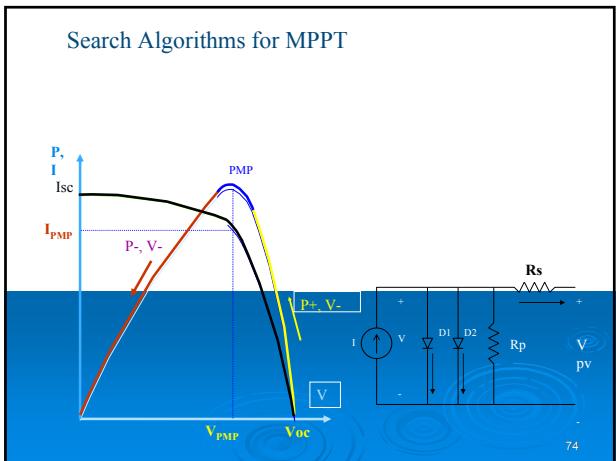
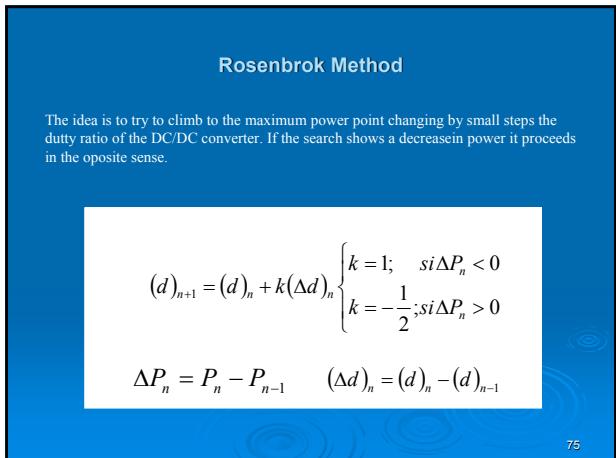


73



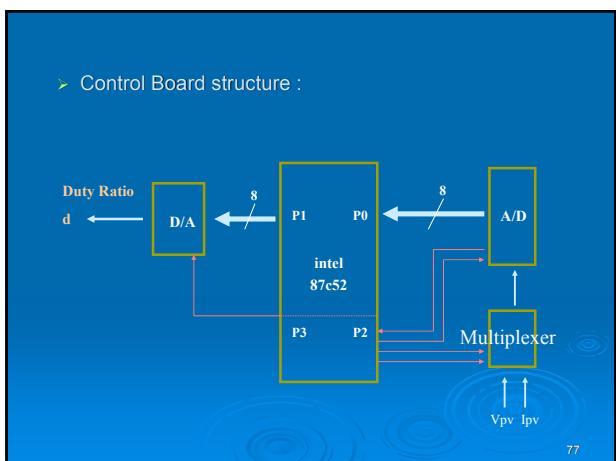
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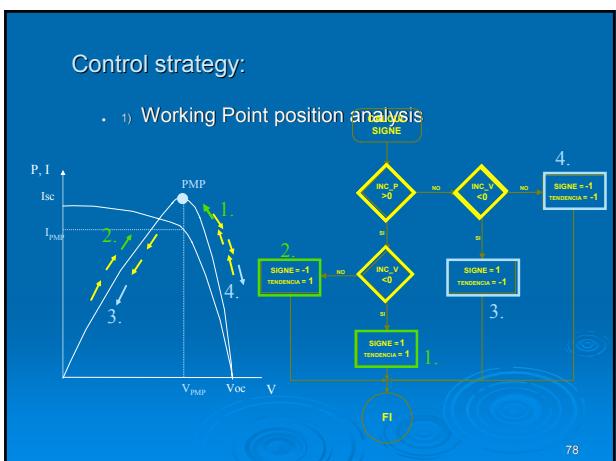
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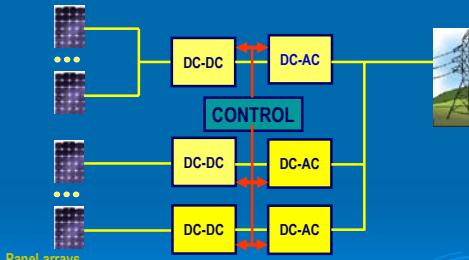
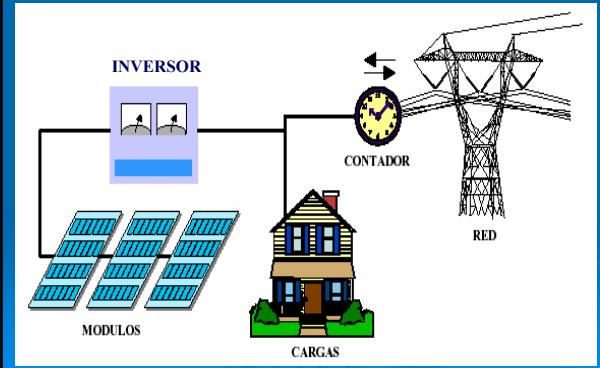


78

## Grid-connected plants

79

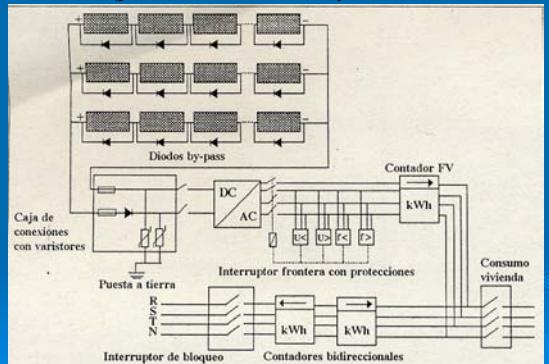
### Photovoltaic system connected to the power network



SOURCE: Project PROCESADO MODULAR DE POTENCIA PARA ENERGÍAS RENOVABLES DPI2003-08887-C03 (UPC-URV-UPNA)

81

### Low Voltage Grid Connected Systems



82

### Anti-islanding in grid-connected systems

One of the problems in grid connected systems is islanding.

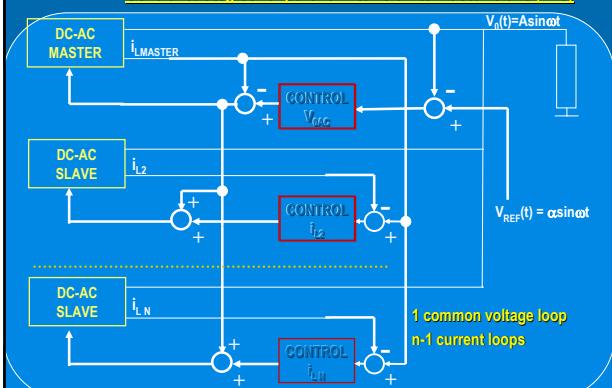
In case of grid disconnection the voltage and frequency of the photovoltaic converter output can change dangerously.

Integration of the anti-islanding functions on the control sub-system have been proposed.

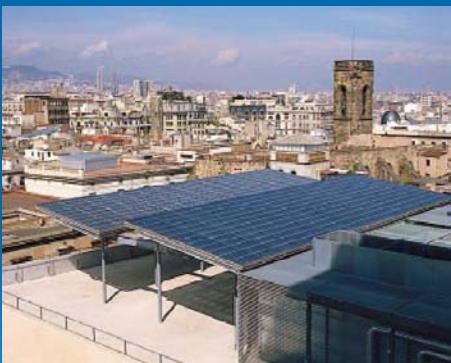
Some of the methods are based on fast voltage and frequency detection or output impedance variation.

83

### Control strategies for parallel DC/AC units: Master-Slave (M-S)



Photovoltaic generation in one of the  
Barcelona's Local Administration buildings



85



86

"Furum de las Culturas" Barcelona 2004



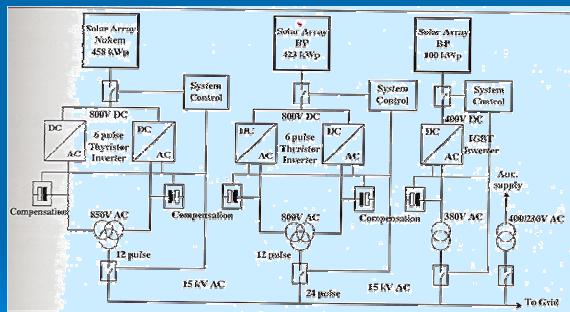
87

Solar Plant at "Forum de las Culturas"-Barcelona 2004



88

## High power plants



1MW<sub>p</sub> plant connected to the electrical grid (TOLEDO PV)

89

DC/AC Converters for Stand-alone and Grid-connected Plants

**DC/AC Converters for  
Stand-alone and  
Grid-connected Plants**

90

## Technical Data for Photovoltaic Inverters

Device	Dormüller	Fronius	SMA	ACE	Siemens
	DM1150135	Sunrise	SunnyBoy	5001 Ss	4 x 300 kVA
		Mirco	2000		
Rated DC power	100W	820 W	1900W	50 kW	1086kW
Rated AC power	90 VA	750 VA	1800VA	50kVA	1197 kVA
Maximum PV power	150 W	1100W	2600 W	55 kW	1400kW
Start of feed-in (W)	2.5	9	7	50	700
Stand-by demand (W)	0	5	7	35	40
Night consumption	0	0	0,1	0	30
DC MPP range (V)	28-50	120-300	125-500	300-420	460-730
Maximum distortion	3	5	4	0.1	act. Filter
Maximum efficiency ()	89	92	96	97	97
Euro efficiency ()	86.6	90.4	95.2	94.2	96.2

Source: data from Photon International, 2001

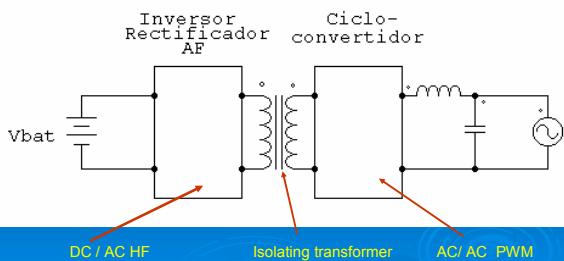
91

## Topologies for DC/AC converters

# Topologies for DC/AC Converters

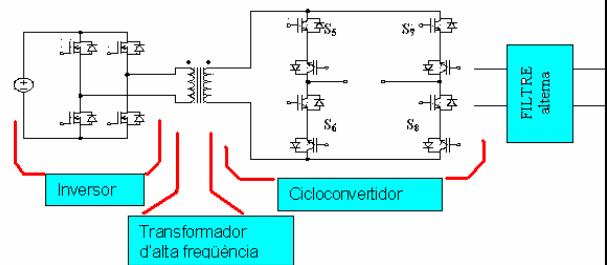
92

### Topologies with high frequency DC/AC conversion and isolating high frequency transformer



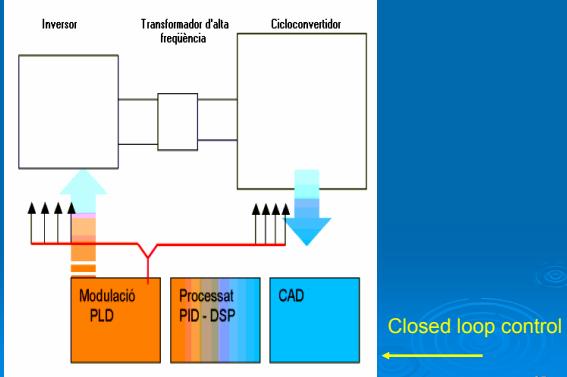
93

### Topologies with high frequency DC/AC conversion



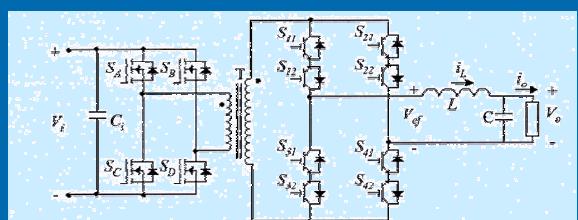
94

### Topologies with high frequency DC/AC conversion



95

### High frequency converter and PWM modulation



- MOS-FET are used in the DC side to lower conduction losses.
- IGBT's are used in the AC sPWM side where voltages are higher. Bi-directional possibility is obtained with antiparallel Connection of IGBT's

96