StoRES

Promotion of higher penetration of Distributed PV through storage for all

Priority Axis 2: Fostering low-carbon strategies and energy efficiency in specific MED territories: cities, islands and remote areas
2.2: To increase the share of renewable local energy sources in energy mix strategies and plans in specific MED territories

Deliverable n°: **3.6.2**

Deliverable Name: **Simulations of future scenarios**

Project co-financed by the European Regional Development Fund

1. Document Info

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2. Document History

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3. Contents

4. List of Figures

5. List of Tables

6. Project Summary

The project addresses the development of an optimal policy for the effective integration of Renewable Energy Sources (RES) and Energy Storage Systems (ESS). The primary challenge is to achieve increased penetration of RES and predominantly Photovoltaics (PV), in the energy mix of islands and rural areas in the Mediterranean (MED) region without compromising grid stability. The main objective of StoRES is to boost self-consumption in the MED region with the integration of optimal storage solutions. Testing coupled PV-ESS solutions in different pilot sites and taking into account local particularities for optimization, current barriers concerning grid reliability with higher RES deployment will be eliminated. In addition to this, the development and integration of the proposed solution at both residential and community levels and the application of different policy scenarios will lift the barriers related to the grid integration of ESS and will extend the practical knowledge about this technology. It is expected that all the shortcomings regarding the intermittent nature of PV energy for increased penetration into the energy mix will be addressed whilst maintaining smooth operation of the grid.

The project started on the 1st of November 2016 and is expected to be completed within 36 months.

7. Introduction to Deliverable 3.6.2

The aim of this deliverable is to assess the possible impact of a wide development of ESS in each project partner's region, by extrapolating the results obtained within the data analysis task.

The methodology developed for this purpose, was firstly, the organisation of an internal survey aiming to collect quantified figures on average electricity consumption by residential houses from the project partners. Then, simulations were carried out using pilot and historic data from all participating countries.

The results served to draw some scenarios, representing the electricity that could be saved from the grid if more ESS are deployed in the energy mix of the participating countries, focusing on the effect of higher PV penetration in the energy mix of the regions involved.

8. Internal survey

For the purpose of this work, it was decided to focus on the development of hybrid PV-ESS solutions only at buildings used as main residences, since they represent the most adapted residential buildings where to develop such plants. Actually secondary houses might not be used enough to justify the investment in ESS and the consumption might not be constant enough to make self-consumption really interesting.

An excel file was developed, as shown in Figure 1, asking information about the number of residential premises and their average electricity demand, etc. It was sent to all the project partners.

3.6.2. Simulations of future scenario

Interreg Mediterranean StoRES

Project co-financed by the European Regional Development Fund

Location	
Country	
Specific area considered	
Aggregated data on the area	
Total electricity consumption in the area (GWh)	
Total number of residential houses	
Percentage of main residences (%)	
Total number of main residences	0
Average rate of houses that can be equipped with PV (%)	
Average electricity demand / year for a house (kWh)	
Pilot sites data	
Average self-sufficiency rate without storage (%)	
Average self-sufficiency rate with storage (%)	
Extrapolation of pilot data to national statistics	
Average electricity saved / house using self-consumption without storage (kWh)	0
Average electricity demand / house using self-consumption without storage (kWh)	0
Total electricity saved for houses using self-consumption without storage (GWh)	0
Average electricity saved / house using self-consumption with storage (kWh)	0
Average electricity demand / house using self-consumption with storage (kWh)	0
Total electricity saved for residential houses with storage (GWh)	0

Comments

Give here other statistics, other information on your pilot area, that would help to compare the impact of storage on electricity consumption

Figure 1: Survey sent to the partners for the collection of the required information.

9. Methodology

The methodology was developed according to the following steps:

- Collection of data
  - Collection of the number of residential premises used as main residences in each region (N)
  - Collection of the average annual electricity demand for a residential house in each region (D)
  - Extraction of the average Self-Sufficiency Rate without ESS (SSR_{PV}) and the average Self-Sufficiency Rate with an ESS (SSR_{ESS}), from the data analysis report (see Deliverable 3.6.1)
- Calculation of electricity savings
  - The electricity which is self-consumed by residential houses with a PV plant but without ESS is calculated by the formula: $N \times D \times SSR_{PV.}$ (1)
  - The electricity which is self-consumed by residential houses with a PV plant + ESS is calculated by the formula: $N \times D \times SSR_{ESS.}$ (2)

Equation (2) represents the energy savings which would be generated by a massive deployment of ESS in the main residential houses.

Different scenarios according to the percentage of houses equipped by ESS are also proposed.

10. Results

10.1 Description of the areas considered for the scenarios

The scenarios are developed either on regional areas or on whole countries. Table 1 demonstrates the areas considered for the scenarios. Each area has defined a percentage of houses that can be equipped, taking into consideration the average constraints that can be usually met on economical or technical aspects (it includes the share of houses with north-oriented roofs or non equipable roofs, the share of owners which cannot afford to invest in an ESS, etc.).

Table 1: Areas considered for the scenarios and average percentages of households equipped with PV-ESS.

Country	CYPRUS	SPAIN	FRANCE	GREECE	ITALY	PORTUGAL	SLOVENIA
Area considered	Whole island	Aragon region	Region Auvergne-Rhone-Alpes	Entire country	Sardinia region	Algarve	Slovenia
Percentage of houses equipped	60%	35%	50%	55%	30%	50%	60%

10.2 Description of the housing stock

According to the huge differences of size between the areas covered, the residential housing stock considered varies significantly, between 378,349 (Algarve, Portugal) and 6,371,901 (Greece) main residences, as it can be seen in Figure 2.

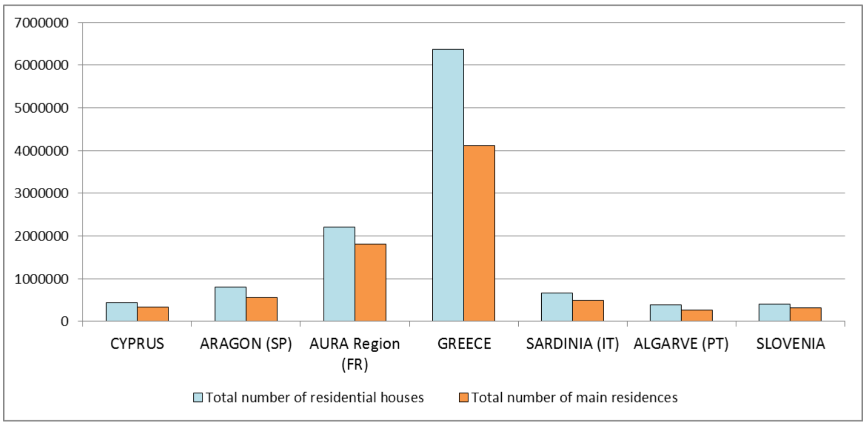

Figure 2: Number of residential premises in each region.

Figure 3 illustrates the electricity demand per household and the total demand of the area considered.

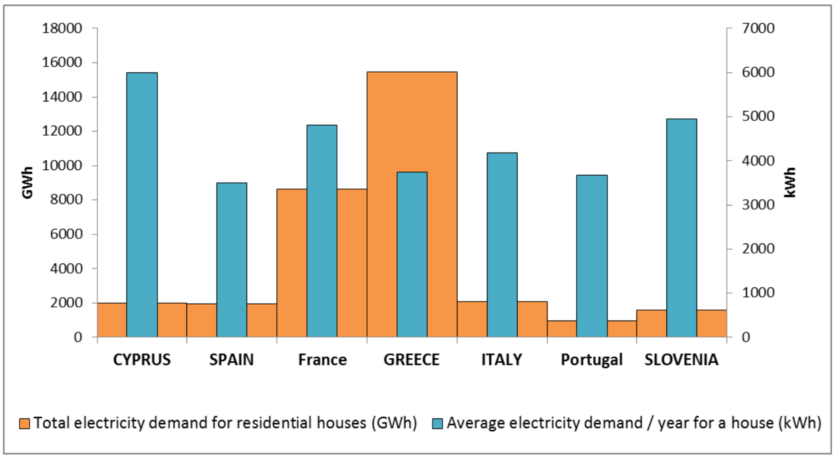

Figure 3: Electricity demand per household (right-hand side) and total demand of the area (left-hand side).

10.3 Scenarios

According to the data collected, the energy savings per household were obtained, considering the following cases of installation:

- Net consumer installation
- Prosumer with PV system
- Prosumer with PV+ESS integrated system.

The results are illustrated in Figure 4.

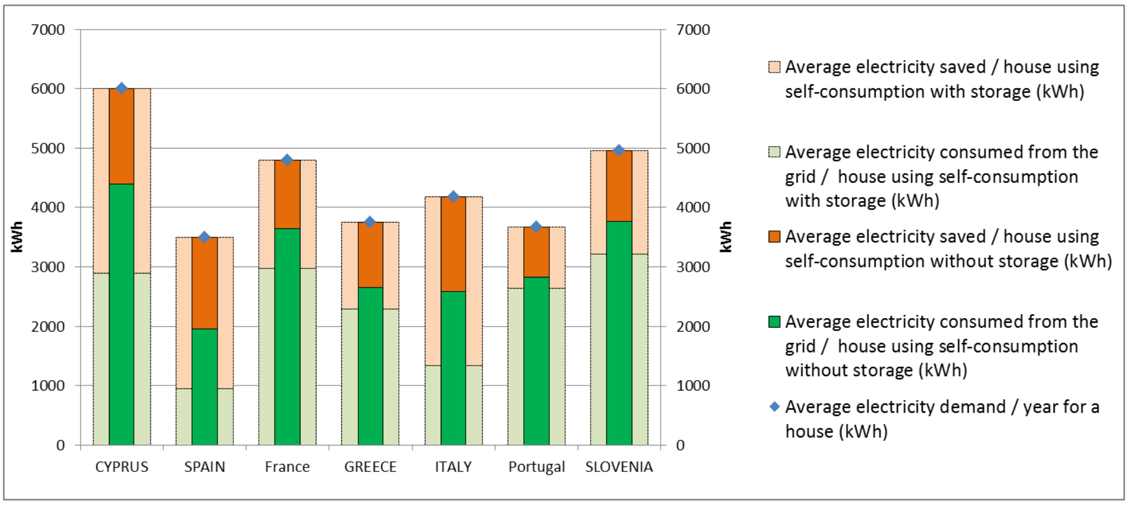

Figure 4: Electricity savings (orange bars) compared to the average demand (blue points) per house with PV self-consumption, without storage (dark coulour) and with storage (light colour).

Figure 5 demonstrates the estimated savings, when the approach is applied to the total housing stock of main residences on the selected areas.

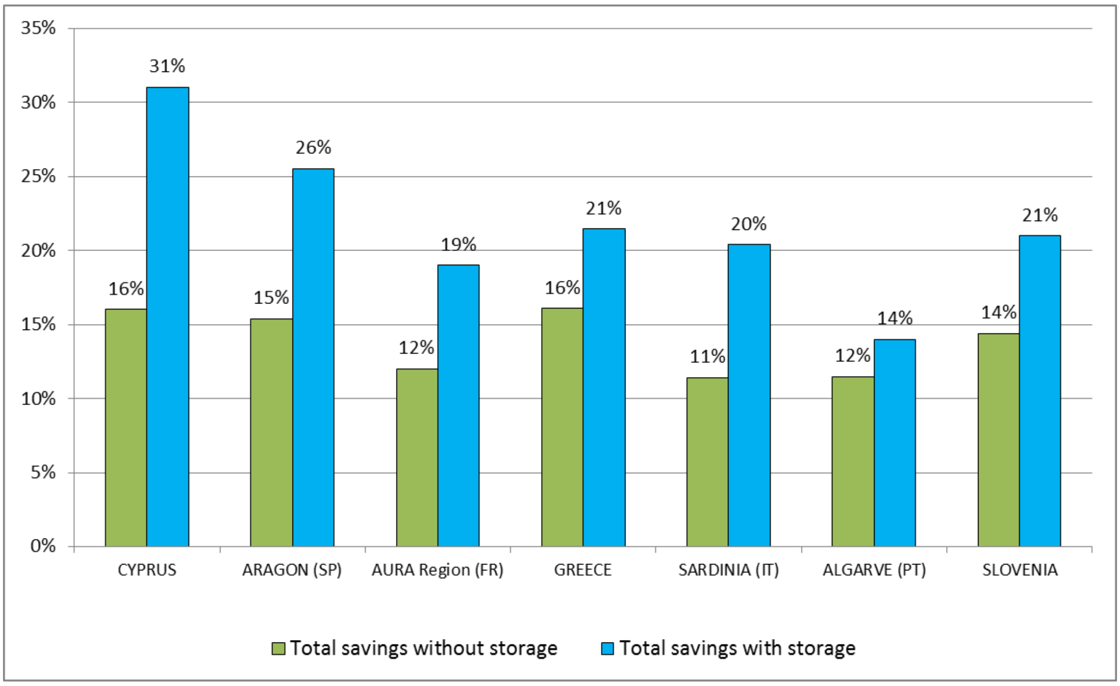

Figure 5: Electricity savings thanks to self-consumption, without and with storage in the selected areas.

Cyprus is the area where residential energy storage could trigger the highest savings in terms of electricity consumed from the grid.

When compared to the area's total electricity demand (all sectors), we obtain the impact of residential storage on the electricity demand, which reaches a maximum of 14% in Cyprus, as it can be seen in Figure 6.

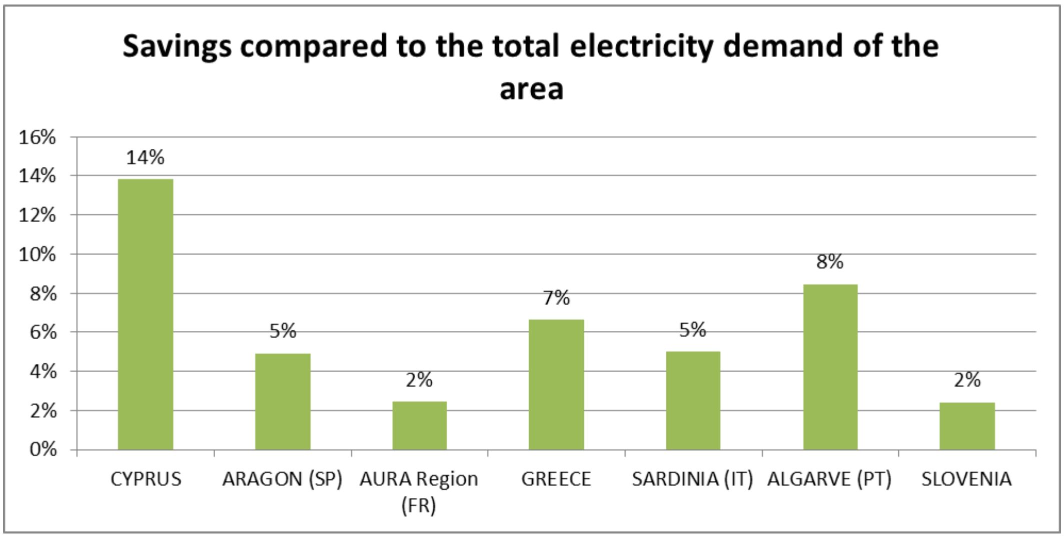

Figure 6: Electricity savings compared to the total area's electricity demand.

All these results are strongly correlated to the rate of households which are planned to be equipped with a PV-ESS installation (hypothesis described in Table 1) and Cyprus actually took into consideration the highest rate of installation.

The following results in Figure 7 are calculated with a 100% rate of equipment for every area, which represents the maximum potential savings that could be reached, independently of any constraint of installation, regarding ESS in residential housing.

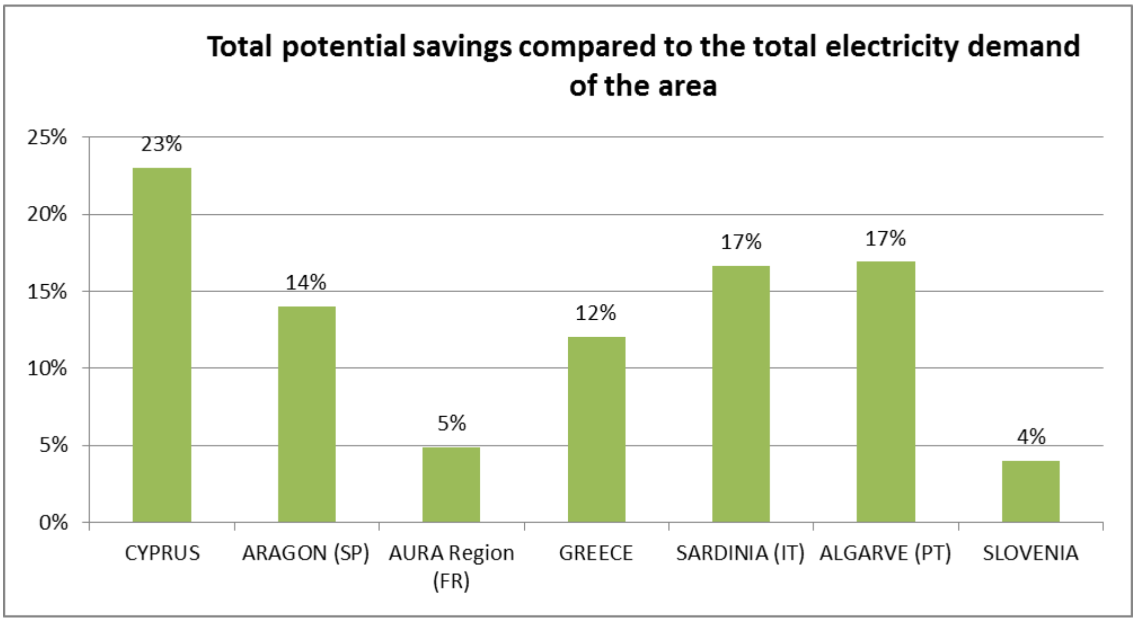

Figure 7: Maximum potential savings compared to the area's total electricity demand

The saving rates are between 4% and 23%, with an average of 11%, which is rather significant, since this approach deals with the development of storage on residential houses compared to the whole electricity demand (all sectors) of the areas.

11. Conclusions

The analysis conducted in this report assesses the impact of PV+ESS systems on the electrical consumption savings, regarding buildings used as main residences. On average, a value of 11% of savings from the total electricity demand per examined area/country could be reached. When considering that not all houses can be equipped with a PV-ESS (because of technical obstacles or lack of investment capacity) this rate becomes lower, reaching 6%.