STUDY OF 1-PHASE AC TO DC CONTROLLED CONVERTER (HALF CONTROLLED AND FULL CONTROLLED)
Half Controlled AC-DC Converter

- A simple Half Controlled converter is nothing more than a single p-n junction diode connected in series to the load resistor. We are giving an alternating current as input. Input voltage is given to an ideal transformer and the resulting output of the transformer is given to the diode ‘D’ and load resistor R. The output voltage is measured across load resistor R.

- The rectification is the most important application of a PN junction diode. The process of rectification is converting alternating current (AC) to direct current (DC).
Full Controlled AC-DC Converter

- A Full controlled AC-DC converter is a circuit, which converts an ac voltage into a pulsating dc voltage using both half cycles of the applied ac voltage. It uses diodes of which one half conducts during one half cycle while the other conducts during the other half cycle of the applied ac voltage.

- During the positive half cycle of the input voltage, the one half set of diodes becomes forward biased and the other half becomes reverse biased. The load current flows through Diodes and the voltage drop across R will be equal to the input voltage.
Full Controlled Circuit Topology
Waveforms

Input Waveform

Output Waveform
Half Controlled Circuit Topology
Waveforms

Input Waveform

Output Waveform
The half controlled AC-DC converter circuit using a semiconductor diode (D) with a load resistance R is shown in figure. The diode is connected in series with the secondary of the transformer and the load resistance R. The primary of the transformer is being connected to the ac supply mains.

The ac voltage across the secondary winding changes polarities after every half cycle of input wave. During the positive half-cycles of the input ac voltage i.e. when upper end of the secondary winding is positive w.r.t. its lower end, the diode is forward biased and therefore conducts current.

If the forward resistance of the diode is assumed to be zero (in practice, however, a small resistance exists) the input voltage during the positive half-cycles is directly applied to the load resistance R, making its upper end positive w.r.t. its lower end. The waveforms of the output current and output voltage are of the same shape as that of the input ac voltage.
During the negative half cycles of the input ac voltage i.e. when the lower end of the secondary winding is positive w.r.t. its upper end, the diode is reverse biased and so does not conduct. Thus during the negative half cycles of the input ac voltage, the current through and voltage across the load remains zero. The reverse current, being very small in magnitude, is neglected. Thus for the negative half cycles no power is delivered to the load.

Thus the output voltage developed across load resistance $R$ is a series of positive half cycles of alternating voltage, with intervening very small constant negative voltage levels, It is obvious from the figure that the output is not a steady dc, but only a pulsating dc wave. To make the output wave smooth and useful in a DC power supply, we have to use a filter across the load. Since only half-cycles of the input wave are used, it is called a half wave rectifier or half controlled AC-DC converter.
The peak voltage of the output waveform is the same as before for the half controlled AC-DC converter provided each have the same rms voltage. To obtain a different DC voltage output different Voltage levels can be used.

A circuit that produces the same output waveform as the full controlled AC-DC controller circuit is that of the Full Wave Bridge Rectifier. Single phase rectifier uses four individual rectifying diodes connected in a closed loop bridge configuration to produce the desired output wave. The advantage of this bridge circuit is that it does not require a special center tapped transformer, so it reduces its size and cost. Single secondary winding is connected to one side of the diode bridge network and the load to the other side.
The advantages of a full controlled AC-DC Converter is that it has a smaller AC ripple value for a given load and a smaller reservoir or smoothing capacitor than an equivalent half-wave rectifier circuit. The fundamental frequency of the ripple voltage is twice that of the AC supply frequency 100Hz where for the half-wave rectifier it is exactly equal to the supply frequency 50Hz. The amount of ripple voltage that is superimposed on top of the DC supply voltage by the diodes can be virtually eliminated by adding a much improved filter to the output terminals of the bridge. Low-pass filter consists of two smoothing capacitors of the same value and a choke or inductance across them to introduce a high impedance path to the alternating ripple component.
Conclusion

- Any AC-DC converter topology is used to construct DC power supplies.

- The practical application of any converters is to be used as a component in building DC power supplies. However for applications in which a constant DC voltage is not very essential, you can use power supplies with half wave rectifier,

- Thus the half controlled and full controlled converter is Implemented using the Solid thinking Activate tool.