**BRIEF MARKET SURVEY ON PHOTOVOLTAIC (IN ITALY – Summer 2023)**

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1. **SMALL POWER PHOTOVOLTAIC SYSTEMS FOR DOMESTIC/SME (Small or Medium Enterprises) USE**

The data collected on commercial sites on Internet (Amazon and Alia) are as follows. An attempt has been made to detect, where possible, the minimum and maximum values of the individual kits, the assembly of which is at one's own expense or with generally trusted technicians. For small systems, beyond the "do-it-yourself", it is therefore possible to take into account an additional assembly burden.

|  |  |
| --- | --- |
| **kWp** | **€** |
| 1 | 1472,5 |
| 1,5 | 2176,744 |
| 1,5 | 2176,744 |
| 2 | 2872,422 |
| 3 | 4246,198 |
| 3 | 4246,198 |
| 3 | 4246,198 |
| 4,5 | 6277,001 |
| 4,5 | 6277,001 |
| 6 | 8283,104 |
| 6 | 8283,104 |
| 10 | 13553,62 |
| 10 | 13553,62 |
| 10 | 13553,62 |
| 10 | 13553,62 |
| 20 | 26439,19 |
| 20 | 26439,19 |
| 30 | 39084,11 |
| 30 | 39084,11 |
| 30 | 39084,11 |
| 50 | 63953,22 |
| 50 | 63953,22 |
| 50 | 63953,22 |

Tab. 1

Subjected to correlation between Cost (Euro) and Peak Power (kWp), the data collected provide the results shown in this graph in Fig. 1.

Fig. 1

It can be seen that the correlation is quite good (> 0.9) and the coefficient of determination R2 suggests that the error with respect to the real detected data can be contained in the range of ±10% (presumably the assembling costs of the kits not always included). The green contour line of the data suggests the general scope of market values. Values outside the green line are either off the market or due to kits with particular performances (apart from the storage batteries which are included). Although the correlation function found appears linear, it is in fact a power function with exponent (0.964) very close to 1. This indicates that, although small, a scale effect linked to the size of the plant is implied. That is, the higher the system power, the lower the unit price per kWp installed.

1. **PHOTOVOLTAIC POWER SYSTEMS FOR ELECTRICITY GENERATION AND INDUSTRIAL USE**
2. **Data relating to large Enel photovoltaic plants in Sicily.**

Refer to:

<file:///D:/Documents/DC/Energia/Fotovoltaico_%20in%20Sicilia%20stanno%20per%20nascere%20due%20importanti%20parchi%20solari.pdf>

<https://va.mite.gov.it/it-IT/Oggetti/Info/8492>

* "Blusolar Augusta 1": total peak power up to 80 megawatts, nominal DC power equal to 80.21079 MWp and AC input power equal to 60.00 MW, made up of 141,966 bifacial photovoltaic modules, for a total investment of approximately 60 million euros. The estimated producibility of the photovoltaic system is equal to 155,711 MWh/year.
* "Blusolar Augusta 2", to be built in the Ogliastro district, to the west and south of the basin of the same name, near the "Pista del sole", between the territories of Augusta and Villasmundo (fraction of Melilli). peak power equal to 34.6175 MWp integrated with a 10 MW AC storage system. Total cost from metric calculation 28.3 MEuros, rounded to 30 for security and other charges.
* A subsequent solar park, therefore, located north-west of the one under construction, which will boast 56,750 photovoltaic modules for a value, from the general economic framework, of approximately 33 million euros, producing electricity for 65,246 million when fully operational MWh/year (about 32 MW?).

1. **Data from eia (US Energy Information Administration)**

In 2023, from eia (US Energy Information Administration) data, it is noted that the investment for a 150 MW photovoltaic solar system with storage has an average unit cost (per MW) of 1748 USD2021/kW, a zero variable cost for O&M and an annual fixed cost for O&M of 33.67 USD2021 /kW. Having set an average annual inflation rate from 2021 to 2023, the overnight investment cost (without financial charges) is therefore (150000 kW x 1748 USD2021/kW x 1.032) = 278 MUSD2023. Assuming an exchange rate of 1 to 0.89 between the dollar and the euro, we have 278 MUSD2023/0.89 = 312 MEuro.

1. **For Large Power Plants**

Neglecting the peculiarities of the individual system (panel diversity, layout, configuration, etc.) and assuming the cost as a function of peak power as the only variable, the following table can be considered:

|  |  |
| --- | --- |
| **MWp** | **M€** |
| 32 | 33 |
| 34 | 30 |
| 80 | 60 |
| 150 | 312 |
|  |  |

Tab. 1 bis

on which the anomaly relating to the 150 MW plants assumed as a reference by the eia immediately emerges, presumably due to factors not evaluated in this first approach analysis based solely on the assumption of an average unit price between various regions equal to 1748 USD2021/kW per “Solar PV with storage” . Value taken from the document “Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022”. In fact, as the following graph shows, beyond the good correlating function in Fig. 2, through a 2nd degree polynomial, which gives continuity to the single datum together with the others, it would mean that once the size of 50 MW is exceeded, the scale effect ceases and unit prices increase, rather than decrease, for reasons not yet known to us, barring involuntary errors or omissions. If this aspect proved to be founded and truthful for some reason, it would be at least "counterintuitive".

Fig. 2

1. **CONCLUSIONI**

|  |  |  |  |
| --- | --- | --- | --- |
| **kWp** | **€** | **€/kW** | **NOTE** |
| 1 | 1472,5 | 1472,5 |  |
| 1,5 | 2176,744 | 1451,162 |  |
| 1,5 | 2176,744 | 1451,162 |  |
| 2 | 2872,422 | 1436,211 |  |
| 3 | 4246,198 | 1415,399 |  |
| 3 | 4246,198 | 1415,399 |  |
| 3 | 4246,198 | 1415,399 |  |
| 4,5 | 6277,001 | 1394,889 | Piccoli |
| 4,5 | 6277,001 | 1394,889 | Impianti |
| 6 | 8283,104 | 1380,517 | Domestici |
| 6 | 8283,104 | 1380,517 | o |
| 10 | 13553,62 | 1355,362 | per |
| 10 | 13553,62 | 1355,362 | PMI |
| 10 | 13553,62 | 1355,362 |  |
| 10 | 13553,62 | 1355,362 |  |
| 20 | 26439,19 | 1321,96 |  |
| 20 | 26439,19 | 1321,96 |  |
| 30 | 39084,11 | 1302,804 |  |
| 30 | 39084,11 | 1302,804 |  |
| 30 | 39084,11 | 1302,804 |  |
| 50 | 63953,22 | 1279,064 |  |
| 50 | 63953,22 | 1279,064 |  |
| 50 | 63953,22 | 1279,064 |  |
| 32000 | 32435447 | 1013,608 | Grandi |
| 34000 | 34387530 | 1011,398 | Impianti |
| 80000 | 78457425 | 980,7178 | Italia |
| 150000 | 1,44E+08 | 958,7735 | USA |

**Tab. 2**

If the US data are excluded. waiting for further investigation and an explanation, it can be noted that the correlation function (power function) found and reported in Fig.1 explains all the unit cost data quite well for both small systems and large systems, to the point of being able to be proposed, in the following Fig. 3, as **a first approach estimator function for scope studies and general comparisons**, also regarding new installations for which, beyond the size, a detailed project and a related estimated metric calculation is not possible yet .

**Fig.3**

The function found, in fact, seems to give "continuity" to both the data of the small and large plants detected in our country. In theory, the gap existing in the intermediate range of the data considered can be criticized as the absence of "homoscedasticity" in the data collected, rather than a mere contingent absence of real data for the "intermediate" sizes, which the research conducted in very stringent did not allow it to be filled. Nonetheless, we are inclined to assume the function found as a first approach estimator tool, at least where plants on the national market are concerned.