PUFIN POWER


Solland
Silicon


Solland
Solar Cells


ELITAL.
ems
energy


ELIFRANCE
ems
energy

PUFIN POWER
Maastricht

PUFIN POWER
Maastricht

PUFIN POWER

PUFIN POWER
Maastricht

- Pufin Power is an integrated and international industrial Holding that works mainly in the photovoltaic sector having inside its own Production:
  -Polysilicon – SOLLAND SILICON – Italy
  -PV cells - SOLLAND SOLAR CELLS – The Netherlands/Germany
  -PV modules production - EL.ITAL. – Italy, ELIFRANCE – France.
  -EMS sector (Electronics Manufacturing Services) – EL.ITAL. Italy , ELIFRANCE – France.
- Staff with high experience and know-how acquired during the years in the sector;
- PV cells production with high efficiency
- Achievements upon the market about its quality production as well as the brand of "Made Europe"
- Integration between electronics and solar energy.

Products and Services

PUFIN POWER Maastricht

ENERGY DIVISION

- ✓ Polysilicon
- ✓ Polysilicon PV Cells
- ✓PV Modules in polysilicon made with 60 and 72 cells

EMS DIVISION

- ✓Production of electronic boards and Electrics Systems
- ✓Industrialization Services
- ✓Logistic distribution and customer care
- ✓Prototyping and re-engineering

Certifications

PUFIN POWER Maastricht

The facilities have management systems compliant with industry standards-
oriented to a continuous improvement and customer satisfaction.

Certification of Quality Management System

ISO 9001 / EN 9100 / ISO TS 16949

Certification of the Environmental Management System, safety and health at work

BS OHSAS 18001 / ISO 14001

Partecipation in the PV-Cycle Management of End of Life Products
Certification of Product / Process
The photovoltaic products are developed and manufactured in accordance with established standards for electrical safety and for Approval of Type

EN 61215:2005 / IEC 61215:2006

EN 61730-2:2007

EN13501

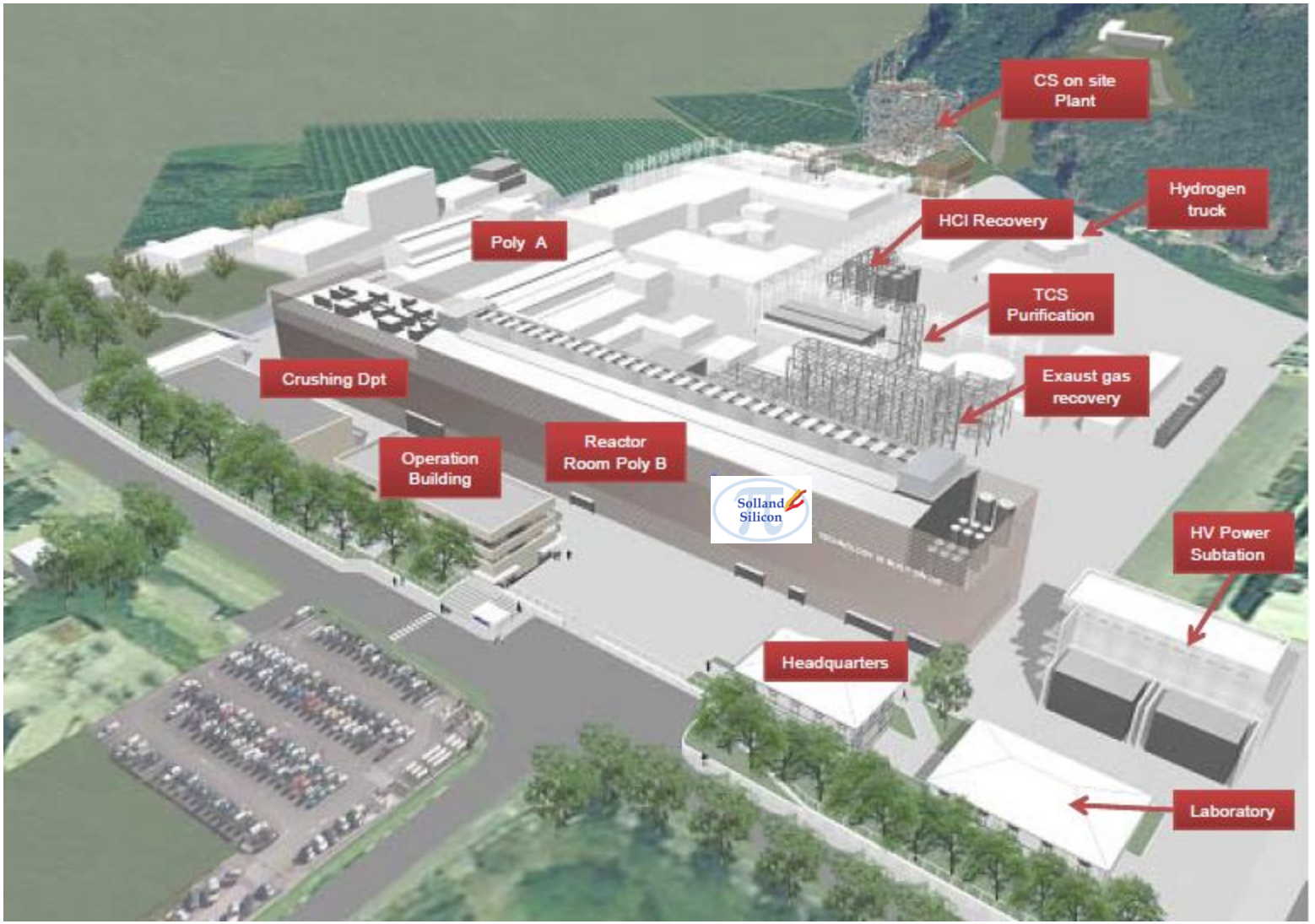
Solland Silicon

www.sollandsilicon.com

Merano Plant

Total property	≈70.000 mq
Covered area	≈20.000 mq
Open area	≈40.000 mq
Green	≈10.000 mq

Merano Plant – Facilities details

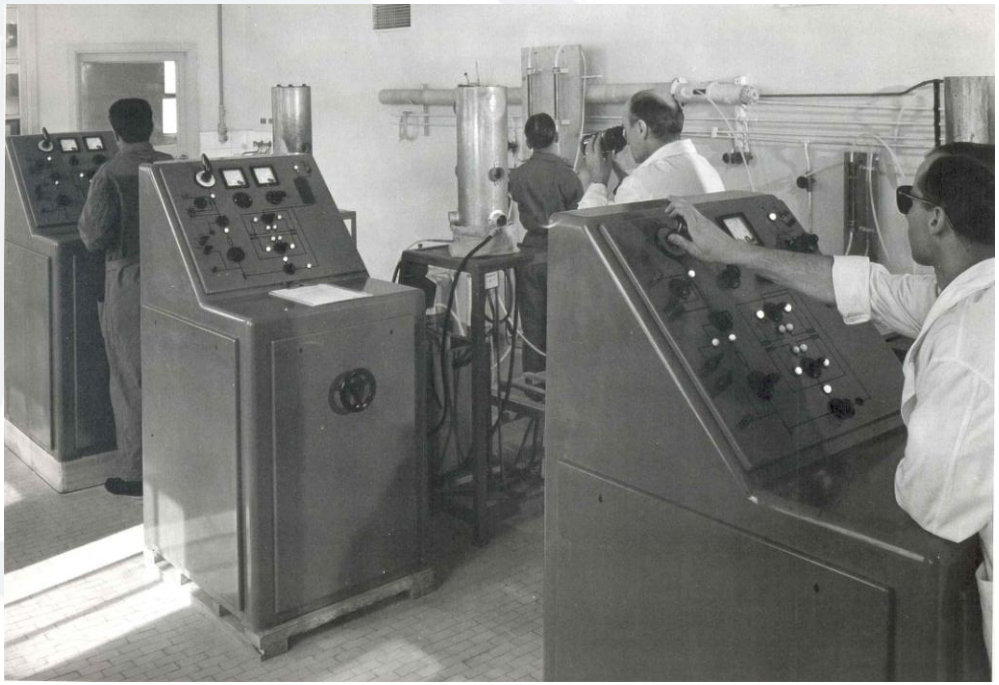


Merano Plant

- The Merano plant has a long history in the field of European (and worldwide) chemical industry:
  - 1920s: Montecatini builds the factory for the production of fertilizers (ammonium sulphate, calcium nitrate, ammonium nitrate) due to the availability of cheap electric power and local raw materials.

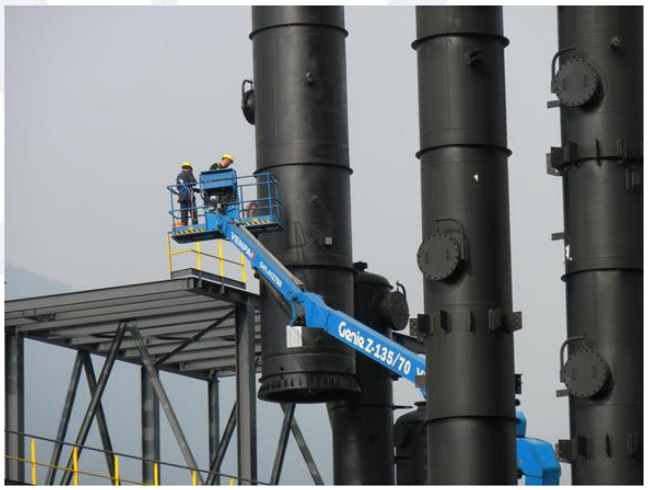
Merano Plant

- 1955 - 1972: Pilot processes are begun at the factory for the production of various types of substances such as beryllium oxide, metallic calcium, metallic lithium, lithium carbonate, hyperpure sodium and several semiconductor compounds.
- 1962: developed the first polysilicon reactor
- 1974: SMIEL is founded and the factory is completely restructured and reconverted for the exclusive production of hyperpure silicon – from polycrystal to the production of wafers.



Merano Plant

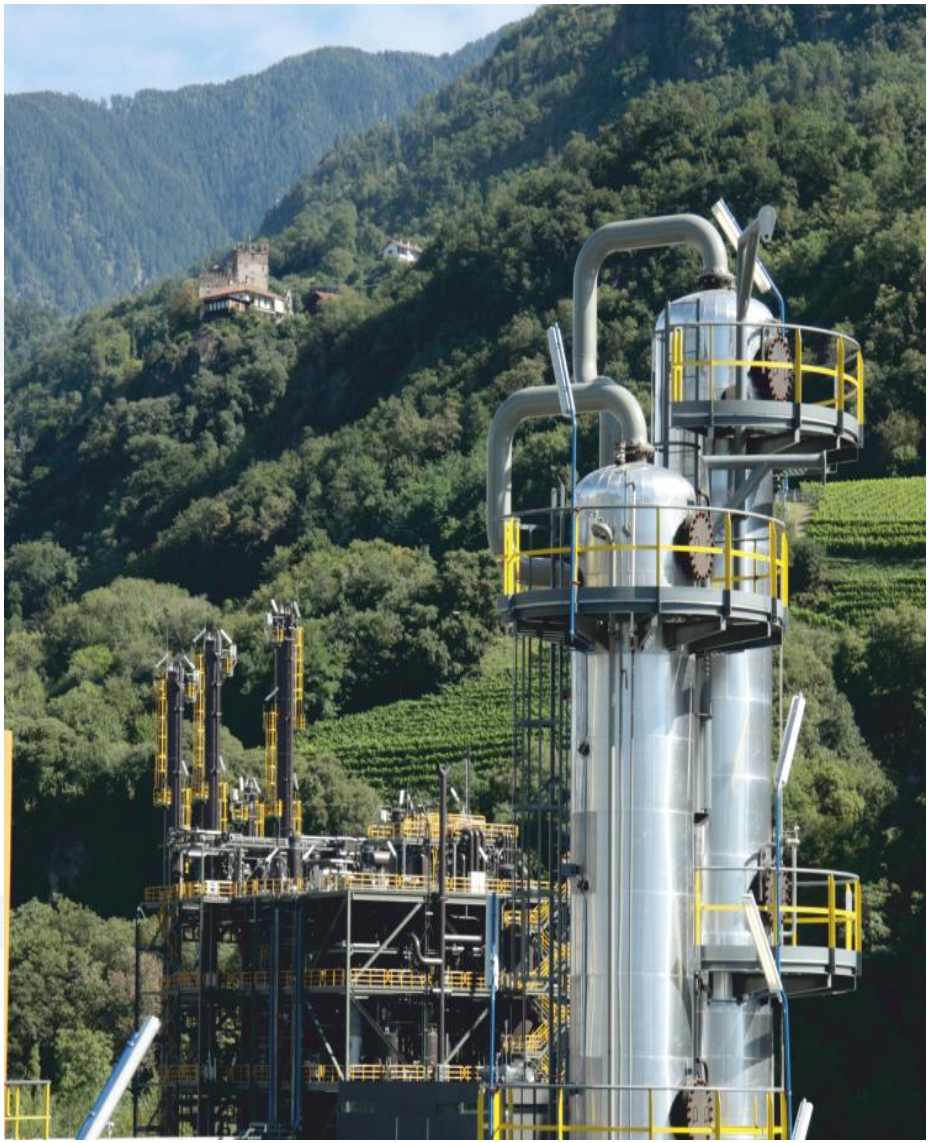
- 2006-2010: with an investment of approximately 350 million dollars the Merano factory is further expanded to meet the growing demand for polycrystalline silicon in the solar photovoltaic market. The project essentially upgrade several sections of the existing chemical plant, expand the capacity installing an impressive chemical purification section, a new reactor room and several production units. The expansion has thus resulted in major building construction as well as work on plant systems, which were designed and built using the finest technologies available for minimizing risks, reduce the operating cost and environmental impact.



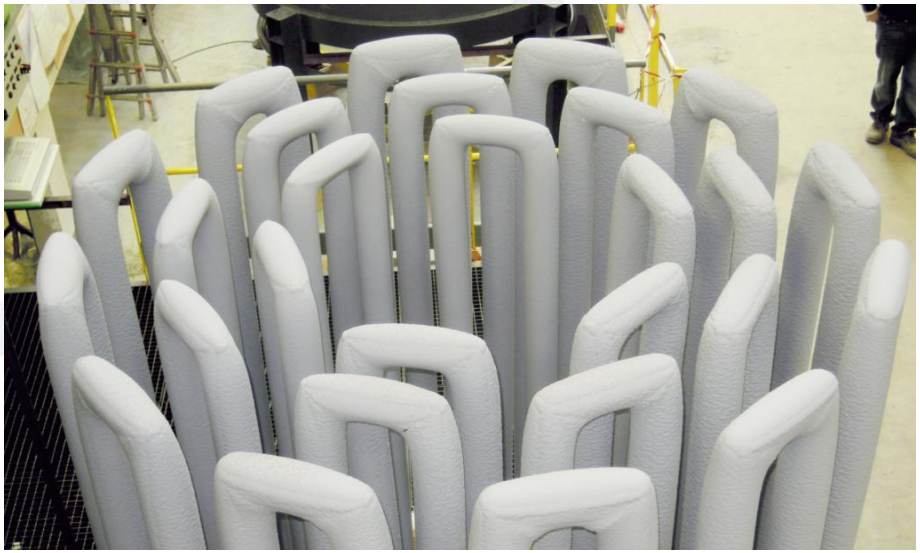
Some Mayor Milestones

- First studies on polysilicon production began in Merano in 1958 by the plant owner Montecatini
- First silicon pilot line was built in 1961 in Merano
- Industrial production using Siemens technology started in 1976, also in Merano
- 12-rod Siemens reactors operating at moderate pressure were introduced in 1984
- 18-rod reactors were launched in 2007
- 36-rod reactors were launched in 2008
- 54-rod reactors were launched in 2011

Solland Silicon



Solland Silicon



Technology Highlights

- All CVD reactors (12, 18, 36 and 54 rods) have been designed according to plant Engineering know how
- The overall process is designed and operated to handle DCS formation and allow to feed TCS + DCS to the CVD reactors
- TCS and STC purity is assured by a proprietary patented reactive distillation technology, very effective in removing Boron but also Posphorous and other metals
- STC converters are designed internally and assure high STC conversion rate and low energy consumption
- The Front End has been designed and constructed by German Company

Installed capacity

Chlorosilanes production capacity (Technical grade):	**Up to 25.000 MTpY**
Trichlorosilane Electronic Grade production capacity (for EPI application):	**Up to 600 MTpY**
Polysilicon Siemens technology based production capacity:	**Up to 4000 MTPY PV Grade**

Solland Silicon

Solland Solar Cells

www.sollandsolar.com

SOLLAND SOLAR CELLS Heerlen (The Netherlands)

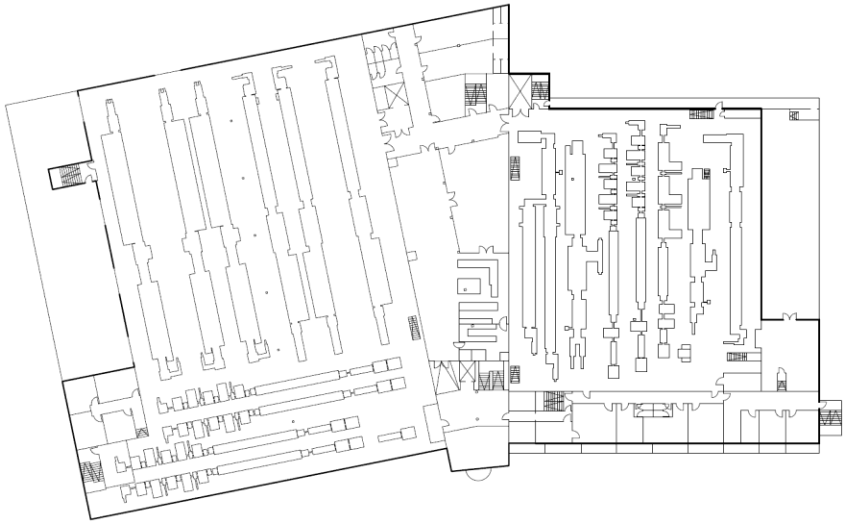
Solland Solar Cells

SOLLAND SOLAR CELLS

Solland Solar Cells BV is specialized in the production of Polysilicon PV Cells.

The Facility makes use of a non- stop production lines with a full capacity about 180 MWp for year.

The equipments reflect the current level of production and allow to exploit this kind of technology respecting the strict rules in environmental and personal protection.



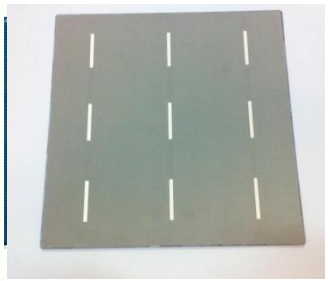
Products - Cell 3BB

Specification

Technical Data sheet

DMS loc.:	Rev.:	Doc.:	Rev. date:	Doc. owner:	Physical location:
8100.03E	03	FO	28-05-2013	QA	

Cell Type: H-pattern / segmented Back-side
Configuration 01



Cell Layout _GEN_03

Dimensions		
Feature	**Qualification**	**Permitted Deviation**
Outer dimensions	156mm x 156mm	± 0.5 mm
Cell thickness nominal as ordered	on wafer level	± 30 µm
Bow 	Cell placed on flat surface sunny side up. Distance between centre of cell and flat surface	<= 2.5mm.

Front surface		
Width of busbar	1.4 mm	± 0.1 mm
Number of busbar	3	
Distance between centre busbar and outer busbar	52.0	± 0.2 mm
Material of busbar	Silver	

Back surface		
Width of busbar	2.5 mm	± 0.5 mm
Number of segments	3	
Length of segment interruption	25 mm	± 0.5 mm
Number of busbar	3	
Distance between centre busbar and outer busbar	52.0	± 0.2 mm
Material of busbar	Silver	
Material of the surrounding parts of the back surface of the cell	Aluminum	

1/2

8100.03E 02 FO Specification Technical Datasheet Cont3B.docx

Electrical properties		
Power	Power classes according to P_{max} at standard test conditions (STC, AM 1.5, 1000 W/m^2, 25°C) Accuracy of measurement ± 1.5% relative to ISE certified reference cell	Divided in classes, see below
Reverse bias criteria	Reverse dark measurement V_{bias}= -12 V allowed current V_{bias}= -6 V allowed current measurement accuracy ± 2%	 I bias <2.0 A, I bias <0.4 A.
Shunt resistivity	(Dark I-V measurement) at 0V	R_{sh}> 15 Ohm

Typical data at STC (non encapsulated cells)*

Cellclass	Pmpp(W)	Efficiency(%)	Voc(mV)	Isc(A)
S156PS375	3.75	15.40	602	8.18
S156PS380	3.80	15.60	605	8.22
S156PS385	3.85	15.80	607	8.25
S156PS390	3.90	16.00	609	8.28
S156PS395	3.95	16.20	612	8.33
S156PS400	4.00	16.40	614	8.38
S156PS405	4.05	16.60	616	8.41
S156PS410	4.10	16.80	618	8.45
S156PS415	4.15	17.00	620	8.49
S156PS420	4.20	17.20	622	8.53
S156PS425	4.25	17.40	625	8.56
S156PS430	4.30	17.60	627	8.60
S156PS435	4.35	17.80	630	8.63
S156PS440	4.40	18.00	633	8.66
S156PS445	4.45	18.20	635	8.69

Main equipmentrs and technological systems

Automation line and optical control: Jonas & Redmann

Texturing: Schmid

Furnace: Sierratherm

Insulation : Schmid

SINA: Roth & Rau

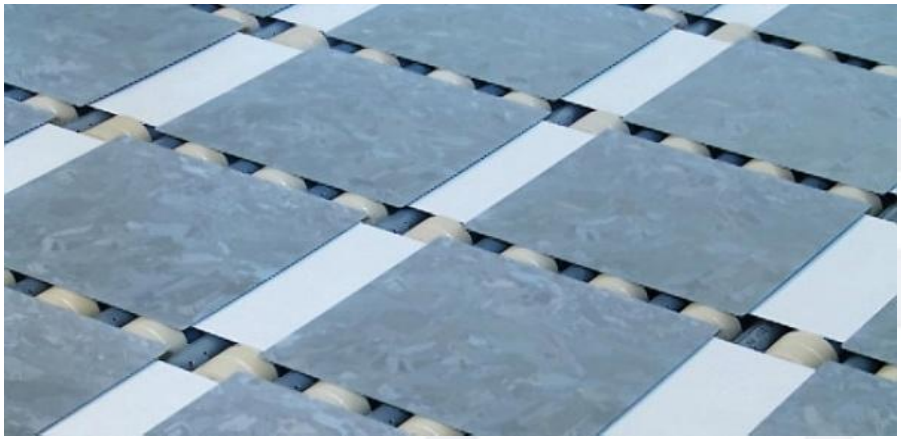
Serigraphy: Baccini

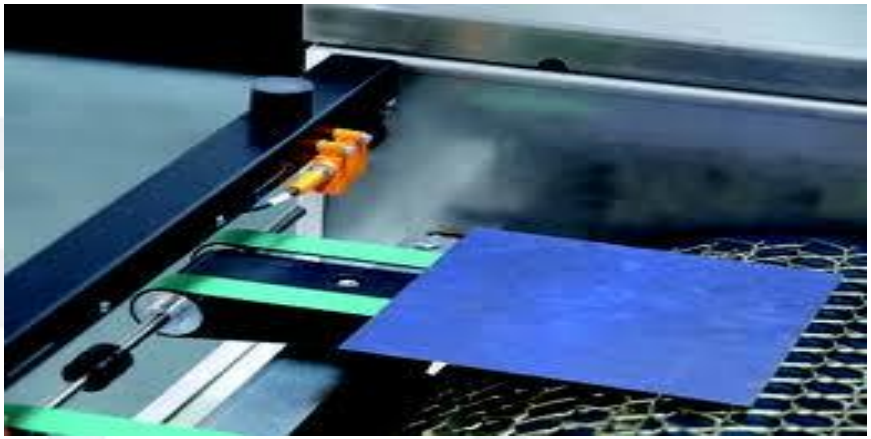
Firing Furnace: Despatch

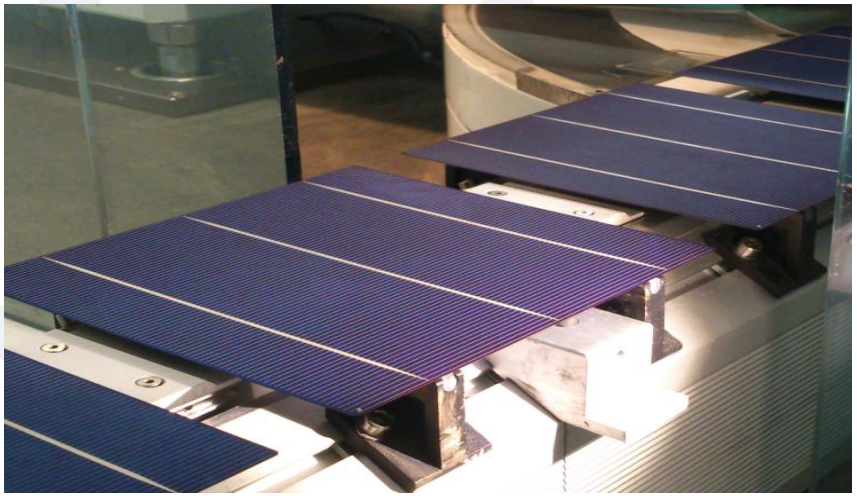
Test: Berger Lichttechnick

PV Cells Process Illustration

Process Illustration







EL.ITAL.

ems energy

www.elitalspa.com

EL.ITAL. AVELLINO (ITALY)

Principali distanze da Avellino
Main highway distances from Avellino

Torino	Km 789
Milano	Km 882
Venezia	Km 744
Firenze	Km 495
Roma	Km 230
Bari	Km 200
R. Calabria	Km 474

A 40 Km dall'Aereoporto Internazionale di Napoli Capodichino.
A 2 Km dall' Uscita Avellino Est dell'Autostrada A16 Napoli – Bari

At only 40 Km from International Capodichino Airport.
At only 2 Km from Avellino Est barrier on the A16 motorway.

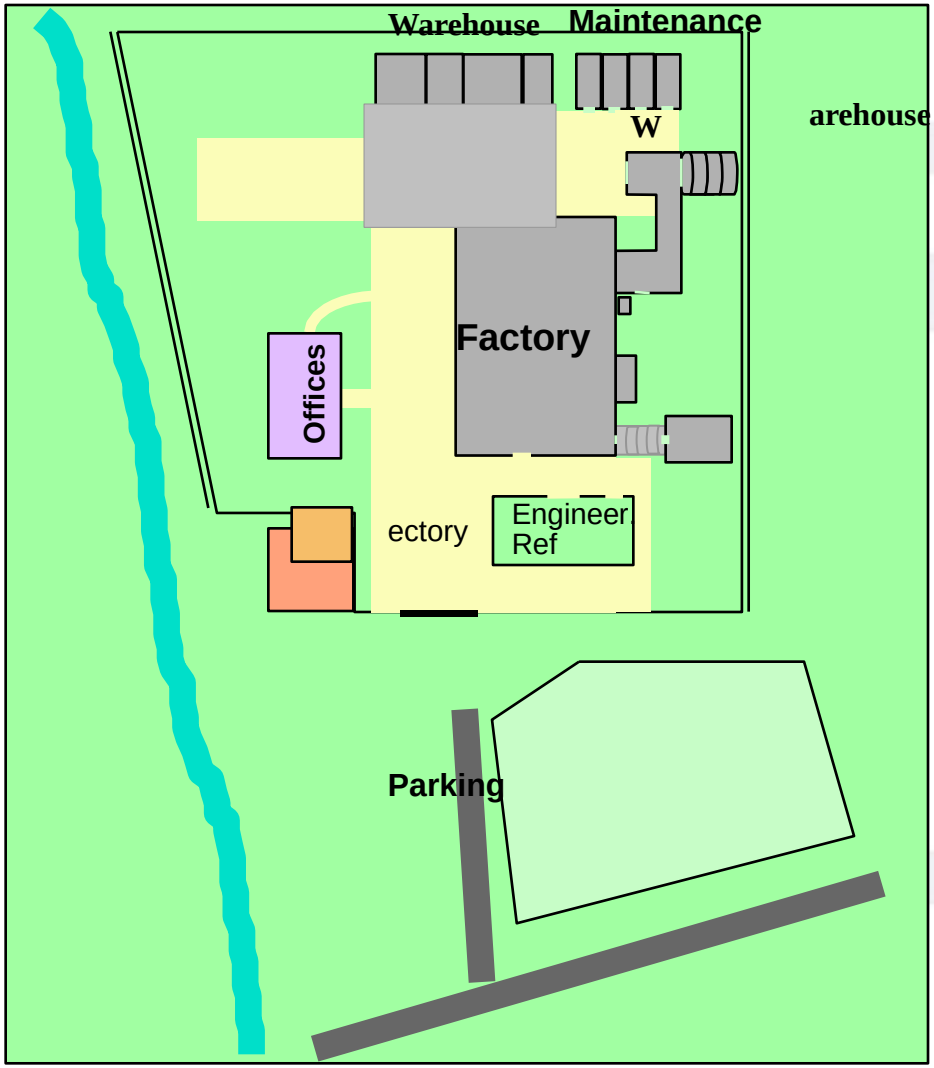
Campania

Napoli	Km 40
Salerno	Km 30
Caserta	Km 50
Benevento	Km 40

Site History

1974	Foundation of ITALDATA to strengthen existing collaboration between SIEMENS and STET (It. Gov.)
1975 – 1983	TLC Product evolution: - Automatic Fault Analyser for PSTN, µP controlled Modems, PCBA's for "TUT-System" Informatic Products: - Manufacturing center of Power Supplies for Siemens Printers, HD Drive Unit for Siemens Mainframes (PCBA and final Assembly)
1984 – 1995	TLC Products: Development and Manufacturing of Products oriented to Italian Telecom Market (Home Working for Telecom Services and Card Reader) Informatics Products: - Manufacturing of Midrange Computers and Optical Devices
1995 – 1997	PC Siemens Assembly Plant
1997 – 2000	Complete Responsibility for the Siemens PC Consumer Business (up to 300.000 PC in 1999) including engineering, purchasing, manufacturing, distribution and service
2000	Flextronics overtaking the Avellino site
2001 – 2002	Improvement of EMS activity for PC Consumer market (MediaWorld and Uniero), Communication Devices (ADSL Router for Digicom)
2003 - 2004	EMS activity oriented to industrial market: Conditioning System Controllers , Door Hub Controller for Automotive, Electronic Meter for ENEL
2005	GRUPPO PUGLIESE overtaking the Avellino site. New Customers acquisition in the Defence and Medical market segments. Startup of the ENERGY project.
2009	EL.ITAL. Avellino Srl becomes EL.ITAL.SpA
2010	Creation of Energy Division and startup of PV Modules manufacturing

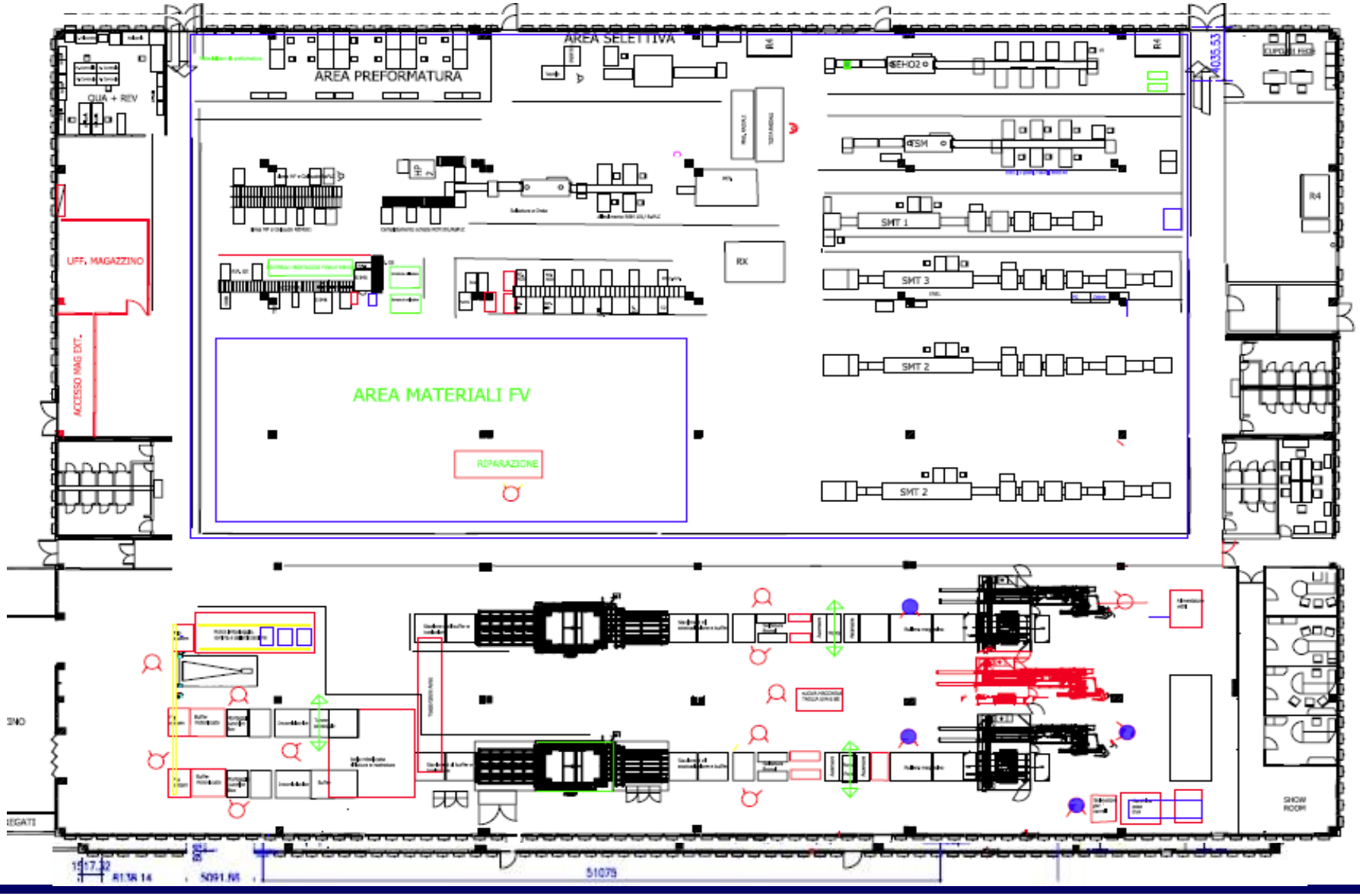
The Site



Plant

Total surface	**(mq 70.000)**
Local gross surface	**(mq 10.968)**
- thereof office area	**(mq 2.100)**
- thereof manuf. area	**(mq 5.425)**
- thereof warehouse area	**(mq 2.193)**
- thereof other functions (maintenance, facilities)	**(mq.1.250)**
External area	**(mq. 2.700)**

Manufacturing lines layout



PV Modules Manufacturing Lines

Annual production capacity of approximately
75 MWp

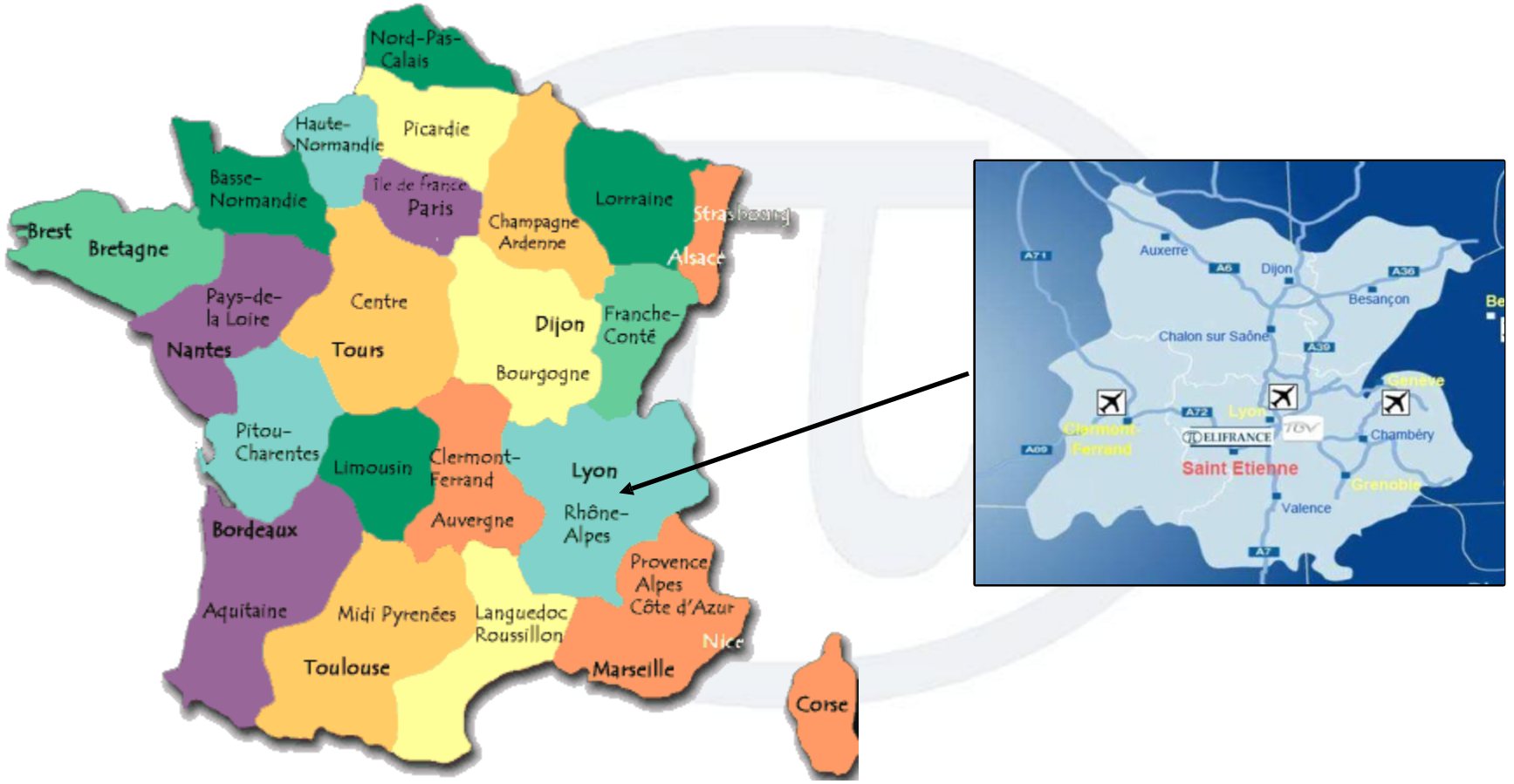
EMS Manufacturing Lines

ELIFRANCE

ems energy

www.elifrance.com

ELIFRANCE Saint Etienne (FRANCE)



Our History – For than 70 years !

- **1941 –** CRC Creation : “Constructions Radioélectriques du Centre”

- **1971 –** Schlumberger overtaking of CRC

- **1992 –** Test activity development)
(Banking terminal, ATE..)

- **2003** - Flextronics overtaking of the factory and its activities

- **2010** - Pufin overtaking of the factory and its activities transforming Flextronics Saint Etienne in ELIFRANCE with the start of the Energy activity

- **2011** - Start producing photovoltaic modules

ELIFRANCE Key Advantages

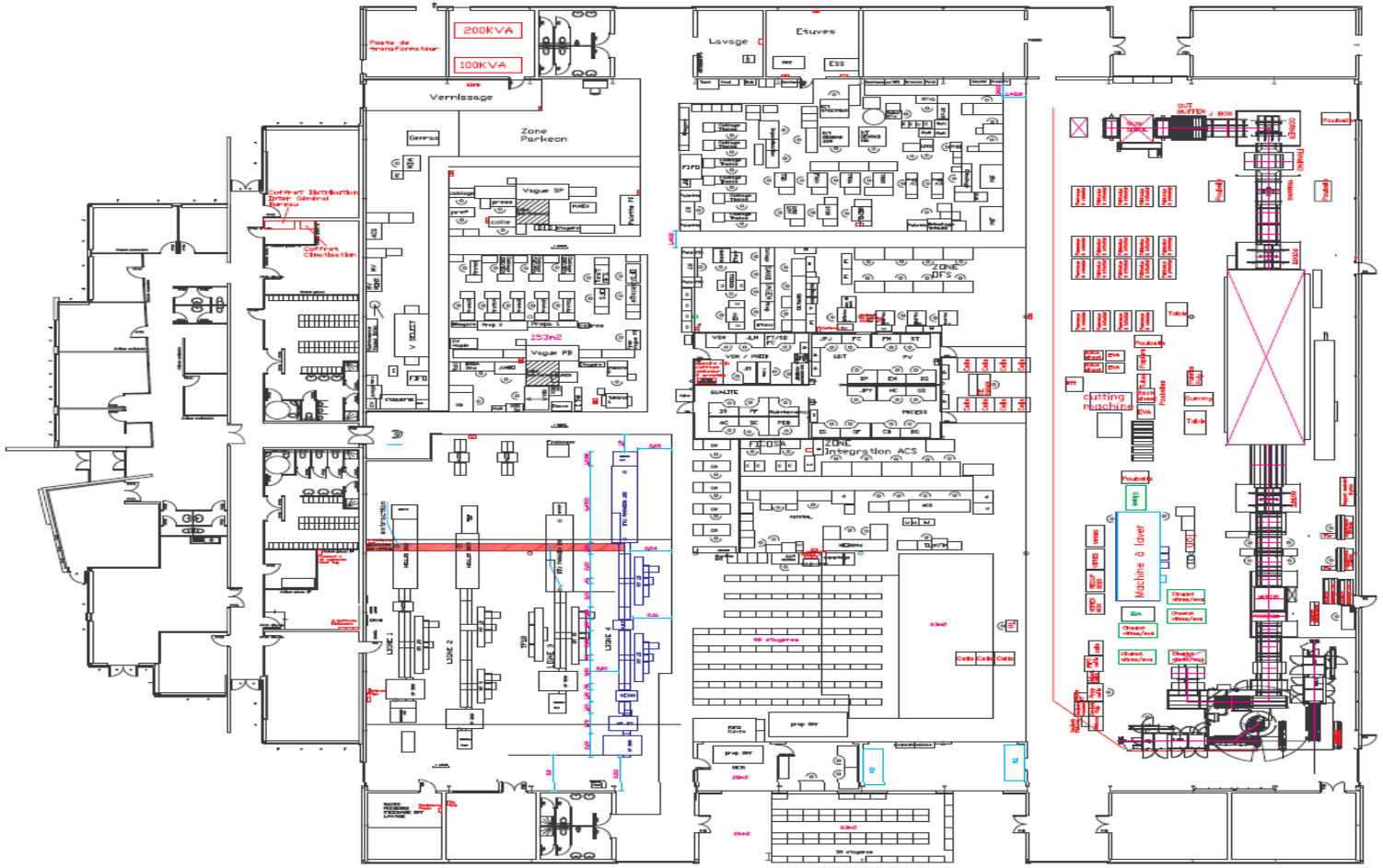
Part of an international Group

- **Revenue of site based on two complementary activities**

Unique skills

- In test and measurement
- In managing design partners
- In Box Build
- In building specific Electronic processes
- In dealing with international activities

Manufacturing lines layout



PV Modules Manufacturing Lines

Annual production capacity of approximately 45 MWp

EMS Manufacturing Lines

Energy Division

WORLD ENERGY COUNCIL

energy

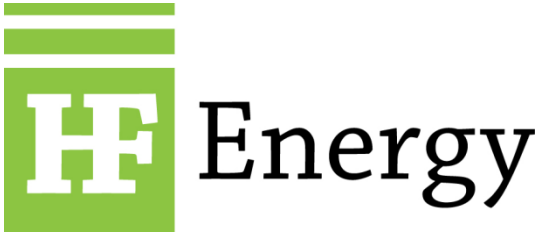
Energy Division Main Customers

Energy Division Main Customers

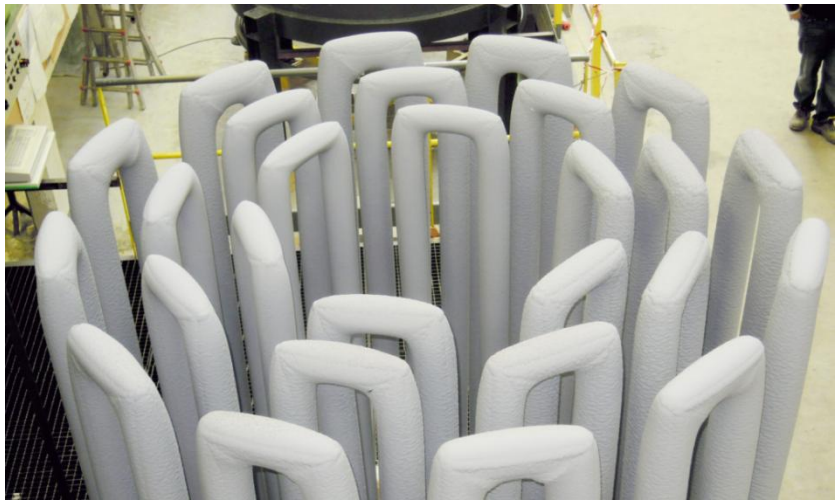
LOGI.TECH

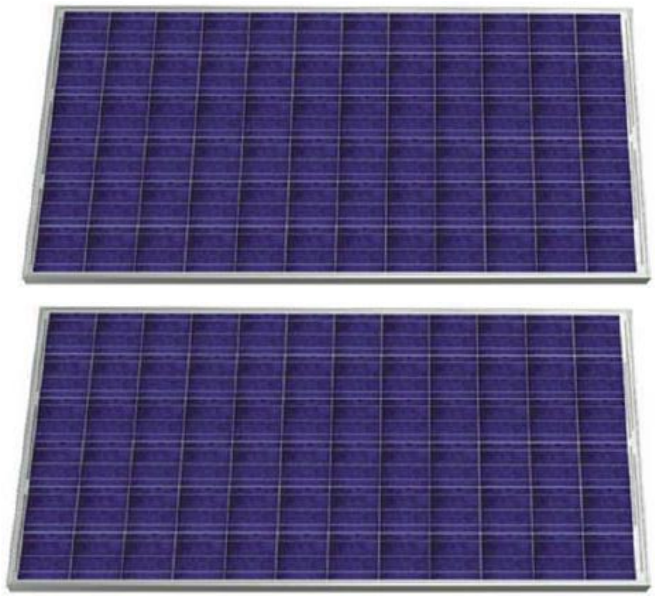
ANZ POWER

DENTRO IL SOLE



PRODUCTS





Some examples of PV plants built using conventional EL60 - EL72 modules

Acqualagna (PU) - Le Pole - c.a. 5 MWp - EPC: IMET

San Benedetto del Tronto (AP) – Stadio Comunale
EPC Troiani & Ciarrocchi

Oppeano (VR) - c.a. 1 MWp – EPC: FAR SYSTEM

Montesarchio (BN) - c.a. 1MWp - EPC: ELIOSIS

San Cassiano (LE) - c.a. 1 MWp - EPC: FIN POWER

Mottola (TA) - c.a. 1 Mwp EPC: SIEMENS

Some examples of PV plants built using innovative modules (model EL 60 IS) for Total Building Integration using “Capillary Comb” frames

Santa Palomba (RM) Potenza: c.a. 405 kW EPC: Logi.tech Srl

Jesi (AN) Potenza: c.a. 1.6 MW EPC: Piquadro Srl

Montegrosso d'Asti (AT) Potenza: c.a. 710 kW EPC: TERMOCOMPONENTI Srl

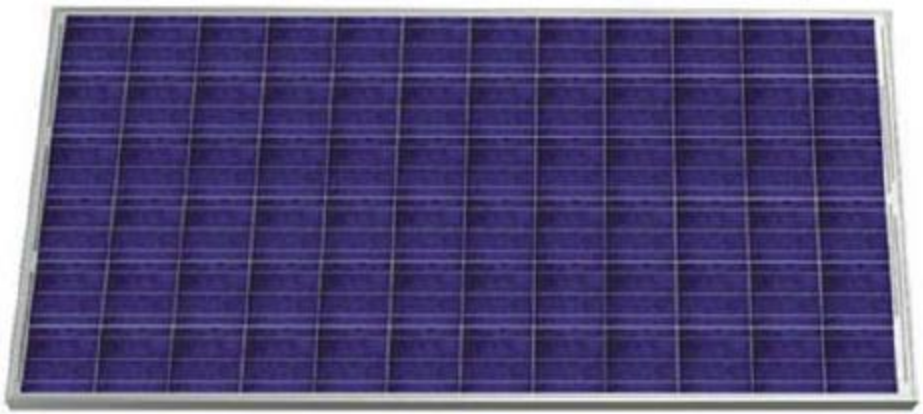
Module Series EL72

Mechanical and construction data

Photovoltaic elements type	Silicon Poly-Crystalline cells with antireflection coating
Photovoltaic elements per module	72 cells organized in 6x12
Photovoltaic cells dimensions	156 x 156mm ±0,5mm Thickness 200µm ±40µm
Module Dimensions (mm) (Length X Width W Height)	1973 x 999 x 40 ± 1,5mm
Module Weight	23kg cables and junction box included
Frame material	Extruded anodized aluminium alloy
Front Glass features	High transmission, low-Iron tempered glass 3,2mm thickness Glass may have anti-reflective coating
Junction box and connectors	IP65 with 3 integrated bypass diodes. Cables fitted with compatible MC4 connectors
Operating Temperature Maximum applicable loads	from -40°C to +85°C wind: 2,4kPa snow: 5,4kPa

Temperature Factors

Normal Operating Cell Temperature	NOCT	46°C	
Temperature factor for current Isc	α	+1,998 mA/°C (average)	+0,023 %/°C
Temperature factor for voltage Voc	β	-106,1 mV/°C (average)	-0,285 %/°C
Temperature factor for Power Pmpp	γ	-0,941 W/°C (average)	-0,392%/°C



Revision: 29 May 2015

Electrical data

			EL72295	EL72300	EL72305	EL72310	EL72315	EL72320	EL72324
Maximum power in STC*	Pmpp	Wp	295	300	305	310	315	320	324
Open Circuit Voltage	Voc	V	45,16	45,40	45,72	46,11	46,49	46,86	47,09
Voltage at Pmpp	Vmpp	V	35,89	36,23	36,61	36,99	37,37	37,69	37,89
Short-circuit current	Isc	A	8,71	8,80	8,87	8,94	9,01	9,08	9,15
Current at Pmpp	Impp	A	8,22	8,28	8,33	8,38	8,43	8,49	8,55
Typical Module Efficiency	ηm	%	14,97	15,22	15,47	15,73	15,98	16,24	16,33
Surface Power density	δs	W/m2	150	152	155	157	160	162	164
Power Tolerance	ΔP	%	0/+3%						
Maximun system voltage	Vmax	Vcc	1000						
Maximum reverse current	Irm	Acc	15						

* Peak in Standard Test Conditions : Irradiance = 1000W / m² – A.M.=1.5 – Module Temperature =25°C

kiwa Partner for progress

CE

ECOEM riciclo e gestione dei raee

Module Series EL60

Mechanical and construction data

Photovoltaic elements type	Silicon Poly-Crystalline cells with antireflection coating
Photovoltaic elements per module	60 cells organized in 6x10
Photovoltaic cells dimensions	156 x 156mm ±0,5mm Thickness 200µm ±40µm
Module Dimensions (mm) (Length X Width W Height)	1655 x 999 x 35 ± 1,5mm
Module Weight	19kg cables and junction box included
Frame material	Extruded anodized aluminium alloy
Front Glass features	High transmission, low-Iron tempered glass 3,2mm thickness Glass may have anti-reflective coating
Junction box and connectors	IP65 with 3 integrated bypass diodes. Cables fitted with compatible MC4 connectors
Operating Temperature Maximum applicable loads	from -40°C to +85°C wind: 2,4kPa snow: 5,4kPa

Temperature Factors

Normal Operating Cell Temperature	NOCT	46°C	
Temperature factor for current Isc	α	+1,998 mA/°C (average)	+0,023 %/°C
Temperature factor for voltage Voc	β	-106,1 mV/°C (average)	-0,285 %/°C
Temperature factor for Power Pmpp	γ	-0,941 W/°C (average)	-0,392%/°C

Revision: 29 May 2015

Electrical data

			EL60245	EL60250	EL60255	EL60260	EL60265	EL60270
Maximum power in STC*	Pmpp	Wp	245	250	255	260	265	270
Open Circuit Voltage	Voc	V	37,50	37,78	38,14	38,54	38,94	39,24
Voltage at Pmpp	Vmpp	V	29,81	30,19	30,58	30,95	31,32	31,58
Short-circuit current	Isc	A	8,71	8,80	8,89	8,97	9,05	9,15
Current at Pmpp	Impp	A	8,22	8,28	8,34	8,40	8,46	8,55
Typical Module Efficiency	ηm	%	14,82	15,12	15,42	15,73	16,03	16,33
Surface Power density	δs	W/m2	148	151	154	157	160	163
Power Tolerance	ΔP	%	0/+3%					
Maximun system voltage	Vmax	Vcc	1000					
Maximum reverse current	Irm	Acc	15					

* Peak in Standard Test Conditions : Irradiance = 1000W / m^2 – A.M.=1.5 – Module Temperature =25°C

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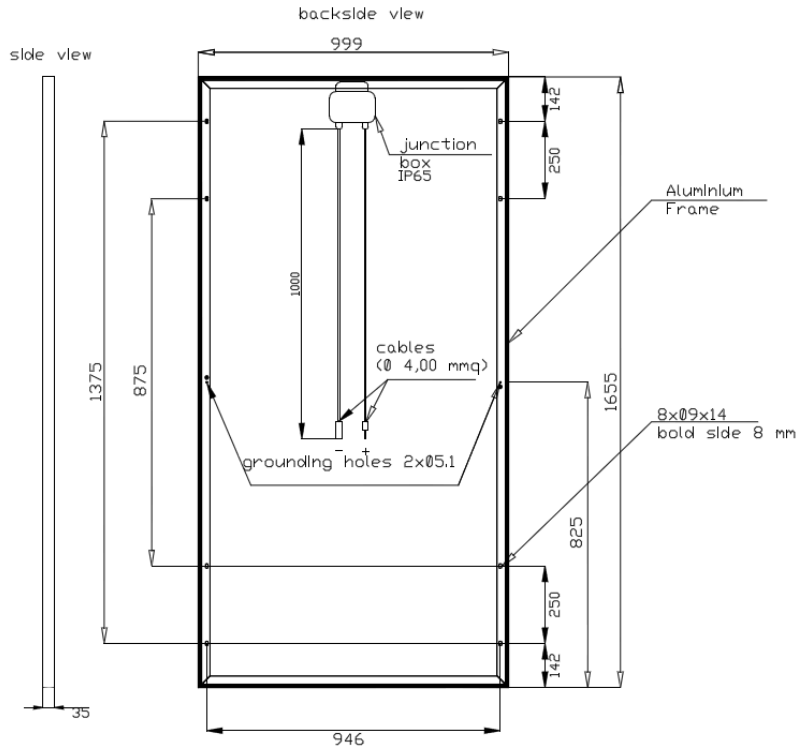
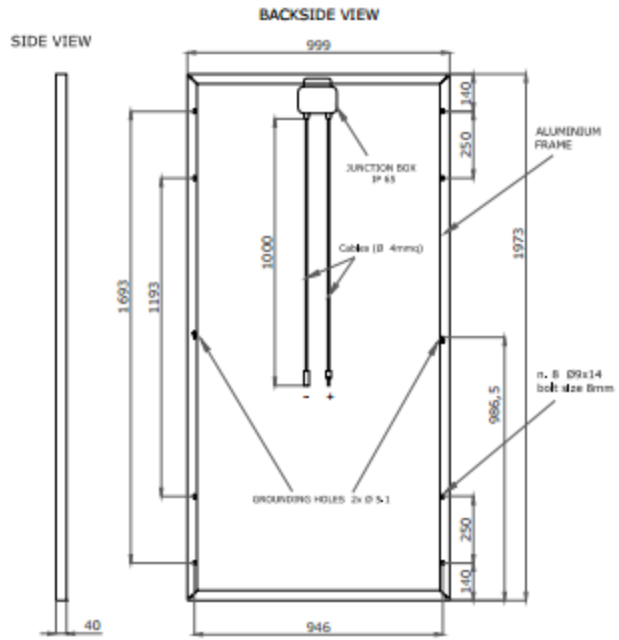
ECOEM riciclo e gestione dei raee

Mechanical drawings: EL Series



EL60



EL72

Module Series EL60IS

Mechanical and construction data

Photovoltaic elements type	Silicon Poly-Crystalline cells with antireflection coating
Photovoltaic elements per module	60 cells organized in 6x10
Photovoltaic cells dimensions	156 x 156mm ±0,5mm Thickness 200µm ±40µm
Module Dimensions (mm) (Length X Width W Height)	1716 x 1060 x 58 ± 1,5mm
Module Weight	24kg cables and junction box included
Frame material	Extruded anodized aluminium alloy Capillary Comb ® frame
Front Glass features	High transmission, low-Iron tempered glass 3,2mm thickness Glass may have anti-reflective coating
Junction box and connectors	IP65 with 3 integrated bypass diodes. Cables fitted with compatible MC4 connectors
Operating Temperature Maximum applicable loads	from -40°C to +85°C wind: 2,4kPa snow: 5,4kPa

Temperature Factors

Normal Operating Cell Temperature	NOCT	46°C	
Temperature factor for current Isc	α	+1,998 mA/°C (average)	+0,023 %/°C
Temperature factor for voltage Voc	β	-106,1 mV/°C (average)	-0,285 %/°C
Temperature factor for Power Pmpp	γ	-0,941 W/°C (average)	-0,392%/°C

INNOVATIVE MODULES DESIGNED FOR ARCHITECTURAL INTEGRATION WITH "CAPILLARY COMB" FRAME (PATENTED SYSTEM)

Photovoltaic module equipped with "Capillary Comb" frame removes and replaces the use of traditional covering system or façade thus realizing an architectural and integrated coating able to replace the traditional roof mantle.

Frame colors: aluminum grey; Other colors according to RAL are available on request.

Electrical data

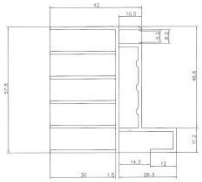
			EL60245 IS	EL60250 IS	EL60255 IS	EL60260 IS	EL60265 IS	EL60270 IS
Maximum power in STC*	Pmpp	Wp	245	250	255	260	265	270
Open Circuit Voltage	Voc	V	37,50	37,78	38,14	38,54	38,94	39,24
Voltage at Pmpp	Vmpp	V	29,81	30,19	30,58	30,95	31,32	31,58
Short-circuit current	Isc	A	8,71	8,80	8,89	8,97	9,05	9,15
Current at Pmpp	Impp	A	8,22	8,28	8,34	8,40	8,46	8,55
Typical Module Efficiency	ηm	%	14,82	15,12	15,42	15,73	16,03	16,33
Surface Power density	δs	W/m2	148	151	154	157	160	163
Power Tolerance	ΔP	%	± 3% -0/+3%					
Maximun system voltage	Vmax	Vcc	1000					
Maximum reverse current	Irm	Acc	15					

kiwa Partner for progress

CE

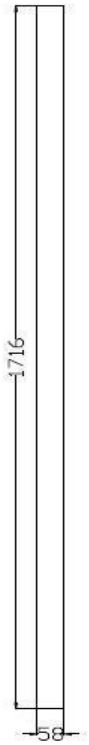
ECOEM

Mechanical drawings : EL60IS

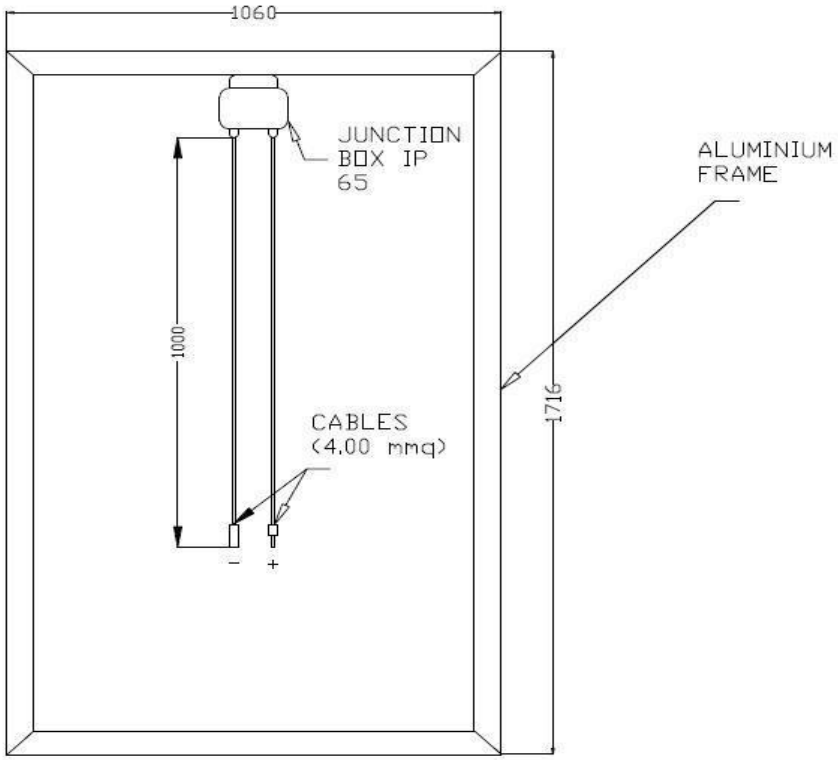


SECTION

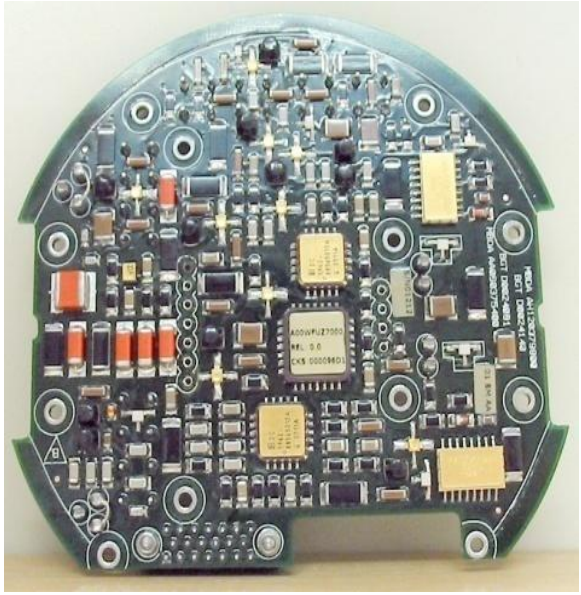
SIDE VIEW

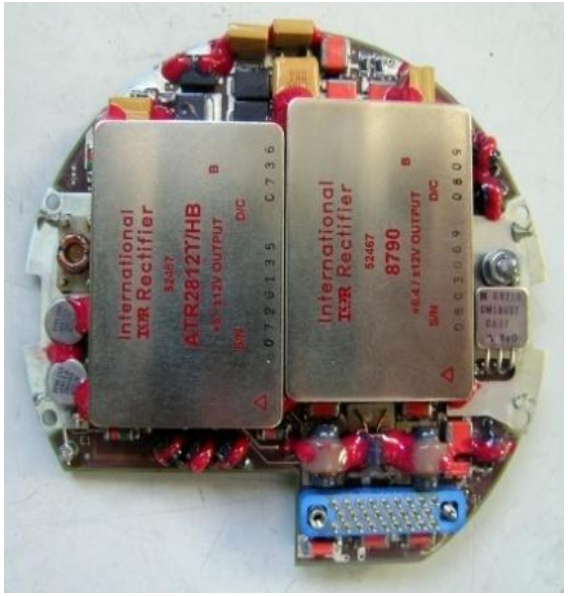


BACK SIDE VIEW



EMS Division



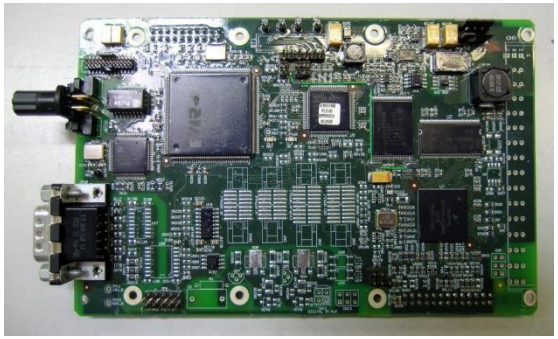


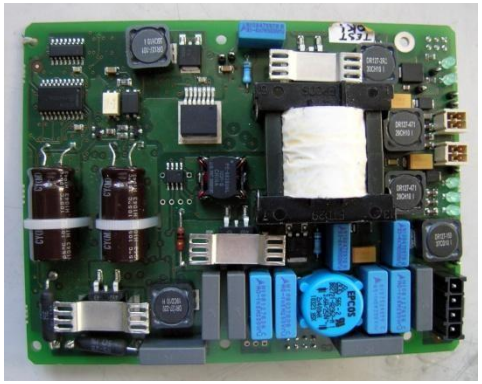
ems

Our EMS customers

E design partner:

Products Portfolio electronics boards





Railway Energy Meter

FAR SYSTEMS
SISTEMI ELETTRONICI DEL TRASPORTO AMBIENTE E COSTRUZIONI
ELECTRONIC SYSTEMS FOR TRANSPORTATION ENVIRONMENT & BUILDINGS

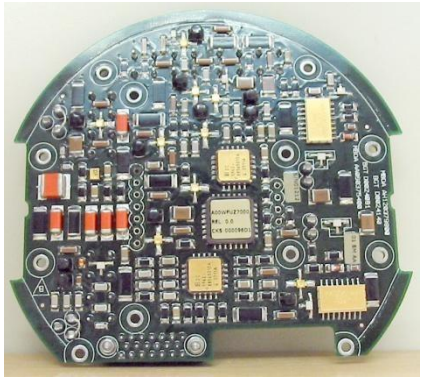
Controller for GSM Base Station

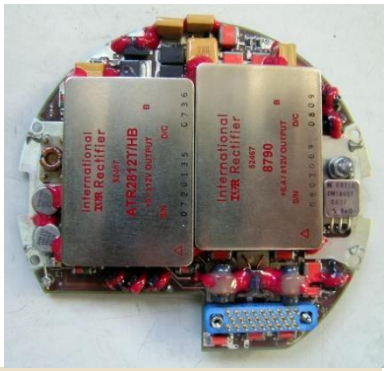
SIEMENS

PC Main-Boards

SIEMENS

Products Portfolio: PCBA

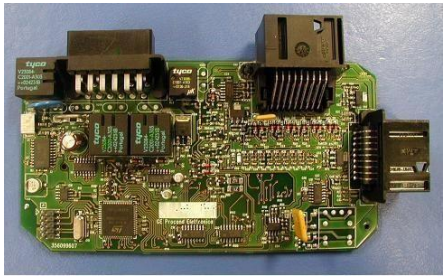




Controller Board and Power supply

IRIS-T Missile

MBDA MISSILE SYSTEMS



Car Services Control Boards

SELCOM GROUP

Conditioning Controller Board

EMERSON

Welder Control Boards and Inverter

AWELCO www.awelco.com

Products Portfolio: Finished Products

Welder

AWELCO www.awelco.com

ADSL Home Access gateway

digicom

Car services Control Device (Nodi Porta)

SELCOM GROUP

Conditioning Control Unit

EMERSON

Railway Energy Meter

FAR SYSTEMS
SISTEMI ELETTRONICI DEL TRASPORTO AMBIENTE E COSTRUZIONI
ELECTRONIC SYSTEMS FOR TRANSPORTATION ENVIRONMENT & BUILDINGS

Final box cabling & assembly

Specific process

Soft lead

Press fit

Conformal coating

Underfill

Potting

Retinning

www.pufinpower.com

THANK YOU !