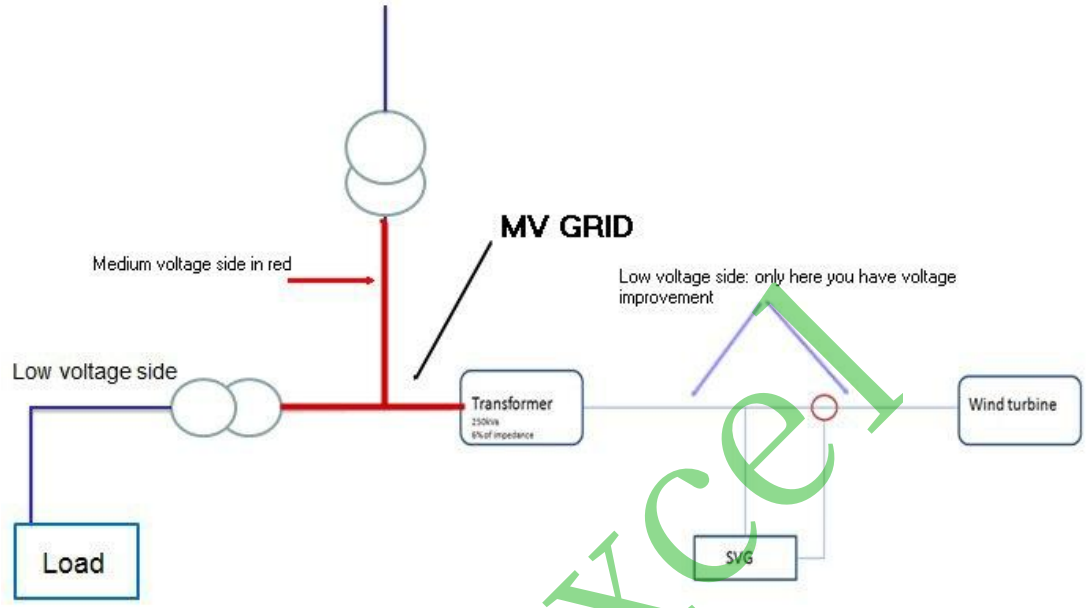
The application of SVG on wind turbine

In wind turbine , the asynchronous generator transfer the wind energy to electric power, then the electric power supply to loads working or feedback to Grid, the efficiency of generator will be improved if the terminal voltage of generator improved



Above picture showed a simple diagram of wind turbine system , SVG was installed between transformer and generator , after SVG compensated done the reactive power consumed by generator, the voltage of generator output terminal was increased , then the generator magnetizing current will follow to increased and flux density increased ,and then reactive power consumption of the generator increased , finally the exported power increased ,so the resultis the efficiency of generator increased.

The voltage improved formula：

$$\Delta U = U1 * \frac{U_C\%}{100} * \frac{Q}{C}$$

△U=the voltage improved range of generator output terminal

U1=generator output terminal voltage

Uc%= transformer nameplate impedance

Q= reactive power consumption of generator

S=capacity of transformer

For example :

A wind turbine system , Q=100kvar , S=250KVA, Uc%=6%,

U1=231.7V Do a calculation according to the above formula:

△U=U1* (Uc%)/100*Q/S=231.7*(6%)/100*100/S=5.56V

So after SVG did PFC, the generator output terminal voltage can be improved 5.56V

A true data showed that before PFC voltage is 231.7V, after PFC the voltage is 236.9V, △U=237.3V-231.7V=5.6V, the true result is very close to calculation result)

Ora	Tensioni (V)			Cosphi			Potenza reattiva (kVar)		
	V1	V2	V3	PF1	PF2	PF3	Kvar1	Kvar2	Kvar3
18/06/14 14:37:12.490	232.1	231.4	231	0.776	0.791	0.787	39.02108	37.6361	38.5891
18/06/14 14:37:12.550	232.1	231.4	231	0.776	0.791	0.787	39.02108	37.6361	38.5891
18/06/14 14:37:12.600	232.1	231.4	231	0.776	0.791	0.787	39.02108	37.6361	38.5891
18/06/14 14:37:12.650	232.1	231.7	231	0.781	0.794	0.79	39.12589	37.99974	38.96602
18/06/14 14:37:12.700	232.1	231.7	231	0.781	0.794	0.79	39.12589	37.99974	38.96602
18/06/14 14:37:12.760	232.1	231.7	231	0.781	0.794	0.79	39.12589	37.99974	38.96602
18/06/14 14:37:12.810	232.1	231.7	231	0.781	0.794	0.79	39.12589	37.99974	38.96602
18/06/14 14:37:12.850	232.1	231.4	231.4	0.769	0.782	0.78	38.50341	37.44844	38.16925
18/06/14 14:37:12.910	232.1	231.4	231.4	0.769	0.782	0.78	38.50341	37.44844	38.16925
18/06/14 14:37:12.970	232.1	231.4	231.4	0.769	0.782	0.78	38.50341	37.44844	38.16925
18/06/14 14:37:13.020	231.7	231.4	231.4	0.754	0.782	0.78	37.58981	37.44844	38.16925
18/06/14 14:37:13.070	231.7	231.7	231.4	0.754	0.77	0.767	37.58981	36.45014	37.27816
18/06/14 14:37:13.130	231.7	231.7	231.4	0.754	0.77	0.767	37.58981	36.45014	37.27816
18/06/14 14:37:13.180	231.7	231.7	231.4	0.754	0.77	0.767	37.58981	36.45014	37.27816
18/06/14 14:37:13.230	236.9	236.2	236.9	0.976	0.981	0.977	10.03371	8.957798	10.19471
18/06/14 14:37:13.280	236.9	236.2	236.9	0.976	0.981	0.977	10.03371	8.957798	10.19471
18/06/14 14:37:13.330	236.9	236.2	236.9	0.976	0.981	0.977	10.03371	8.957798	10.19471
18/06/14 14:37:13.390	237.3	236.6	237.6	0.986	0.99	0.988	7.133439	6.106238	6.873948
18/06/14 14:37:13.440	237.3	236.6	237.6	0.986	0.99	0.988	7.133439	6.106238	6.873948

Case study :

Before SVG PFC:

The PF=-0.869 , The voltage =400.06V, the active power =341.46kW

After SVG PFC:

The PF=-0.998 , The voltage =411.50V, the active power =372.02kW

So after SVG PFC, the voltage improved △U=411.50-400.06=11.44V, The exported active power improved= 372.02-341.46=30.56kW, so the efficiency of generator improved

Time	Vp-L1	GEN I-L1	P-GEN-L1	MainsS-L1	MainsQ-L1	PF-L1
13:02:44.658	400.22 V	887.06 A	305.52 kW	355.05 kVA	180.88 kVAr	-0.861
13:02:44.678	400.22 V	922.44 A	319.47 kW	369.19 kVA	185.05 kVAr	-0.865
13:02:44.698	400.31 V	939.19 A	325.50 kW	376.01 kVA	188.24 kVAr	-0.866
13:02:44.718	400.03 V	952.44 A	330.30 kW	381.00 kVA	189.90 kVAr	-0.867
13:02:44.738	400.28 V	960.88 A	334.10 kW	384.65 kVA	190.61 kVAr	-0.869
13:02:44.758	400.19 V	968.00 A	336.43 kW	387.38 kVA	192.03 kVAr	-0.868
13:02:44.778	400.06 V	981.62 A	341.46 kW	392.75 kVA	194.06 kVAr	-0.869
13:02:44.798	411.50 V	906.81 A	372.02 kW	372.90 kVA	25.62 kVAr	-0.998