, Spanish, Italian, Chinese)
Recommended Cybersecurity Best Practices	CS-Best-Practices-2019-340 (English)

(Other option manuals and Instruction sheets are available on www.se.com)

You can download these technical publications and other technical information from our website at www.se.com/en/download.

Electronic product data sheet

Scan the QR code in front of the drive to get the product data sheet.



Terminology

The technical terms, terminology, and the corresponding descriptions in this manual normally use the terms or definitions in the relevant standards.

In the area of drive systems this includes, but is not limited to, terms such as **error**, **error message**, **failure**, **fault**, **fault reset**, **protection**, **safe state**, **safety function**, **warning**, **warning message**, and so on.

Among others, these standards include:

- IEC 61800 series: Adjustable speed electrical power drive systems
- IEC 61508 Ed.2 series: Functional safety of electrical/electronic/programmable electronic safety-related
- EN 954-1 Safety of machinery - safety-related parts of control systems
- ISO 13849-1 & 2 Safety of machinery - safety related parts of control systems
- IEC 61158 series: Industrial communication networks - Fieldbus specifications
- IEC 61784 series: Industrial communication networks - Profiles
- IEC 60204-1: Safety of machinery - Electrical equipment of machines – Part 1: General requirements
- IEC 62443: Security for industrial automation and control systems

In addition, the term **zone of operation** is used in conjunction with the description of specific hazards, and is defined as it is for a **hazard zone** or **danger zone** in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.

Contact us

Select your country on www.se.com/contact.

Schneider Electric Industries SAS

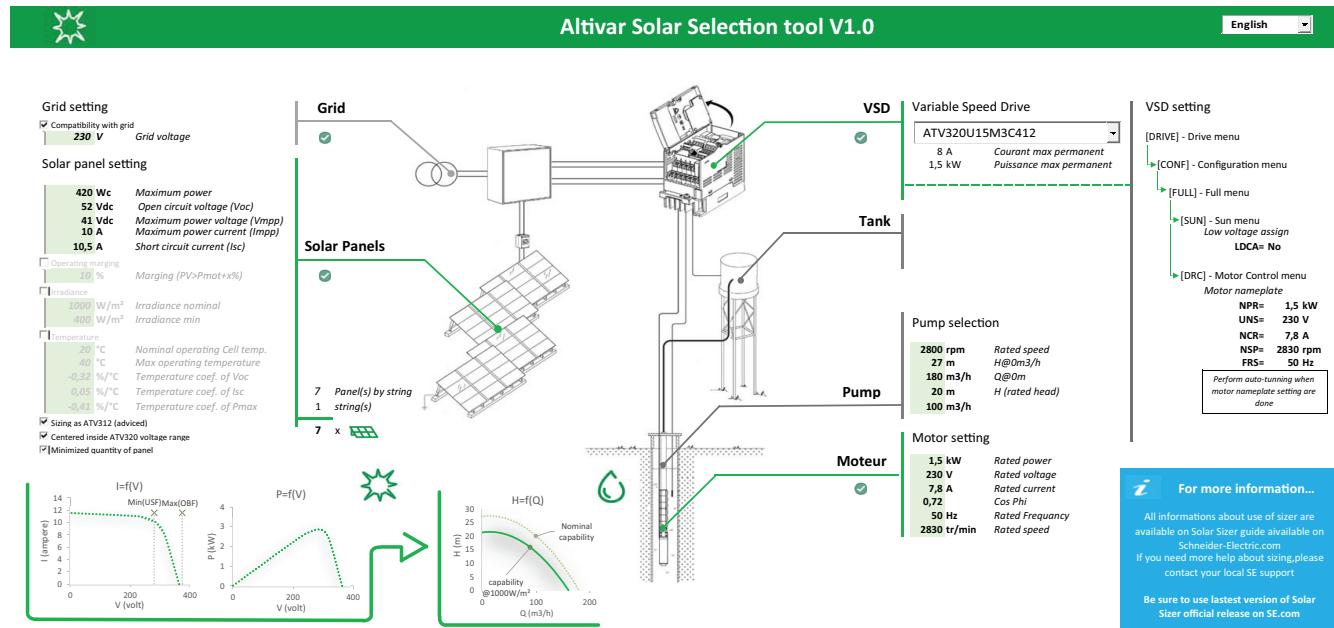
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France

Global description of the Solar Sizer tool



✓ The requested solution is correct.

⚠ Solution in line with motor and solar panel data, but one of the two sections is not consistent.

✗ The solution doesn't work. The data is not consistent.

How to video

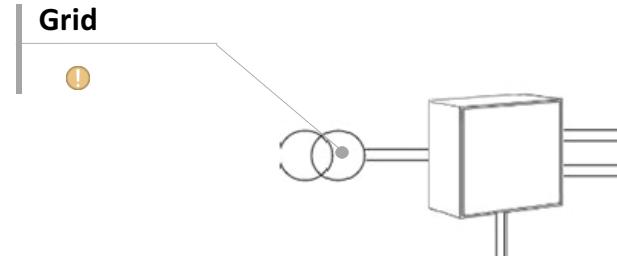
An How to video is available here: FAQ000256627 (English)

“Grid” setting

Overview

When the application required to switch from the grid to solar panels, use this section.

Grid setting
 Compatibility with grid
 230 V Grid voltage



NOTE: [Low Voltage Assign] *L d C R* must be set to *n o* when using the grid.

“Solar panels” setting

Overview

To define the number of solar panels required, fill the data with the datasheet of the solar panels in this section:

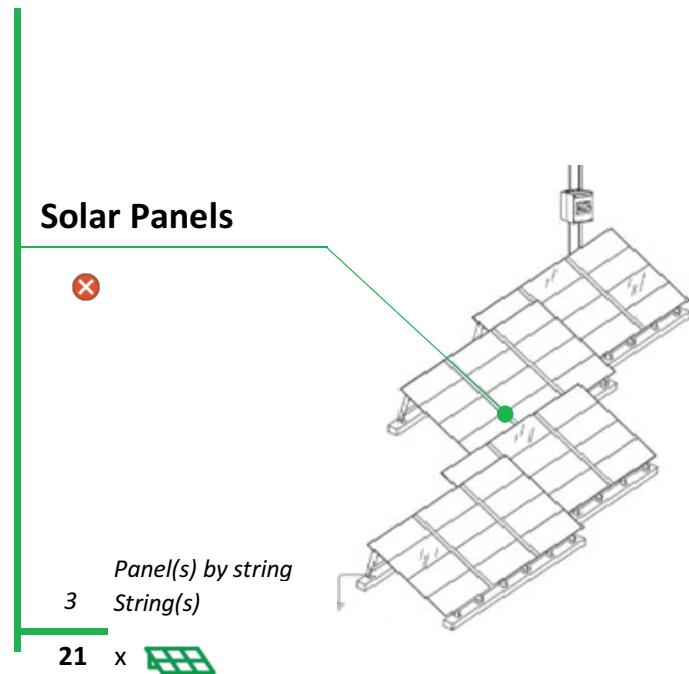
Solar panel setting

310	Wc	Maximum power
45,88	Vdc	Open circuit voltage (Voc)
39,04	Vdc	Maximum power voltage (Vmpp)
8,1	A	Maximum power current (Imp)
8,6	A	Short circuit current (Isc)

Operating margin
 Irradiance
 Temperature

10	%	Marging (PV>Pmot+x%)
1000	W/m ²	Nominal Irradiance
800	W/m ²	Min Irradiance

Sizing as ATV312 (advised)
 Centered inside ATV320 voltage range
 Minimized quantity of panels



Solar Panels setting section of the tool.

Electrical Parameters	
Type	Data
Rated Maximum Power at STC (Wp)	310
Open Circuit Voltage (Voc/V)	45.88
Maximum Power Voltage (Vmpp/V)	39.04
Short Circuit Current (Isc/A)	8.60
Maximum Power Current (Imp/A)	8.10
Module Efficiency [%]	18.20
Power Tolerance	0+3%
Temperature Coefficient of Isc (αIsc)	+0.05%/°C
Temperature Coefficient of Voc (βVoc)	-0.34%/°C
Temperature Coefficient of Pmax (γPmp)	-0.42%/°C
STC	Irradiance 1000W/m ² , Module Temperature 25°C, AM 1.5

Datasheets of the solar panels.

NOTE: STC: Standard Test Conditions

NOTE: Selected Operating margin, irradiance, or temperature to be more specific in the selection of solar panels.

Operating margin

Add a tolerance margin in case of uncertain data.

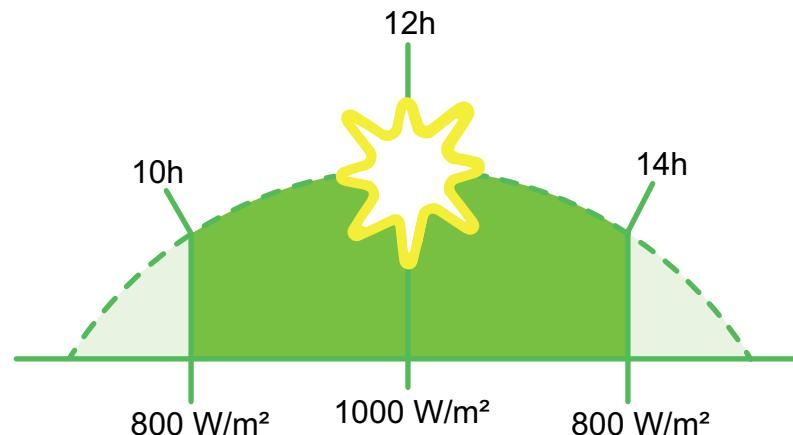
Irradiance

Under the *Min irradiance*, the nominal speed will decrease.

Irradiance

1000	W/m²	<i>Nominal Irradiance</i>
800	W/m²	<i>Min Irradiance</i>

For example:



Temperature

Temperature data of the solar panels:

Temperature

25	°C	<i>Nominal operating Cell temp.</i>
30	°C	<i>Max operating temperature</i>
-0,32	%/°C	<i>Temperature coef. of Voc</i>
0,05	%/°C	<i>Temperature coef. of Isc</i>
-0,42	%/°C	<i>Temperature coef. of Pmax</i>

The maximum operating temperature is linked to the installation environment.

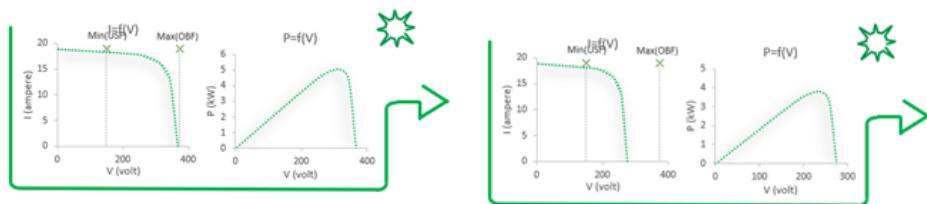
Sizing as ATV312

In case of substitution, select *Sizing as ATV312*. It will deactivate the *L d C R* parameter:

→ [SUN] - Sun menu
Low voltage assign
LDCA= No

Centered inside ATV320 Voltage range

To reduce the chance to trigger a $\text{u } 5 F$ or a $\text{a } b F$, select *Centered inside ATV320 Voltage range*:



Without Centered inside ATV320 Voltage range With Centered inside ATV320 Voltage range

NOTE: Selecting this setting may result in the pump not operating at its rated point.

NOTE:

- $\text{u } 5 F$: Under-voltage error trip threshold.
- $\text{a } b F$: Trip threshold for overvoltage error. Motor running.

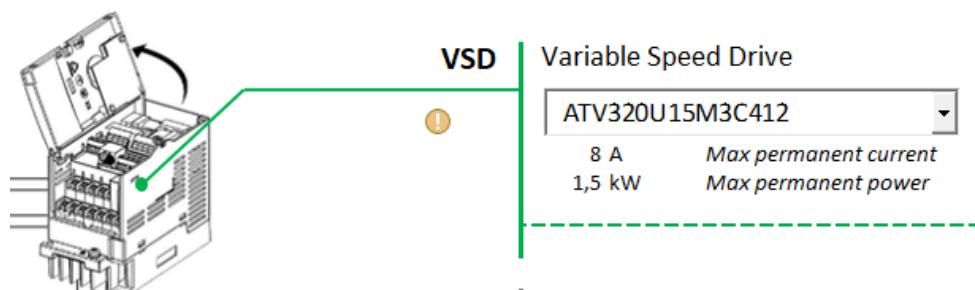
Minimized quantity of panels

Select this option to enable sizing with a criterion for the optimum quantity of solar panels.

Variable Speed Drive selection

Overview

After filling in the solar panel information, select the speed controller from a range of products.



VSD setting section

A reminder of the VSD settings to set in the ATV320:

VSD setting

[DRIVE] - Drive menu

► [CONF] - Configuration menu

► [FULL] - Full menu

► [SUN] - Sun menu

Low voltage assign

LDCA= Yes

► [DRC] - Motor Control menu

Motor nameplate

NPR= 1,5 kW

UNS= 220 V

NCR= 8,75 A

NSP= 2830 rpm

FRS= 50 Hz

*Perform auto-tuning when
motor nameplate setting are
done*

NOTE: For an optimum maximum power point tracking (MPPT) function, it is recommended to enter the motor plate parameters and perform an autotuning.

Pump/Motor section

Overview

Fill the data with the datasheet of the pump and the motor selected which has been chosen according to the depth of the well and the flow rate in this section:

Pump selection	
Pump	2800 rpm <i>Rated speed</i>
	54 m <i>H at 0m3/h</i>
	10,8 m3/h <i>Q at 0m</i>
	43 m <i>H (rated head)</i>
	6,25 m3/h <i>Q (rated flow)</i>

Motor setting	
Motor	1,5 kW <i>Rated power</i>
	220 V <i>Rated voltage</i>
	8,75 A <i>Rated current</i>
	0,71 <i>Cos Phi</i>
	50 Hz <i>Rated Frequency</i>
	2830 tr/min <i>Rated speed</i>

Pump/Motor section in the tool

Nameplate of the pump

Curves section

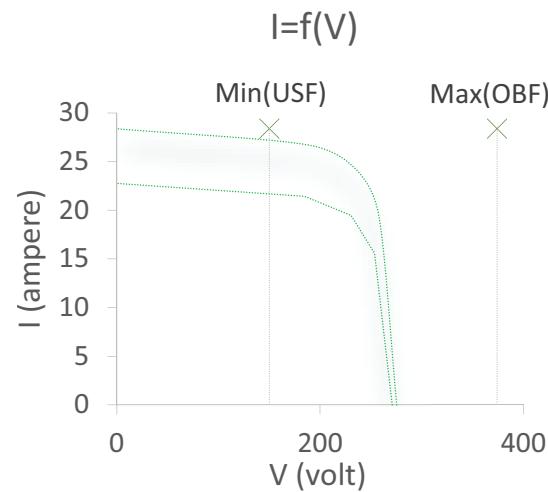
All those data have an impact on the following curves:

NOTE: These curves are for information only and are non-contractual.

Solar array curves

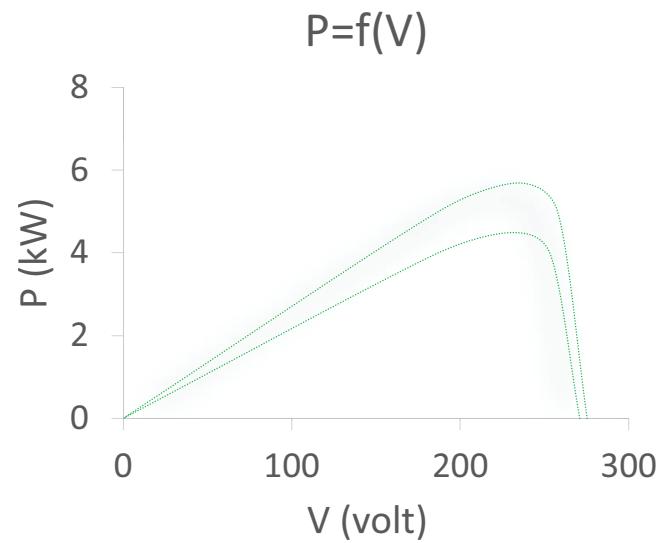
These curves show estimate solar array characteristics based on the solar panel data sheet and the sizing options defined in the tool.

I–V curve



- Min (*u 5 F*): Under-voltage error trip threshold.
- Max (*o b F*): Trip threshold for overvoltage error. Motor running.

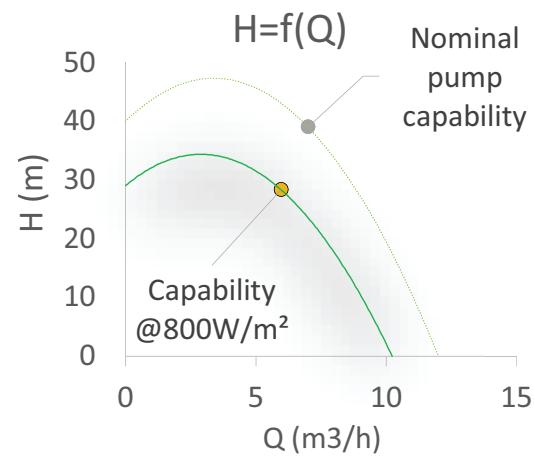
P–V curve



Pump curve

These curves show the estimate pump characteristics (based on the actual shape of the curve) based on the solar panel data sheet and the sizing options defined in the tool.

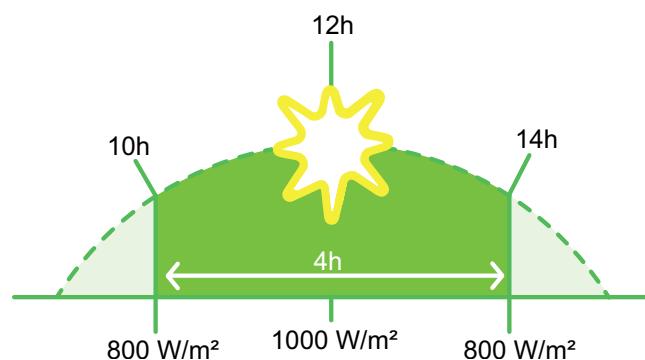
H-Q curve



Example: User Case

Characteristics of the user case

- A small village of 250 peoples.
- 100L per person.
- 25m³ per day.
- Tank of 35m³ to smooth out water needs over the year.
- Unfavorable sunshine conditions: 4h of optimum sunshine per day.



1. Select the pump

1. Calculate the required flow rate: $Q = \text{Daily Flow rate}/\text{optimum sunshine per day} = 25/4 = 6.25 \text{ m}^3/\text{h}$
2. Select our pump/motor and enter the data on the tool:

Pump selection	
Pump	2800 rpm <i>Rated speed</i>
	54 m <i>H at 0m3/h</i>
	10,8 m3/h <i>Q at 0m</i>
	43 m <i>H (rated head)</i>
	6,25 m3/h <i>Q (rated flow)</i>

Motor setting	
Motor	1,5 kW <i>Rated power</i>
	220 V <i>Rated voltage</i>
	8,75 A <i>Rated current</i>
	0,78 <i>Cos Phi</i>
	50 Hz <i>Rated Frequency</i>
	2830 tr/min <i>Rated speed</i>

2. Set the solar information

If solar panels are already selected, enter the data in this section:

Solar panel setting

310 Wc	Maximum power
45,88 Vdc	Open circuit voltage (Voc)
39,04 Vdc	Maximum power voltage (Vmpp)
8,1 A	Maximum power current (Impp)
8,6 A	Short circuit current (Isc)
<input type="checkbox"/> Operating margin	
10 %	Marging (PV>Pmot+x%)
<input checked="" type="checkbox"/> Irradiance	
1000 W/m ²	Nominal Irradiance
800 W/m ²	Min Irradiance
<input type="checkbox"/> Temperature	
25 °C	Nominal operating Cell temp.
30 °C	Max operating temperature
-0,32 %/°C	Temperature coef. of Voc
0,05 %/°C	Temperature coef. of Isc
-0,42 %/°C	Temperature coef. of Pmax
<input type="checkbox"/> Sizing as ATV312 (advised)	
<input checked="" type="checkbox"/> Centered inside ATV320 voltage range	
<input type="checkbox"/> Minimized quantity of panels	

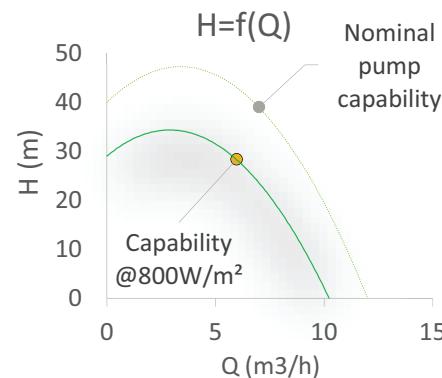
3. Drive Selection:

A drive can be selected:

VSD	Variable Speed Drive
<input checked="" type="checkbox"/>	ATV320U40N4C412
	9,5 A
	4 kW
	Max permanent current
	Max permanent power

4. Analyze the flow curve

The tool shows the flow curve with the data set on the pump data and the drive chosen:



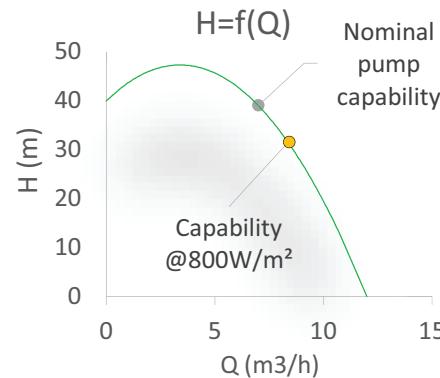
The **Capability curve** do not match the **Nominal Pump capability**.

NOTE: There must be enough energy/power to run the pump at maximum speed to achieve the desired flow rate.

NOTE: Adjust minimum irradiance to match minimum flow capability required.

5. Adapt the hardware configuration

At the end of the selection, the Capability curve must be matching the Nominal Pump capability.



Adapt the hardware configuration by changing the **drive reference** or the **solar panels reference**.

6. Select the solution

Solution #1:

- Drive: ATV320U40N4C412
- Solar panels 310 Wc

	Price	Qty	Total
Drive	680	1	680 €
Panels	480	20	9600 €
Others	100	20	2000 €
Price=		12280 €	

Solution #2:

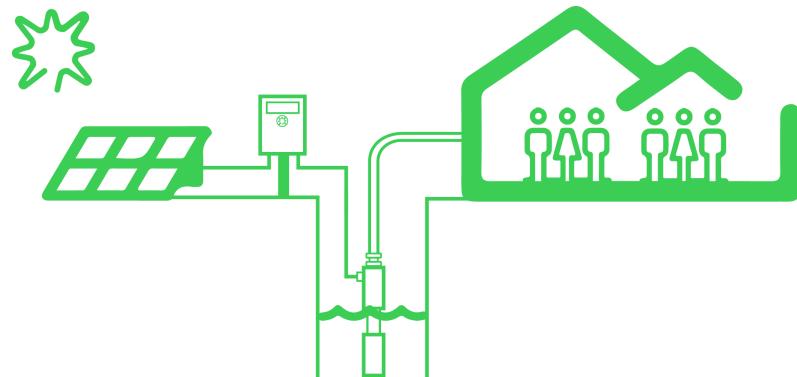
- Drive: ATV320U40N4C412
- Solar panels: 240 Wc

	Price	Qty	Total
Drive	680	1	680 €
Panels	240	26	6240 €
Others	100	26	2600 €
Price=		9520 €	

	Surface	Qty	Total
Panels	1.97	20	39.4 m²
Cabinets	2	1	2.0 m²
Surface=		41.4 m²	

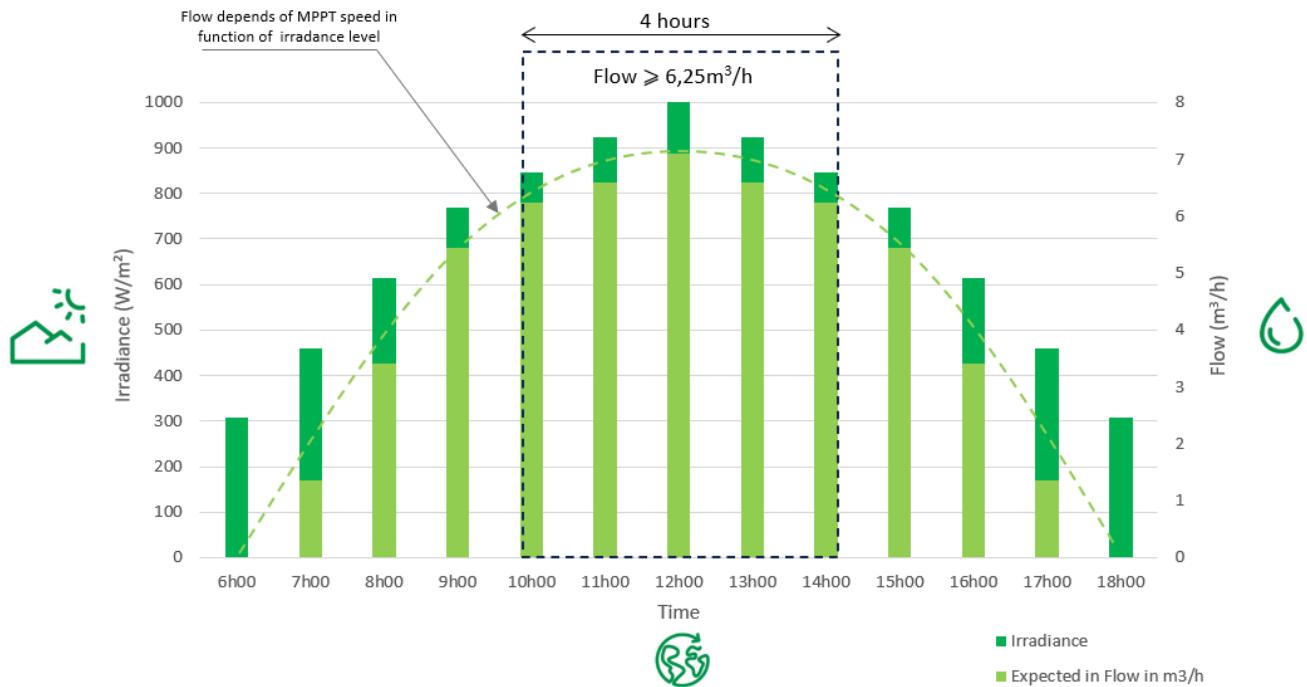


So, in this example, solution number 2 is the least expensive and the most suitable for a village with an unlimited surface area for solar panels.

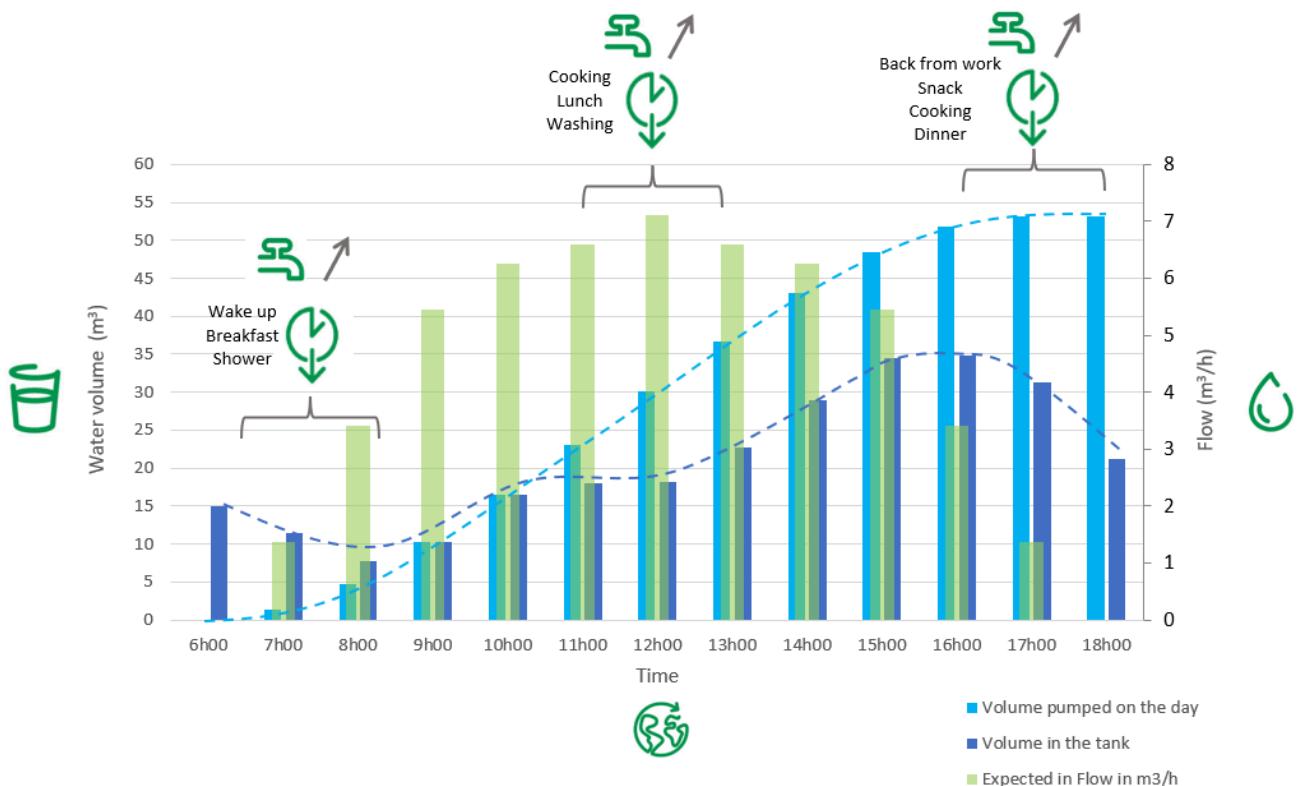


Water production forecast

Water Production vs Sun irradiance



Water Consumption vs Production



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