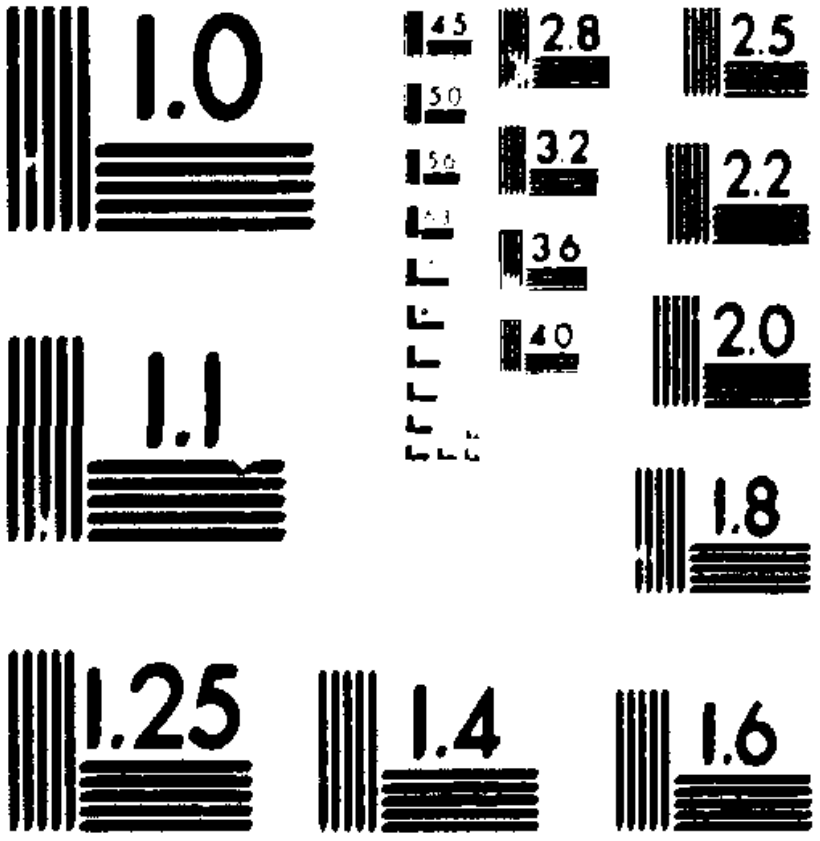

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INTERMEDIATE-SIZED PHOTOVOLTAIC PLANTS TO SUPPLY POWER VILLAGES: FUTURE DEVELOPMENTS

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ABSTRACT

The paper gives an overview of the activity promoted by EEC-DGXII aimed at demonstrating the feasibility of supplying both active and passive power distribution networks by means of PV plants.
Possible improvements of the power conditioning sub-system are presented.

INTRODUCTION

The activity promoted by EEC-DGXII, aimed at demonstrating the feasibility of supplying both active and passive power distribution networks by means of PV plants has been highly successful.

The PV plants at Aghia Roumeli, Pellworm, Rondulinu, and Vulcano are stand-alone plants that can supply small isolated communities.

The plant at Kytnos supplies power to the grid with the help of electro-chemical storage; the plants at Pellworm and Vulcano can also supply power to the grid, the first with e.c. storage and the second without such storage.

1. SUB-SYSTEM TO BE IMPROVED

The photovoltaic arrays and the storage systems used at the above plants have shown a high degree of reliability during the past five years of operation.

The sub-system with the lowest reliability has been found to be the d.c. - a.c. inverter, especially as regards the forced-commutated types designed for stand-alone plants. In order to understand the reasons for the somewhat modest results obtained, it has to be remembered that the inverters used at the pilot plants are all based on the UPS technology intended for special loads (computers, etc.).

UPS inverters, when they are used to supply computers, are extremely reliable, because they are always used in rapid switching with the grid; all overloads are therefore absorbed by the grid, while it remains for the inverter to supply the load with the right waveshape under stationary conditions. However, when this kind of inverter is used in a photovoltaic plant without back-up from the grid, it has to be designed to stand up to all possible overloads in the grid it supplies.

The MTBF required of equipment of this kind to ensure good service for users is at least 10,000 hours, while, in practice, the times recorded have been of the order of 4000-5000 hours.

It is therefore clearly necessary to attempt, with the co-operation of European manufacturers, to design a new generation of inverters for photovoltaic purposes: in other words, strong, simply-made machines that will stand up to overloads and are provided with their own system for diagnosing faults that can be understood even by non-specialists.

Again in the field of energy conversion, it would be advisable to produce forced-commutated units on an industrial scale that could operate both in the stand-alone mode and in parallel to the grid, with or without electrochemical storage.

2. FUTURE DEVELOPMENTS OF INTERMEDIATE-SIZED PHOTOVOLTAIC PLANTS

It is considered that, in the short term, it should be possible to turn medium-sized voltaic plants to good account in combination with other energy sources, mainly diesel generating sets.

The use of hybrid systems (i.e., diesel + photovoltaic) such as the one in Fig. 1, may, generally speaking, be very useful when operating small systems designed to supply isolated communities.

Indeed, they also offer the following advantages:

- The diesel generating-set can always operate at full load i.e., at maximum efficiency.

- When there is a big difference between summer and winter consumption, the photovoltaic plant can, during the low-load period, operate in the stand-alone mode, leaving the diesel unit purely for back-up purposes.
- The cost of producing a kWh can be kept relatively low, since a plant of the type proposed can be used with the maximum degree of automation, thus saving on the cost of maintaining the diesel set, which only has to operate during a small, controllable number of hours.

It should be emphasized that systems such as those proposed can however, be implemented only if forced-commutated inverters of proven reliability are available.

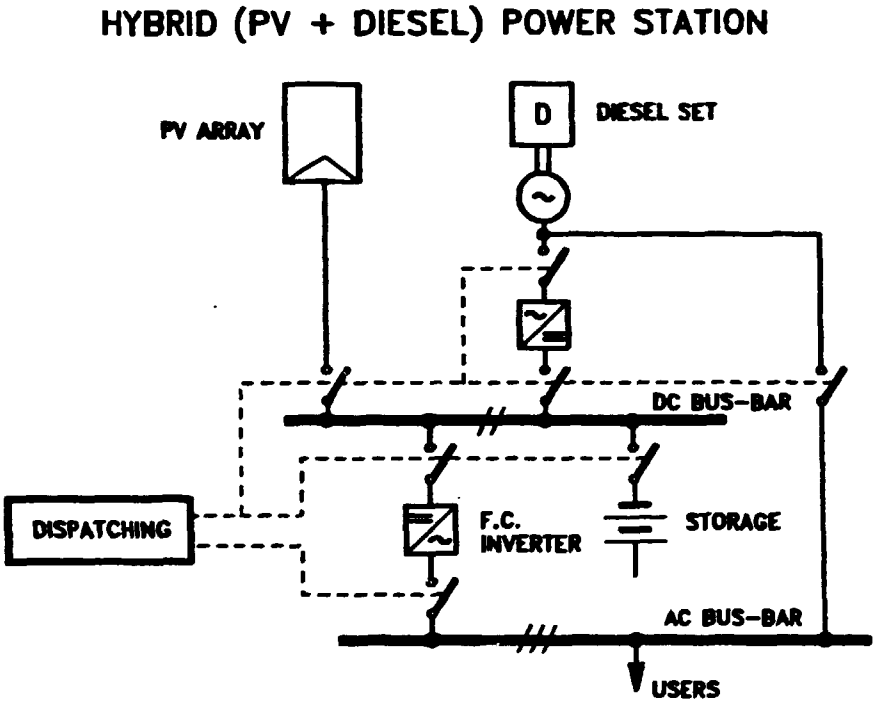

Fig. 1