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DC OVERLOADING OF INVERTERS & COMPATIBILITY WITH NEW GENERATION HIGHER CAPACITY PV MODULES

What is DC Overloading of Inverter?

- Generally, solar power plant only produce 75-85% of power output from SPV power Plant. Solar Modules on DC side does not deliver 100% power at NOCT condition.

- DC side overloading is a good option to improve AC power output of SPV Plant. It allows solar plant to increase generation during non peak hours and optimize overall performance.

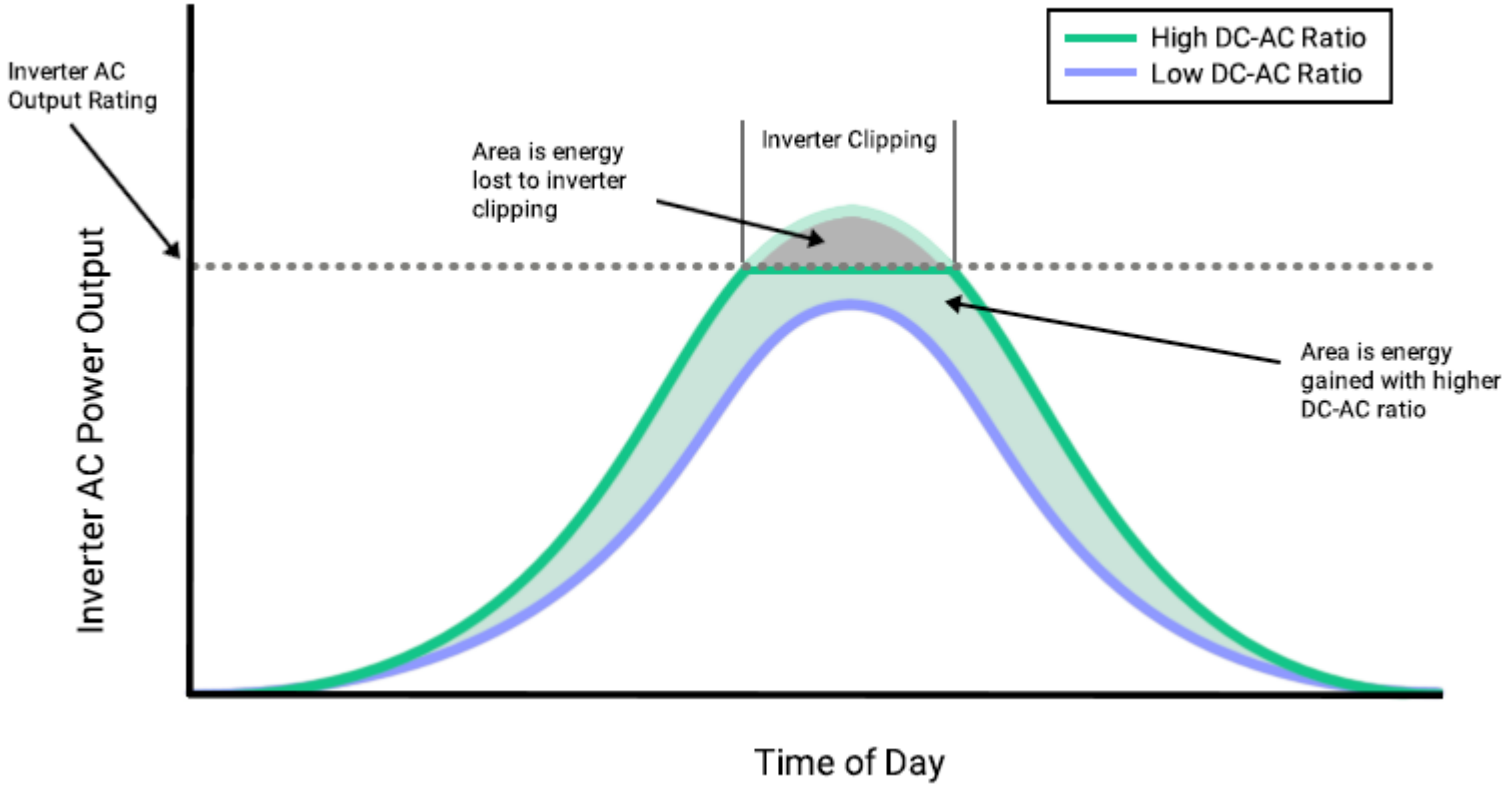
- It vary as per site locations, where the peak power is about 85%, nominal overloading around 10-15% can be done whereas when peak power is around 75%, 15%-20% overloading is preferred.

Overloading of Inverter

Factors to keep in mind while deciding DC Overloading

- Design DC overloading to avoid clipping losses & estimate power generation of PV module while designing PV Plant
- Current & voltage values should be under as per maximum limits of Inverter

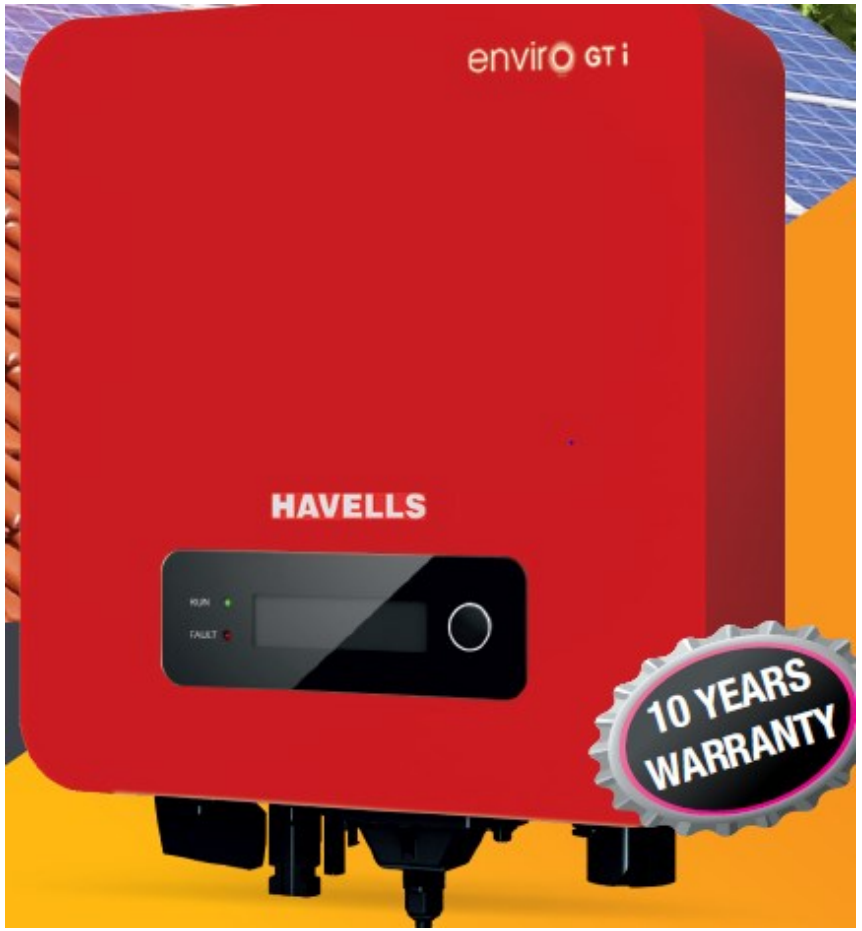
Overloading of Inverter



Single Phase Inverter

Model-

- Enviro GTi1100NG
- Enviro GTi2200NG
- Enviro GTi3000NG
- Enviro GTi5000D



Single Phase Inverter-String/MPPT

S.No		SINGLE PHASE			
1	Model of Inverter	Enviro GTi1100 NG	Enviro GTi2200NG	Enviro GTi3000NG	Enviro GTI5000D
a	Total number of strings	1	1	1	2
b	Number of MPPT	1	1	1	2

Case Study-Single Phase Inverter

DATASHEET	Enviro GTi 3000 NG
Input (DC)	
Recommended Max. PV input power	4100 W
Max. Input voltage	550 V
Start-up voltage	70 V
Rated input voltage	360 V
MPPT operating voltage range	50-550 V
Full power MPPT voltage range	250-500 V
Max. Input current MPPT	12 A
Maxnimun DC input short circuit current per MPPT	15 A
Number of MPPT/ String per MPPT	1/1
Input terminal type	MC4 / H4
Output (AC)	
Rated Power	3000 W
Max. AC Power	3000 VA

Max. voltage per string- 500V
Max. current per string- 12A

ENVIRO PVM6-330			
ELECTRICAL CHARACTERSTICS			
Rated power		Wp	330
Open circuit voltage	Voc	V	46.24
Maximum power voltage	Vmp	V	37.67
Short circuit current	Isc	A	9.31
Maximum power current	Imp	A	8.79
Module efficiency	η	%	17.02

Vmp – 37.67V
Imp- 8.79A

When 1:1 DC:AC-
Total number of modules-
3000/330= 9 approx.

****Calculation-**
Considering 12 modules in string-
Per string voltage- 12 x 37.67 = 452.04V , Per String Current- 8.79A
Result- Voltage & Current values are less than the max. limit hence we can go with this configuration.

Case Study-Single Phase Inverter

Enviro GTi 3000NG

Using 330Wp modules-		
Total number of solar modules	12	nos
Per module capacity	330	Wp
DC Capacity	3.96	KWp
AC Capacity	3	KW
DC:AC Ratio	1.32	

	MPPT 1
Inverter	String 1
3KW	12

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Three Phase Inverter

Model-

- Enviro GTi5500TX
- Enviro GTi8800TX
- Enviro GTi11000TX
- Enviro GTi15000T
- Enviro GTi20000TD
- Enviro GTi30000TD
- Enviro GTi50KT
- Enviro GTi60KT

Three Phase Inverter-String/MPPT

S.No		THREE PHASE							
1	Model of Inverter	EnviroGTi 5500TX	EnviroGTi 8800TX	EnviroGTi 11000TX	EnviroGTi 15000TX	EnviroGTi 20000TD	EnviroGTi 30000TD	EnviroGTi50 KT	EnviroGTi60KT
a	Total number of strings	2	2	2	4	4	6	10	12
b	Number of MPPT	2	2	2	2	2	2	3	3

Case Study 1-Three Phase Inverter

DATASHEET	ENVIRO GTi 60KT
Input (DC)	
Max. Input Power	66000 W
Max DC Power for Single of MPPT	22000 W (530 V - 800 V)
Number of independent MPPT	3
Number of DC Inputs	4 / 4 / 4
Max. input voltage	1000 V
Start-up input voltage	350 V
Rated input voltage	600 V
MPPT voltage range	250 V - 960 V
Full load DC voltage range	530 V - 800 V
Max. input MPPT current	40 A / 40 A / 40 A
Max. input current per string	12 A
Output (AC)	
Rated Power (@230 V, 50 Hz)	60000 W
Max. AC Power	60000 VA

ENVIRO PVM6-330			
ELECTRICAL CHARACTERSTICS			
Rated power		Wp	330
Open circuit voltage	Voc	V	46.24
Maximum power voltage	Vmp	V	37.67
Short circuit current	Isc	A	9.31
Maximum power current	Imp	A	8.79
Module efficiency	η	%	17.02

Vmp – 37.67V
Imp- 8.79A

When 1:1 DC:AC-
Total number of modules-
60000/330= 180 approx.

Max. voltage per string- 800V
Max. current per MPPT- 40/40/40A

****Calculation-**
Considering 236 modules, 20 modules per string -
Per string voltage- 20 x 37.67 = 753.4V , Per String Current- 8.79A
Result- Voltage & Current values are less than the max. limit hence we can go with this configuration.

Case Study 1-Three Phase Inverter

Enviro GTi60KT

Total number of solar modules	240	nos
Per module capacity	330	Wp
DC Capacity	79.20	KWp
AC Capacity	60	KW
DC:AC Ratio	1.32	

	MPPT 1				MPPT 2				MPPT 3			
Inverter	String 1	2	3	4	5	6	7	8	9	10	11	12
60KW	20	20	20	20	20	20	20	20	20	20	20	20
												240

Case Study 2- Selecting Higher wattage modules

DATASHEET	ENVIRO GTi 60KT
Input (DC)	
Max. Input Power	66000 W
Max DC Power for Single of MPPT	22000 W (530 V - 800 V)
Number of independent MPPT	3
Number of DC Inputs	4 / 4 / 4
Max. input voltage	1000 V
Start-up input voltage	350 V
Rated input voltage	600 V
MPPT voltage range	250 V - 960 V
Full load DC voltage range	530 V - 800 V
Max. input MPPT current	40 A / 40 A / 40 A
Max. input current per string	12 A
Output (AC)	
Rated Power (@230 V, 50 Hz)	60000 W
Max. AC Power	60000 VA

DESERV 3S6 or 3S6H (Wp)	380
Rated power (Pmax), Wp	380
Max. power voltage (Vmp), V	40.39
Max. power current (Imp), A	09.42
Open circuit voltage (Voc), V	49.69
Short circuit current (Isc), A	09.93
Module efficiency (%)	19.66

Vmp – 40.39V
Imp- 9.42A

When 1:1 DC:AC-
Total number of modules-
60000/380= 156 approx.

Max. voltage per string- 800V
Max. current per MPPT- 40/40/40A

****Calculation-**
Considering 204 modules, 17 modules per string -
Per string voltage- 17 x 40.39 = 686.63V , Per String Current- 9.42A
Result- Voltage & Current values are less than the max. limit hence we can go with this configuration.

Case Study 2- Selecting Higher wattage modules

Enviro GTi60KT

Using 380Wp modules-		
Total number of solar modules	204	nos
Per module capacity	380	Wp
DC Capacity	77.52	KWp
AC Capacity	60	KW
DC:AC Ratio	1.292	

String	MPPT 1				MPPT 2				MPPT 3			
Inverter	String 1	2	3	4	5	6	7	8	9	10	11	12
60KW	17	17	17	17	17	17	17	17	17	17	17	17
												204

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Case Study 3 - Selecting Higher wattage modules

DATASHEET	ENVIRO GTi 60KT
Input (DC)	
Max. Input Power	66000 W
Max DC Power for Single of MPPT	22000 W (530 V - 800 V)
Number of independent MPPT	3
Number of DC Inputs	4 / 4 / 4
Max. input voltage	1000 V
Start-up input voltage	350 V
Rated input voltage	600 V
MPPT voltage range	250 V - 960 V
Full load DC voltage range	530 V - 800 V
Max. input MPPT current	40 A / 40 A / 40 A
Max. input current per string	12 A
Output (AC)	
Rated Power (@230 V, 50 Hz)	60000 W
Max. AC Power	60000 VA

ELECTRICAL DATA | STC*

CS1U	395MS	400MS	405MS	410MS
Nominal Max. Power (Pmax)	395 W	400 W	405 W	410 W
Opt. Operating Voltage (Vmp)	43.9 V	44.1 V	44.3 V	44.5 V
Opt. Operating Current (Imp)	9.01 A	9.08 A	9.16 A	9.23 A
Open Circuit Voltage (Voc)	53.3 V	53.4 V	53.5 V	53.6 V
Short Circuit Current (Isc)	9.55 A	9.60 A	9.65 A	9.70 A
Module Efficiency	19.16%	19.40%	19.65%	19.89%
Operating Temperature	-40°C ~ +85°C			
Max. System Voltage	1500V (IEC/UL) or 1000V (IEC/UL)			
Module Fire Performance	TYPE 1 (UL 1703) or CLASS C (IEC 61730)			
Max. Series Fuse Rating	20 A			
Application Classification	Class A			
Power Tolerance	0 ~ + 5 W			

Vmp – 44.5V
Imp- 9.23A

When 1:1 DC:AC-
Total number of modules-
60000/410= 146 approx.

Max. voltage per string- 800V
Max. current per MPPT- 40/40/40A

****Calculation-**
Considering 192 modules, 16 modules per string -
Per string voltage- 16 x 44.5 = 712V , Per String Current- 9.32A
Result- Voltage & Current values are less than the max. limit hence we can go with this configuration.

Case Study 3 - Selecting Higher wattage modules

Enviro GTi60KT

Using 410Wp modules-		
Total number of solar modules	192	nos
Per module capacity	410	Wp
DC Capacity	78.72	KWp
AC Capacity	60	KW
DC:AC Ratio	1.312	

	MPPT 1				MPPT 2				MPPT 3			
Inverter	String 1	2	3	4	5	6	7	8	9	10	11	12
60KW	16	16	16	16	16	16	16	16	16	16	16	16
												192

Summary

	Inverter AC (KW)	DC (KW)	DC:AC	Overloading allowed
Three Phase	60	78	1.30	30%
	50	65	1.30	30%
	30	39	1.30	30%
	20	26	1.30	30%
	15	18	1.20	20%
	10	13	1.30	30%
	8	10	1.25	25%
	5	6	1.20	20%
Single Phase	5	6	1.20	20%
Single Phase-NG Series	3	4.1	1.37	37%
Single Phase-NG Series	2.2	3	1.36	36%
Single Phase-NG Series	1.1	1.5	1.36	36%

THANK YOU