This paper introduces a new zero-voltage-switching (ZVS) isolated DC-DC converter with two input ports which can be utilized in hybrid energy systems, for instance, in a fuel cell and super-capacitor system. By fully using two high frequency transformers, the proposed converter can effectively integrate a current-fed boost half-bridge (BHB) and a full-bridge (FB) into one equivalent circuit configuration which has dual-input ability and additionally it can reduce the number of the power devices. With the phase-shift control, it can achieve zero-voltage switching turn-on of active switches and zero-current switching (ZCS) turn-off of diodes leading to negligible reverse recovery loss. Voltage conversion ratio is higher compared to the conventional boost converter owing to the BHB circuit and the corresponding control. Finally, a 25–50 V input, 300–400 V output prototype with a 600 W nominal power rating are built up and tested to demonstrate the effectiveness of the proposed converter topology.