



# इलेक्ट्रॉनिक्स कॉर्पोरेशन ऑफ इंडिया लिमिटेड

ELECTRONICS CORPORATION OF INDIA LIMITED

***N Rambabu***  
***Executive Director***



# ECIL Fondly Remembers its Founders



**Dr. Homi J Bhabha**  
Founder Chairman AEC



**Dr. Vikram Sarabhai**  
Founder Chairman



**Dr. A S Rao**  
Founder Managing Director



## Company Profile

- ❖ Established in 1967 as a Public Sector Enterprise under the Department of Atomic Energy (DAE)
- ❖ ECIL is engaged in the design, development, engineering, manufacturing, testing, qualification, supply, installation, commissioning and maintenance of a wide variety of electronic equipment / systems
- ❖ Consistently profit making Schedule 'A' CPSU



Nuclear

Defence

Aerospace

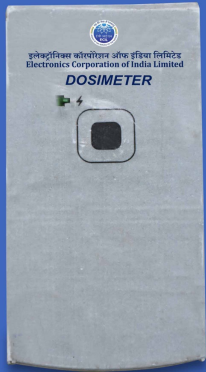
Security

IT & e - Gov.





# Major R&D Products - in recent past



**Safe & Secure PLC - NUCON**



# **Power Converters to FAIR/GSI, Germany (In-kind Contribution by India)**



# Genesis



- ECIL's participation to FAIR was identified & Working Groups were formed to cover
  - FPGA systems,
  - Power converters
  - SCADA systems
- Working Group meeting on Power converters was held at VECC, Kolkata on 10-07-2009.
- Technical Support
  - VECC
  - BARC
  - RRCAT



# Contracts signed by ECIL

## **Bi-partite contract**

- Contract signed with Bose Institute, Kolkata in Sep, 2012 for the supply of 533 Nos of Power converters (28 Varieties) to FAIR/GSI.
- Pre-Prototypes developed by RRCAT/VECC/BARC/ECIL as proof of concept.

## **As a part of the above,**

### **Tri-partite contract – I**

- Signed with FAIR/GSI & Bose Institute in May, 2014 for the supply of 78 Nos of Power converters (4 Varieties).

### **Tri-partite contract – II**

- Signed with FAIR/GSI & Bose Institute in March, 2016 for the supply of 118 Nos of Power converters (5 Varieties)

### **Tri-partite contract-III**

- Signed with FAIR/GSI & Bose Institute in Nov, 2019 for the supply of 258 Nos of Power converters (2 Varieties)





# Summary of Tri-partite contracts



<b>Contract No.</b>	<b>Quantity</b>	<b>Delivered</b>	<b>To be supplied</b>
<b>I</b>	78	76	2
<b>II</b>	118	91	27
<b>III</b>	258	215	43
<b>Total</b>	<b>454</b>	<b>382</b>	<b>72</b>



# Salient features of Power Converters



- IGBT based switched mode converters
- Multiple Quadrant operations (1, 2, 4 )
- Stability up to 100 ppm
- Current rating up to 600 A
- Power rating up to 134 kW
- Maximum voltage ranging up to 250 V
- Drives normal and super conducting Magnets (up to 125 H)
- Meeting IEC/DIN standards
- EMC requirements (Conducted Emission & Harmonics as per IEC standards)
- Conformity against European standards (CE certified)



# Quality Assurance Plan



- Component procurement policy and inward inspection
- Stage inspection during assembly & wiring
- Functional tests and Burn-in tests
- Type tests



# Power Converters



## Typical photographs of HB.C1 Power Converter (38.7 V, 100 A)



Front view



Rear view

# Storage area in Germany





## Issues faced so far

- Two types of power converters manufactured, tested and supplied to FAIR in October, 2016.
- Units are functionally acceptable but few observations were made by FAIR during visual inspection as follows.
  - Manufacturing / quality issues
  - Inconsistency in manufacturing process in view of first-of-series
  - Damage during transportation



# Mitigation

- Preparation of Detailed Manufacturing process Documents
- Augmentation of exclusive Storage, Manufacturing & Test facility to meet the FAIR requirements
- Multilevel quality checks
- Training of personnel to ensure the quality in manufacturing and testing
- Review and continuous guidance of Technical committee from VECC/RRCAT/BARC
- FAT testing as per approved test procedures
- Transportation by sea route in special containers







# Actual challenges and difficulties of production



- Qualification of vendors
- Receipt of material in time



# Upcoming Tri-partite contract – IV



Experiment	Power Converter	Ratings	Quantity	Remarks
HEBT	HB.Q3 FBL	300 A	4	
	HB.Q1 HED	300 A	2	
	<b>Total</b>		<b>6</b>	
SFRS	FR.D2	265 A	27	
	FR.Q4	315 A	85	<b>Prototype is under development by FAIR</b>
	FR.C3	300 A	106	
	<b>Total</b>		<b>218</b>	
<b>Total Power Converters</b>			<b>224</b>	

## Present status:

- Draft BoM shared by FAIR to ECIL.
- Specifications of major components like magnetics, laminated bus bars, cabinet, etc under finalization by FAIR.



# High Voltage Power Supplies for ITER & Other Power Electronics Projects



# ECIL collaboration with ITER-India



- MOU made between ITER India, Institute of Plasma Research (IPR) and ECIL in the areas of High Voltage Power Supplies for ITER.
- **ECIL executed the following projects based on the TOT.**
  - 27 kV, 190 A Ion Cyclotron High Voltage Power Supply (IC-HVPS) to ITER-India, Gandhinagar.
  - (-)96 kV, 75 A SPIDER Acceleration Grid Power Supply (SP-AGPS) to NBTF, RFX, Padua, Italy.
  - (-)96 kV, 75 A Diagnostic Neutral Beam Acceleration Grid Power Supply (DNB-AGPS) to ITER- India, Gandhinagar.
  - (-)100 kV, 25 A Regulated High Voltage Power Supplies (RHVPS) to Bhabha Atomic Research Centre (BARC), Mumbai.



# Upcoming Projects for ITER



- 27 kV, 170 A and 14 kV, 20 A dual output Ion Cyclotron HVPS (IC-HVPS) for ITER, France - Qty: 8 Nos.
- (-)55 kV, 110 A Electron Cyclotron HVPS (EC-HVPS) for ITER, France – Qty: 4 Nos.
- (-)65 kV, 40 A Lower Hybrid Current Drive High Voltage Power Supply (LHCD - HVPS) for Klystron operation to IPR, Ahmedabad – Qty: 1 No.

# Typical photographs of IC-HVPS



*Clockwise from top-left corner; ICHVPS and DNB-AGPS at ITER-India lab, SP-AGPS at NBTf facility, Padua*



## Other Power electronics projects



- A 9 MeV RF Electron LINAC for cargo scanning has been designed and developed by BARC at ECIL and ECIL is operating it for application like neutron radiography.
- Manufacturing of 10 MeV Industrial LINACs to RRCAT, Indore for food irradiation.
- Development of 4 MW AC drives for sodium coolant pumps in Fast Breeder Reactors at BHAVINI.



Thank you