A photovoltaic (PV) pumping system in which the motor-pump is directly coupled to the PV generator without a matching device is potentially simple and inexpensive and usually reliable. The typical problem of this system is that perfect matching between the PV generator and the motor-pump system is nearly impossible. With the increased use of these systems, more intention is paid to their design and optimum utilisation in order to achieve the most reliable and economical operation. Because of the relatively high cost of a PV generator, the system designer is mainly interested in its full utilisation by optimum matching of the systems components. In order to improve the performance of a PV pumping system two options are generally available to the system designer; (1) Careful selection of the dc motor and pump such that they match the maximum power trajectory of the PV generator as closely as possible and (2) Use a DC-DC converter known as Maximum Power Point Tracker (MPPT). This study addresses the matching and optimisation of the PV pumping system in terms getting the maximum utilisable output electrical, mechanical and hydraulic energy. First, the optimum matching study has focused on the ration between the intake electrical energy of the motor and the available maximum power of the PV generator under different conditions. Therefore, an efficient matching technique is presented to express the field current of the dc motor in terms of maximum power point current of the PV generator. By this means the best match is obtained between PV generator and dc motor, and maximum daily gross mechanical energy is extracted from the PV generator. Second, this matching analysis has extended to

the generated motor mechanical energy with respect to the available maximum power of the PV generator. Then, a design procedure to achieve maximum
daily output mechanical energy is presented. However, since the ultimate objective of the pumping system is to pump water. Therefore, this matching analysis should be extended to the delivered hydraulic energy with respect to the maximum power of the PV generator. In this analysis two optimisation procedures to match a PV water pump for its optimum hydraulic efficiency have been presented