

Railways

Defence & Aerospace

Spares & Services for Power Plants

Industry 4.0 Solutions for Business Power Plants

International Operations for Thermal & Hydro power plants

Nuclear & Hydro

Coal to Chemical & Hydrogen

75
Azadi Ka
Amrit Mahotsav

बी एच ई एल
BHEL

BHEL SAMVAAD 3.0

for Development of local suppliers

Castings & Forgings

09.11.2023

Castings & Forging items seeking interest of local sources



Sl.	BHEL Unit	Item	Value per annum, (Rs Cr.)
Forgings			
1	HEEP Haridwar, HPEP Hyderabad	Rotor Forgings – (Weight: 30 MT to 86 MT, Dia.: 1080 – 1256 mm; Length: 9000 – 13635 mm)	49.0
2	HEEP Haridwar	LP Rotor Shaft Forgings – (Weight: 53 MT, Dia: 1400 – 1910 mm; Length: ≥ 6500 mm)	36.0
3	HEEP Haridwar, HPEP Hyd., HEP Bhopal	Retaining Ring Forgings (Ferrous) – (Weight: 33 kgs to 1800 kgs)	22.0
4	HEP Bhopal	Retaining Ring Forgings (Non-Ferrous) – (Weight: 78 kgs to 255 kgs)	1.0
<i>(ESR and Cold Expansion facility required)</i>			
5	HEEP Haridwar	IP Rotor Shaft Forgings – (Weight: 27.5 MT, Dia 1160 mmX 3895 mm X 6257 mm)	20.0
6	HEEP Haridwar	HP Rotor Shaft Forgings– (Weight: 16 MT, Dia 800 mm X 2765 mm X 5475 mm)	18.0
<i>(Water and air quenching of the rotor have resulted in cracks. Oil quenching is a proven method to achieve the parameters devoid of cracks)</i>			
7	HEP Bhopal	Forged Pelton Runner – (Weight: 10 MT, Disc dia : 3050 mm)	10.0
Total			157.0

Castings & Forging items seeking interest of local sources



Sl.	BHEL Unit	Item	Value per annum, (Rs Cr.)
Castings			
1	HEEP Haridwar	Castings of IP Outer Casing – Nodular Grade – (Weight of one half: 29 MT to 42 MT) <i>(Inoculation facility required)</i>	20.0
2	HEP Bhopal	Centrifugal Castings – (Weight: 188 kgs , Dia 1050 mm X 280 mm) <i>(low demand)</i>	0.5
Total			20.5

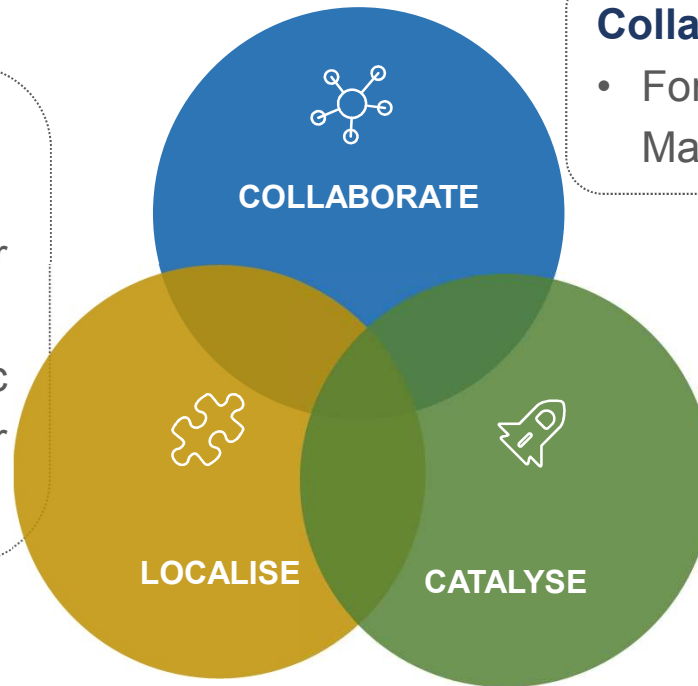
BHEL's Framework for AatmaNirbharBharat



Localise

Import substitution through

- in house engineering or manufacturing
- supporting domestic manufacturers for indigenization



Collaborate

- For Technology and Manufacturing

Catalyse

- Enable solutions for challenges faced in engineering and manufacturing
- Support domestic ecosystem with R&D and Testing infrastructure

Indigenized offerings with Indigenized supply chain

Castings & Forging items indigenized in last 2 years

(on account of Make in India efforts)



Sl.	Item	Supplier, M/s	Value per annum, (Rs Cr.)
1	Hydrogenerator shaft forgings (36 MT)	L&T Special Steels and Heavy Forgings, Mumbai	20.0

Retaining Ring Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Forgings	Rotor coils of Generator		HEEP Haridwar	9	85030090, 85030010	Siemens, WEG, Crompton Greaves, L&T
	Turbo-Generator	HY19372	HPEP Hyderabad	15		
	Generator/ Motors	BP19381/BP19383	HEP Bhopal	3		
Special Features of the job		Matl. Grade: Ferrous - X8CrMnN1818K/ X4CrNiMnMo N19138 / X4CrNiMnMo N19165, Non Ferrous - CuNi14Al3				
		Dimension 1 (F): OD: 1131 to 1320 mm, ID.: 991 to 1167 mm, Weight: 1000 to1800 Kg Dimension 2 (F): OD: 700 to 1150 mm, Thk.: 60 to 80 mm, Weight: 33 to1250 Kg Dimension 3 (F): OD: 403 to 1028 mm, ID: 350 to 981 mm, Weight: 33 to 203 Kg Dimension 4 (NF): OD: 594 to 1245 mm, ID: 544 to 1189 mm, Weight: 78 to 255 Kg				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Cold expansion of forging below 300 deg.	Cold Expansion Facility	No
2.	ESR steel is to be used	Steel Melting & Refining	Yes

samvaad@bhel.in

Retaining Ring Forgings



samvaad@bhel.in

Forging for Winding Support Ring

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging Non Magnetic	To support over armature overhang of Exciter		HEEP Haridwar	0.60	85030090	
Special Features of the job		Chemical Composition (Major Elements): X8CrMnN1818K; Cr: 17.5 – 20.0; Mn: 17.5 – 20.0				
		Dimension: OD: 573 mm; ID: 520mm; Ht Range: 170 – 190 mm; Wt: 54 - 61 kg				
Sl.	Requirements of the job		Facility /Technology		Whether available in India (Yes / No)	
1.	Cold expansion of forging below 300 deg.		Cold Expansion Facility		No	
2.	ESR steel is to be used		Steel Melting & Refining		Yes	

samvaad@bhel.in

Forging for Winding Support Ring



samvaad@bhel.in

Rotor Wedges

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Extruded Profiles (CuNi 2Si)	Turbo-Generator	TG65811	HPEP Hyderabad	3.45	74099000, 85469090 85030010	
Special Features of the job		<ul style="list-style-type: none"> • minimum 0.2% proof stress required is of the order of 520 N/mm²; • tensile strength of 590-750 N/mm² 				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Precision Extrusion with close tolerances	Extrusion & heat treatment	No

samvaad@bhel.in

Rotor Wedges



samvaad@bhel.in

Rotor Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging	Generator Rotor		HEEP Haridwar	40	85030090, 85030010	L&T Siemens India
Forgings	Turbo-Generator	HY19471	HPEP Hyderabad	15		
Special Features of the job		Matl. Grade: 26NiCrMoV145, 15 Dimension 1: Dia.: 1080 – 1256 mm; Length: 9000 – 13635 mm; Wt: 37.2 – 85.0 Ton Dimension: OD: 1080 MM, Length: 10,000 MM, Weight: 35-42 MT				
Sl.	Requirements of the job			Facility /Technology		Whether available in India (Yes / No)
1.	Heat treatment in vertical position or in horizontal position with rotation			Press of high capacity & Heat treatment facility		Not available for forging weight>35 ton

samvaad@bhel.in

Rotor Forgings



samvaad@bhel.in

IP Rotor Shaft Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging	IP Rotor of Steam Turbine	X12CrMoVWNb N10-1-1	HEEP Haridwar	20	84069000	
Special Features of the job		Chemical Composition: C: 0.11 – 0.13; Mn: 0.4 – 0.5; Cr: 10.2 – 10.6; Mo: 1.0 – 1.1; W: 0.95 – 1.05; N: 0.045-0.060, Nb: 0.04-0.06, V: 0.15-0.25; Si: 0.12max; P: 0.012max; S: 0.005max Dimension: IP Rotor 1: Dia 1110mmX 3545mmX 5907mm; Delivery Weight: 27.5 Ton IP Rotor 2: Dia 1140mmX 3895mmX 6257mm; Delivery Weight: 34.3 Ton				
Sl.	Requirements of the job			Facility /Technology		Whether available in India (Yes / No)
1.	Steel melting and secondary refining facility, Forging Press, Manipulator, Handling Capacity			Steel Melting & Forging		
2.	Vertical heat treatment facility			Vertical heat treatment		
3.	Testing facility			Testing		
4	Creep test as part of vendor qualification			Long Term testing		

samvaad@bhel.in

IP Rotor Shaft Forgings



samvaad@bhel.in

HP Rotor Shaft Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging	HP Rotor for Steam Turbine		HEEP Haridwar	18	84069000	Siemens India
Special Features of the job		Chemical Composition: X12CrMoVWNbN10-1-1 C: 0.11 – 0.13; Mn: 0.4 – 0.5; Cr: 10.2 – 10.6; Mo: 1.0 – 1.1; W: 0.95 – 1.05; N: 0.045-0.060, Nb: 0.04-0.06, V: 0.15-0.25; Si: 0.12max; P: 0.012max; S: 0.005max				
		Dimension: Dia 800mm X 2765mm X 5475mm Delivery Weight: 15.9 Ton				
Sl.	Requirements of the job			Facility /Technology		Whether available in India (Yes / No)
1.	Steel melting and secondary refining facility, Forging Press, Manipulator, Handling Capacity					
2.	Vertical heat treatment facility					
3.	Testing facility					
4	Creep test as part of vendor qualification					

samvaad@bhel.in

HP Rotor Shaft Forgings



samvaad@bhel.in

LP Rotor Shaft Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging	LP Rotor for Steam Turbine		HEEP Haridwar	36	84069000	Siemens
Special Features of the job		Chemical Composition: 26NiCrMoV145; 26NiCrMoV115 C: ≤ 0.28; Ni: 3.4 – 3.8; Cr: 1.4 – 1.8; Mo: 0.30 – 0.45, S & P: ≤0.010 Dimension: Dia: 1400 – 1910mm; Rotor Length: ≥ 6500; Weight: 50 – 97 Ton				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Steel Melting & Refining Facility for ingot		
2.	Heat Treatment		
3.	Testing		

samvaad@bhel.in

LP Rotor Shaft Forgings



samvaad@bhel.in

Forging for Armature Clamping

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Alloy Steel Forging Magnetic	To support armature Nonoverhang & core for 250MW Exciter		HEEP Haridwar	0.25	85030090	Siemens India
Special Features of the job		<u>Chemical Composition (Major Elements):</u> X8CrMnN1818K Cr: 17.5 – 20.0; Mn: 17.5 – 20.0 <u>Dimension:</u> OD: 635mm; ID: 393mm; Ht: 145mm				
Sl.	Requirements of the job			Facility /Technology		Whether available in India (Yes / No)
1.	Steel Melting & Refining					
2.	Forging & Heat Treatment					
3.	Testing					

samvaad@bhel.in

Forging for Armature Clamping



samvaad@bhel.in

Hydro Generator Shaft Forgings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Bottom Shaft Forgings	Hydro generator / LIS Motors	ASTM A668 GR-E / HG10035	HEP Bhopal	10 (approx.)	-	Voith Hydro, Andritz Hydro, GE
Special Features of the job		<p>Weight : 32 T – 70 T (approx.)</p> <p>Dimension- Length : 4 M- 5 M (approx.)</p> <p>Diameter (Max. at bearing) : 2 M – 3.5 M (approx.)</p> <p>Shaft diameter : 0.8 M – 1.2 M (approx.)</p>				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Forging facility as per specification/ drawing	Forging Facilities	Yes

samvaad@bhel.in

Hydro Generator Shaft Forging



samvaad@bhel.in

Forged Pelton Runner

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Stainless Steel Forging	Hydro Turbine	ASTM A473 Type S41500	HEP Bhopal	5 to 10 Cr.	84109000	
Special Features of the job		Weight: 10275 Kg, Forged Disc dia : 3050mm, 13-4 Stainless steel forging to ASTM A473 Type S41500 with high impact value of 120J at 0° C				
Sl.	Requirements of the job		Facility /Technology		Whether available in India (Yes / No)	
1.	High Quality Forged Runner Disc with high impact value requirement		Secondary refining facilities required to get sound quality forging			

samvaad@bhel.in

Forged Pelton Runner



Castings of IP Outer Casing – Nodular Grade

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Nodular Casting	IP Outer Casing for Steam Turbine	GGG – 40.3	HEEP Haridwar	20	84069000	Siemens India
Special Features of the job		Material Grade: GGG, EN-GJS-400-18-RT (Nodular Cast Iron) Delivery Weight: 29 – 42 Ton (weight of one half)				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Melting		
2.	Pouring & Casting (Handling)		

samvaad@bhel.in

Castings of IP Outer Casing – Nodular Grade



samvaad@bhel.in

Centrifugal Castings

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Casting	Generators	BP19989	HEP Bhopal	0.5	85030090, 85030010	Competitors - Siemens, TDPS
Special Features of the job		Material Grade: Cu Al Castings Dimension (Outer Diameter X Inner Diameter X Height X Weight): 1050 mm X 995 mm X 280 mm X 188 Kg				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Centrifugally cast Copper Aluminum Alloy is to be used. Rings are to be Centrifugally cast and rough machined.	Centrifugal Casting, Mechanical testing / NDT	Yes (with Size limitations)

samvaad@bhel.in

Centrifugal Castings



samvaad@bhel.in

Hydro Generator Shaft Forgings

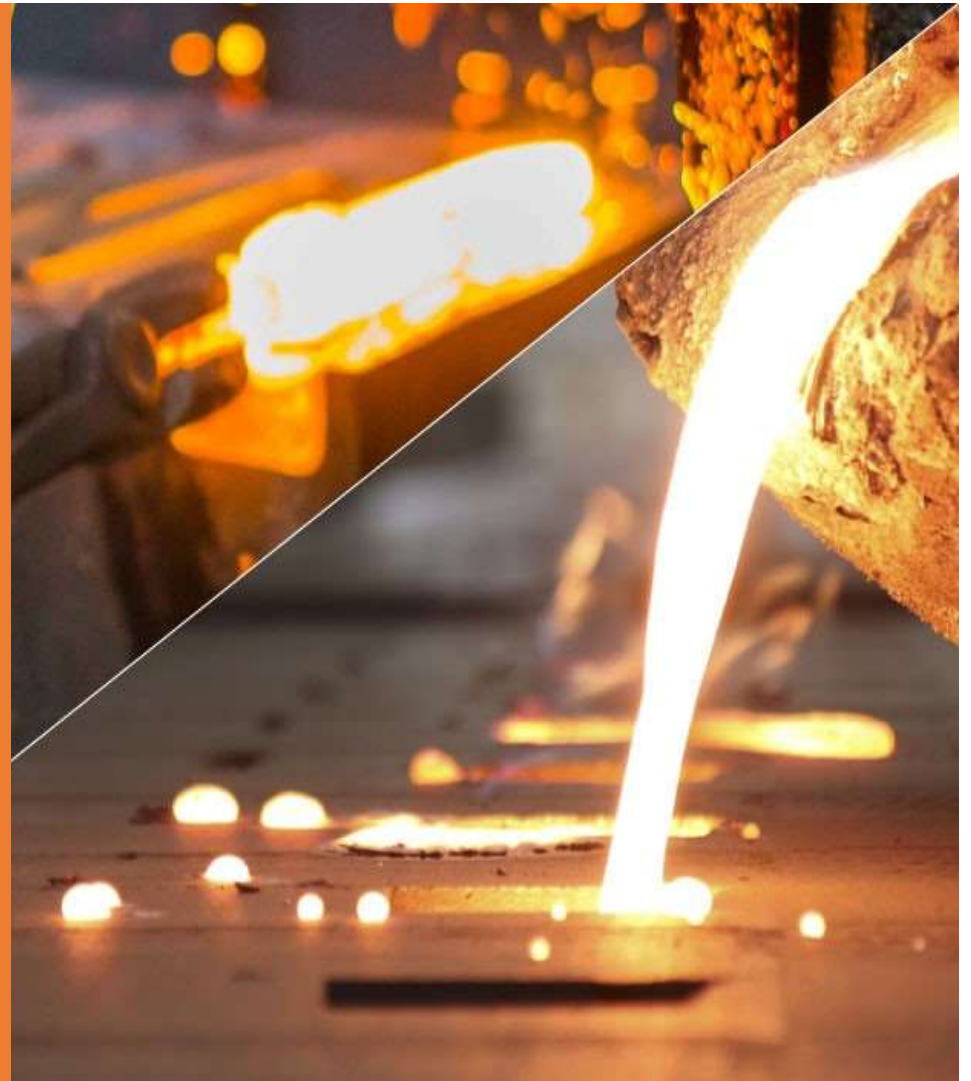
BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Bottom Shaft Forgings	Hydro generator / LIS Motors	ASTM A668 GR-E / HG10035	HEP Bhopal	10 (approx.)	-	Voith Hydro, Andritz Hydro, GE
Special Features of the job		Weight : 32 T – 70 T (approx.) Dimension- Length : 4 M- 5 M (approx.) Diameter (Max. at bearing) : 2 M – 3.5 M (approx.) Shaft diameter : 0.8 M – 1.2 M (approx.)				

Sl.	Requirements of the job	Facility /Technology	Whether available in India (Yes / No)
1.	Forging facility as per specification/ drawing	Forging Facilities	Yes




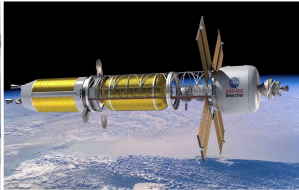


Hydro Generator Shaft Forging



**“NATIONAL FACILITIES FOR
CASTINGS & FORGINGS”**



Proposed Products for “National Facility for Castings & Forgings”

					
Steel, Mining & Metallurgy	Power	Defence & Aerospace	Nuclear & Space	Ship Building	Machine Tools & Others
<ul style="list-style-type: none"> • Copper Tuyeres • Hammer Head • Upper & Lower Shoe • Liner • Pusher Ram • Ingot Moulds • Slag Cups • Bottom Shell • SG Iron Castings • Forged Rolls for Rolling application 	<ul style="list-style-type: none"> • HP, IP, LP & TG Rotor • Hydro shafts • Discs • Retaining & Forged rings • Pelton Runner, Inner Casings • SG Iron Castings (IP Outer) • Super alloy for AUSC • Wind mill shafts & Forged Rolls • Tube Sheets • Nozzles/ Blooms • Closed die forgings (Turbine Blades) 	<ul style="list-style-type: none"> • A/P- Bracket, • Turret Castings • Bomb Shell • NAB Propeller casting • 155/52 Caliber gun barrel • Nuclear Submarine Hull • Closed die forgings (Ti & Al Alloy Forgings) 	<ul style="list-style-type: none"> • Pressure Vessel • Tube Sheets • Hawse Pipe • Closed die forgings (Ti & Al Alloy Forgings) 	<ul style="list-style-type: none"> • Rudder Stock & Castings • Propeller Shaft • Bulkheads • Shell Lip • Deck Lip • Hatchway 	<ul style="list-style-type: none"> • Spindle Stand • Mill Housing • Roll Chocks • Cylinder Liner • Shredder Hammer • Gear Blanks • Sprocket • Spider Wheel • G B Housing

Suggestive Format for Demand aggregation of CASTINGS at Country level



Type	Name of Items being Imported	HSN Code	Matl. Grade	Approx. Weight/Weight Range (MT)	Approx. Dimension / Dimension Range (in mm)	Actual Imports done in last 3 years						Approx. Requirement in Future Years per annum									
						2022-23		2021-22		2020-21		2023-24		2024-25		2025-26		2026-27		2027-28	
						Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin
Grey Iron	Item 1																				
																				
	Item n																				
SG Iron	Item 1																				
																				
	Item n																				
Steel	Item 1																				
																				
	Item n																				
Others	Item 1																				
																				
	Item n																				
Total																					

*Physical-MT/Nos. Financial-Rs. Crs,

Suggestive Format for Demand aggregation of FORGINGS at Country level



Type	Name of Items being Imported	HSN Code	Matl. Grade	Approx. Weight/Weight Range (MT)	Approx. Dimension / Dimension Range (in mm)	Actual Imports done in last 3 years						Approx. Requirement in Future Years per annum									
						2022-23		2021-22		2020-21		2023-24		2024-25		2025-26		2026-27		2027-28	
						Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin
Open Die Forgings	Item 1																				
																				
	Item n																				
Closed Die Forgings	Item 1																				
																				
	Item n																				
Others	Item 1																				
																				
	Item n																				
Total																					

*Physical-MT/Nos. Financial-Rs. Crs,



THANK YOU

Backup

ASSISTANCE REQUIRED FROM GOVERNMENT

- Funding of entire proposed Investment of Rs. 4,875 Crores by Government of India
- Arrangement of specific Import data for Castings and Forgings imported into the country in last 3 years along with its specification (Item name, Material grade, weight, size, quantity and value)
- Likely Demand aggregation (Physical and Financial) at Country level for various types of Castings and Forgings for next 5 years under various sectors
- Support of DPIIT is requested for above data.
- Specific procurement guidelines for this dedicated setup of “National Facility for Castings & Forgings” to all industries (Public & Private) across India from Government of India to make it economical & viable
- In order to fast-track the project completions, exemption from restrictions under rule 161 (iv) & 144 (xi) of GFR 2017 be permitted for P&M required in this facility
- Promotion of India as preferred destination for supplies of Castings and Forgings across the Globe

TENTATIVE INVESTMENT SUMMARY

□ Cr.

S. No.	Project	Business Segment	Tentative Investment
(A) If 8 projects identified are taken up separately			
1	Retaining Rings & Forged Rings	Power Sector	375
2	NAB (Nickel Aluminium Bronze) Propeller Casting	Defence & Aerospace, Shipping	149
3	SG Iron Castings	Power Sector & Industry Sector	243
4	HP, IP, LP, TG rotors, Hydro Shafts & forgings (Including Advance Ultra Super Critical Power Plant)	Power Sector & Industry Sector	2475
5	155/52 Caliber gun barrel & Propeller Shafts	Defence & Aerospace, Ship Building	840
6	Alloy 625 castings for AUSC	Power Sector	82
7	Wind mill shafts & Forged Rolls	Power Sector & Steel	1420
8	Closed die forgings by installing 35,000T Closed Die forge Press and 12,000T Isothermal Press (Titanium/Aluminium Alloy Forgings etc.)	Nuclear & Space, Defence & Aerospace, Power Sector	1209
Sub-Total			6793
(B)	Investment in case all of above projects are sanctioned together for creation of "National Facilities for Castings & Forgings"	All of the above	4875

Proposal (B) with all above 8 projects together with a reduced optimised investment of Rs. 4,875 Crores will be a beneficial proposition leading to ~saving of Rs. 1900 Crores as against proposal (A) of Rs. 6793 Crores

Strategic Edge of CFFP, BHEL, Haridwar for setting up “National Facility for Castings & Forgings”



- Capability to make Steel Castings as low as 0.5MT to as high as 60 MT single piece and Cast-fabricated castings up to 120 MT weight
- Developed and manufactured 20.7 MT weight Alloy 625 Casting, one of the heaviest castings in the category
- Capability to make Forgings upto 36 MT in different material grades
- Available know how from M/s Sheffield Forge masters, UK and M/s Creusot Loire, France to manufacture forgings in different material grades through open die forging
- Capable of melting and handling higher capacity liquid metal and experienced in special grade, e.g. P-91 (Tungsten Grade) and alloy 625, castings of bigger size
- Highly skilled engineers having requisite knowledge base
- Well equipped with production/testing facilities
- Sufficient vacant land available (approx. 1300 Acres) near existing factory area for future expansion

Castings- Market Overview

CASTINGS Global Scenario

- Global metal casting market, valued at USD 26.55 billion in 2021, projected to grow at a **CAGR of 8.7%** from 2022 to 2030
- China's Dominance ~50% in Worldwide Production
- Restrictions on Chinese import, post pandemic has enhanced **opportunities** for Indian players
- Castings market share is dominated by Automotive Industry followed by Valves & **Heavy equipment's**
- Iron Castings (Cast Iron/ Grey Iron & Ductile Iron) is having maximum share (i.e. 67 %) of castings globally

Indian Casting Market and Scope for CFFP

- The import content in Castings in India is quite high (1000+ in million USD) indicating lack of manufacturing facilities attributed to technology/ capacity gaps/ higher cost
- Indian Market is dominated by Small & Medium sized units with only few large units catering to Indian Industry demands
- The market share of Heavy Equipment's itself works out to USD 4.2 billion (i.e. Rs 31,500 Crores) at global level indicating ample opportunity Casting manufacturers

Forgings- Market Overview

FORGINGS Global Scenario

- Global metal forging market, valued at USD 74.36 billion in 2021, projected to grow at a **CAGR of 7.7%** from 2022 to 2030
- Forgings market share is dominated by Automotive Industry followed by Defence & Aerospace
- **Closed Die forging** process dominates the forging requirements in India (~70%) followed by Open die forging (~17%)

Indian Forging Market and Scope for CFFP

- The Indian forging industry has an annual output of about 20 lakh metric ton worth Rs 45,000-50,000 crore (FY2021 approx.)
- India has about close to 400 forging units, of which 80 to 82% can broadly be categorized as tiny and small enterprises, 10% are medium sized and the remaining being large scale.
- **CFFP caters to open Die Forgings i.e.17% market segment**
- These factors validates the need of a “National Facilities of Castings & Forgings” for India to become self reliant under “AatmaNirbhar Bharat” drive for import substitution