



Innovations in Manufacturing Technology for Sustainability in an Emerging Economy - Case Studies from L&T

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India – an Emerging Economy

GDP:
~ 2 T USD



GDP Growth:
~6.5%

National Challenges:

Manufacturing :

- Inclusive Growth
- Infrastructure
- Energy Security
- Self Reliance in Strategic Sectors
- Sustainability:
 - Environment
 - Conservation of Natural Resources
- Made in India Brand
 - Share of global trade in manufactured goods

Materials:

- ✓ Metals & Alloys
- ? Biomaterials
- ? Semiconductors
- ? Energy Materials
- ? Polymers
- ? Ceramics

- % of world manufacturing: **< 2%**
- % of Indian Economy Today: **~17%**
- % of Indian Economy in 2020: **>25%**



CONSTRUCTION



HEALTHY GROWTH



Growth with Sustainability – Company Mantra

Companies growth linked to national growth in Infrastructure



POWER



L&T a company founded by two Danish Engineers in pre-independence India : Contributed to many national firsts

1991 saw liberalisation & globalisation of the Indian economy

Independent India chose a planned & regulated economy for building self reliance

Growth – an imperative for India




ELECTRICAL & AUTOMATION



HYDROCARBON – U/S

HYDROCARBON – M & D

FINANCE & IT



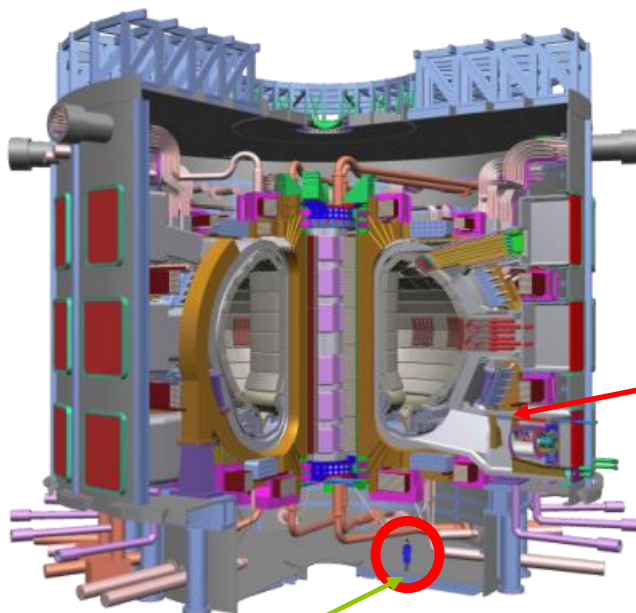
Contribution of Green Portfolio to sales increased from **13.6 %** to **14.31 %** YoY

- Construction of 43.20 mil sqft. green bldgs
- Solar Photovoltaic power plants installation
- Energy efficient Metro rail and monorail
- Hydropower projects
- Wastewater treatment plants
- Efficient transmission and distribution
- Supercritical Thermal Power Plant Equipment
- Coal Gasifier

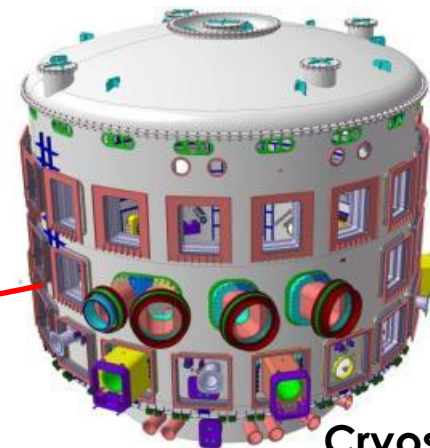
Product Portfolio



India's Clean Energy Security – Nuclear Power



Human size reference



Cryostat

Contribution to the International Thermonuclear Experimental Reactor Project

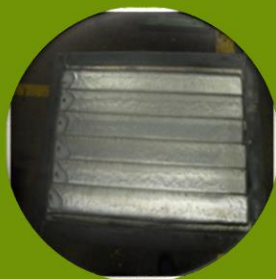
Fusion a possible source of safe, sustainable and abundant energy



Welding Processes for Advanced Materials



Hyper Duplex Stainless Steel for Petro-chemicals



Inconel 690 for Nuclear Steam Generator



P92 for Ultra super-critical power plants



Weldox 1100 for defence structures



Zirconium for PTA plants

More than 5000 welding procedures developed





Case Study 1: Life Cycle Analysis of Process Gas Boiler System

Objective:

- Evaluate the “***Cradle-to-Gate Lifecycle***” for Process Gas Boiler system in order to calculate “**Life Cycle Inventory**” (LCI)
- Implement actions for **reducing impact on environment**
- Embed **Sustainability** across the **Value Chain of L&T’s products**



Process Gas Boiler System

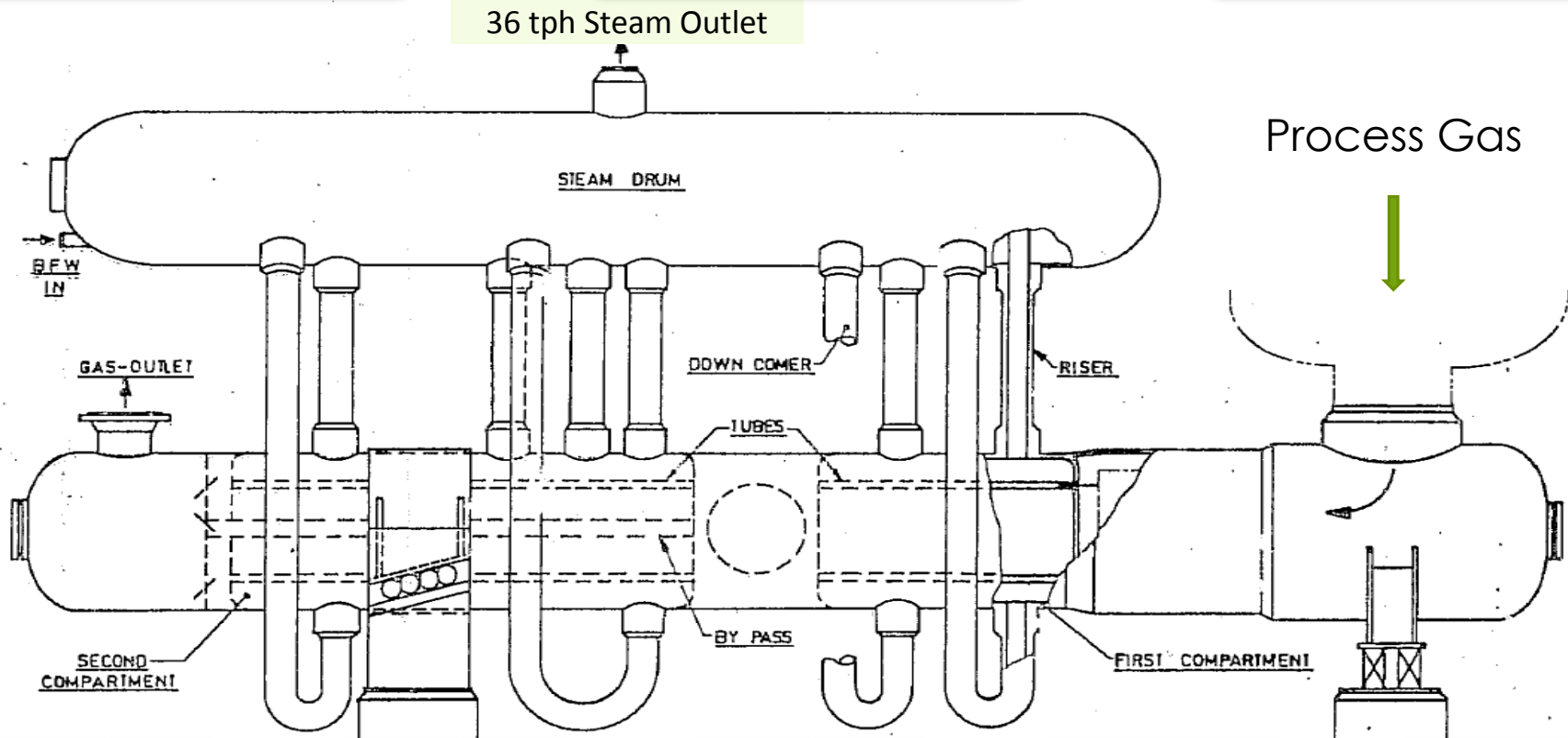
Process Gas Boiler Assembly



Riser & Down Comer Piping



Steam Drum General Assembly



Goal & Scope Definition



Data Collection & Quality Check



LCA System Modeling



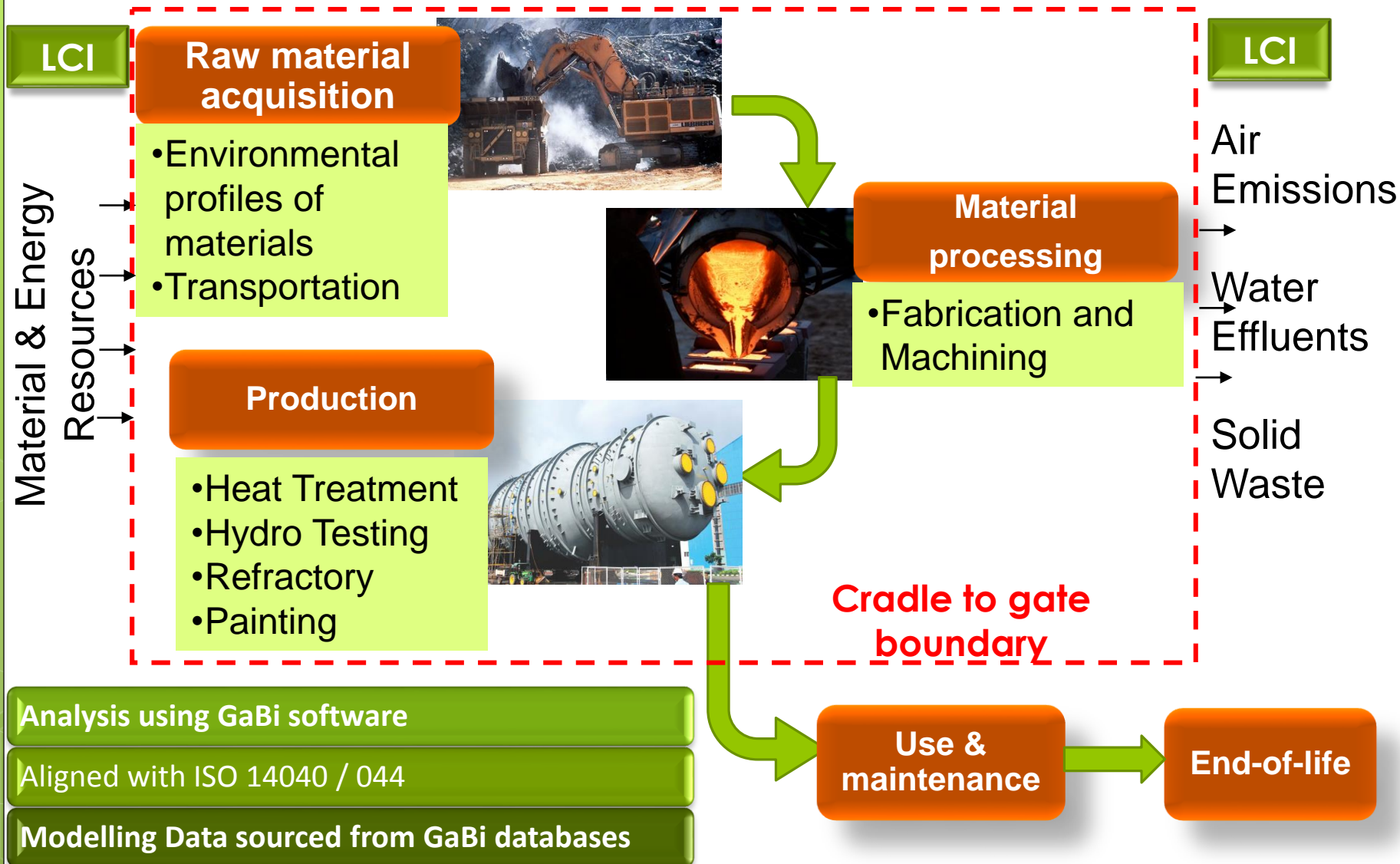
LCI & LCA Calculations



Interpret & Recommend

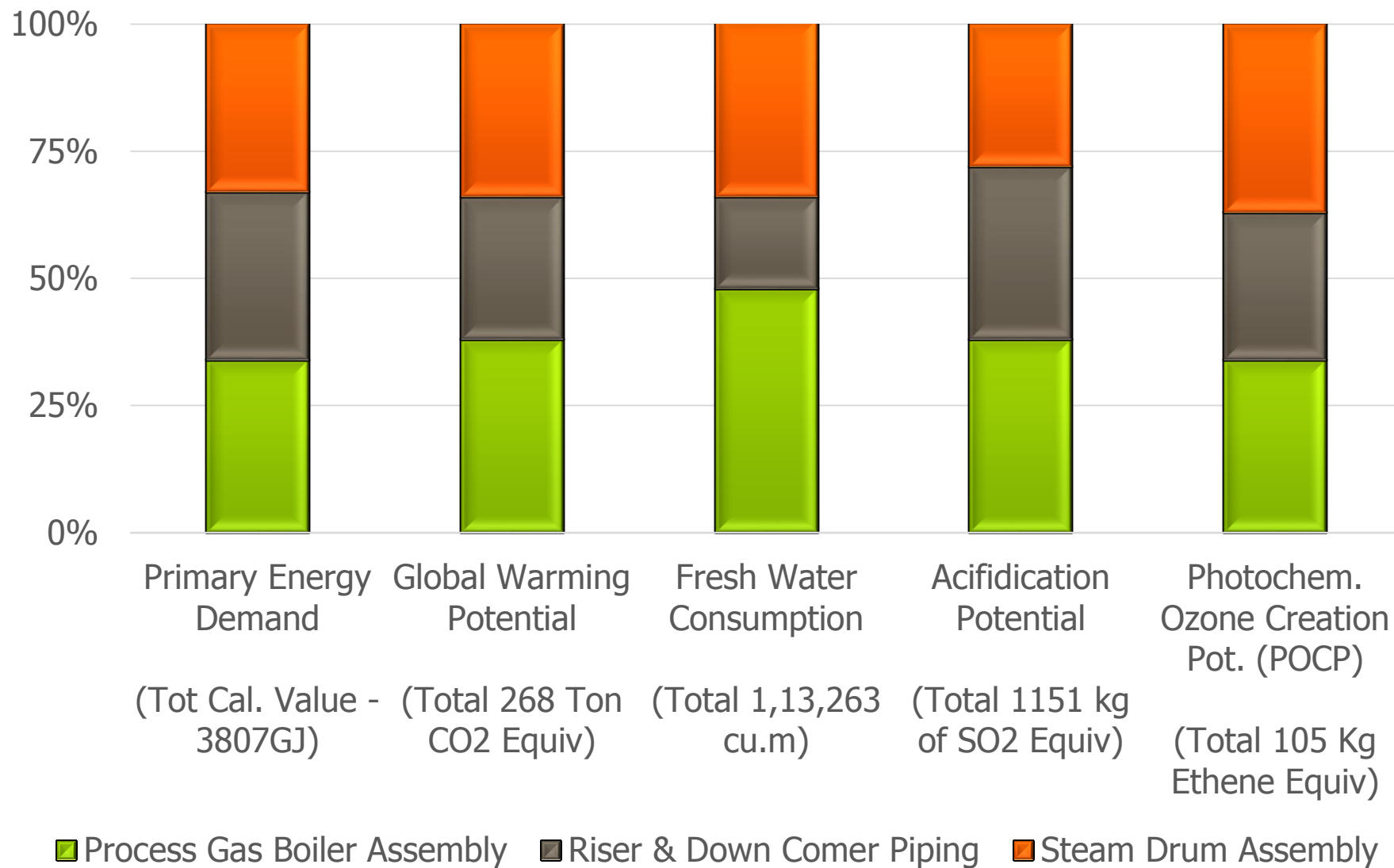


Analysis of Value Chain – Cradle to Gate





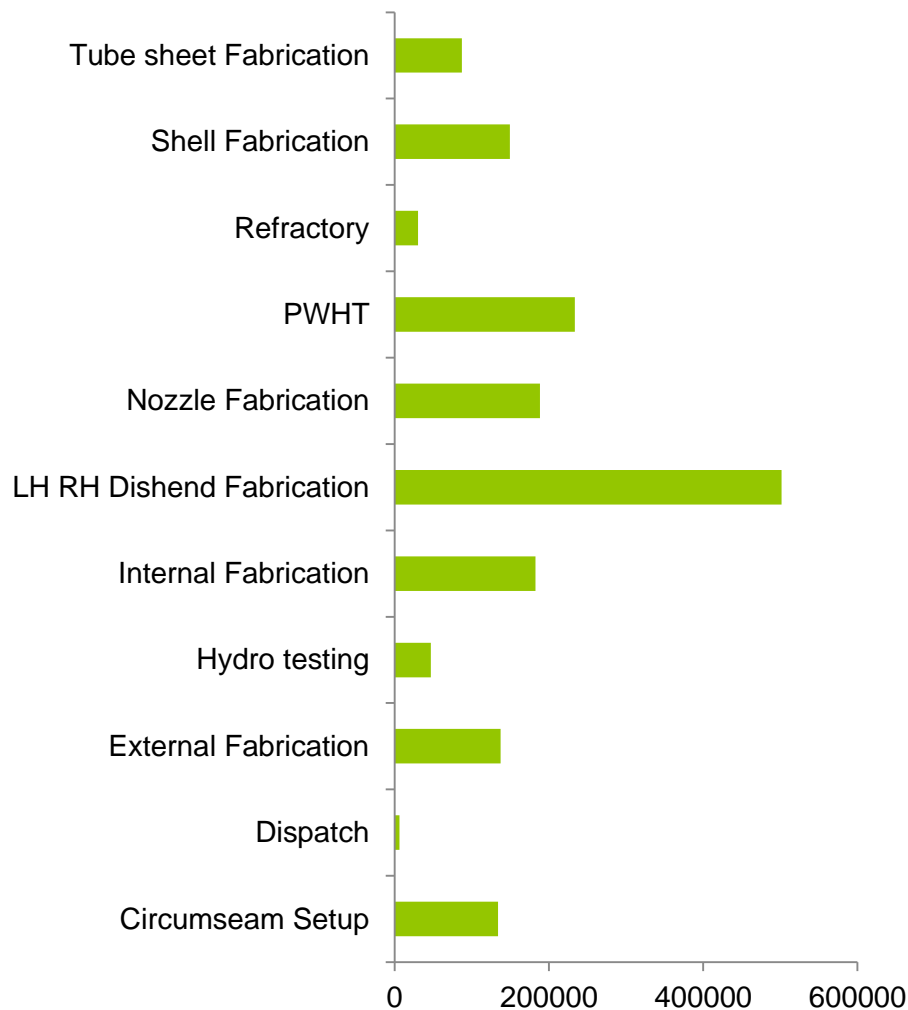
Observations



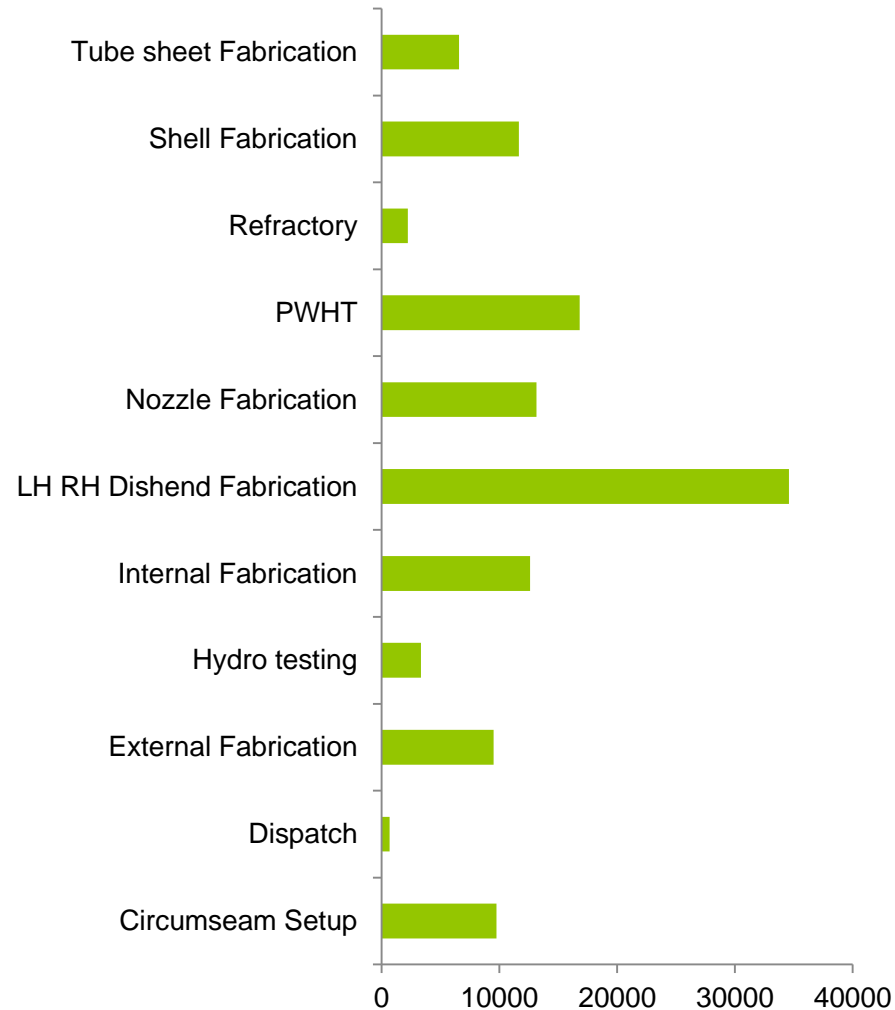


Activity-wise break-up of key Environmental Impacts

Primary energy demand from ren. and non ren. resources (net cal. value) [MJ]



Global Warming Potential (GWP 100 years) [kg CO2-Equiv.]





Recommendations

Reduction in parameters	If electricity consumption reduces by 5%		If Natural Gas consumption reduced by 5%		Sourcing of Wind power (90 %)		If weight of material is reduced by 5%
	External	L&T In-house	External	L&T In-house	External	L&T In-house	Cradle to Gate
Acidification Potential (AP) [kg SO ₂ - Equiv.]	0.85	0.15	8.5	1.5	6.8	1.2	58
Global Warming Potential (GWP 100 years) [tons CO ₂ -Equiv.]	701.51	499.49	2,894.8	2,061.20	9,360.25	6,664.79	13413 (5%)
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	0	0	1		0.2	0.8	5
Primary energy demand (net cal. value) [MJ]	7,249.25	4,766.24	50,978.85	33,251.15	96,707.18	63,589.81	169658 (5.0%)
Total freshwater consumption [cu.m]	5,161.66	4.13	1,479.04	1.18	68,858.86	55.13	5663.2 (5.0%)



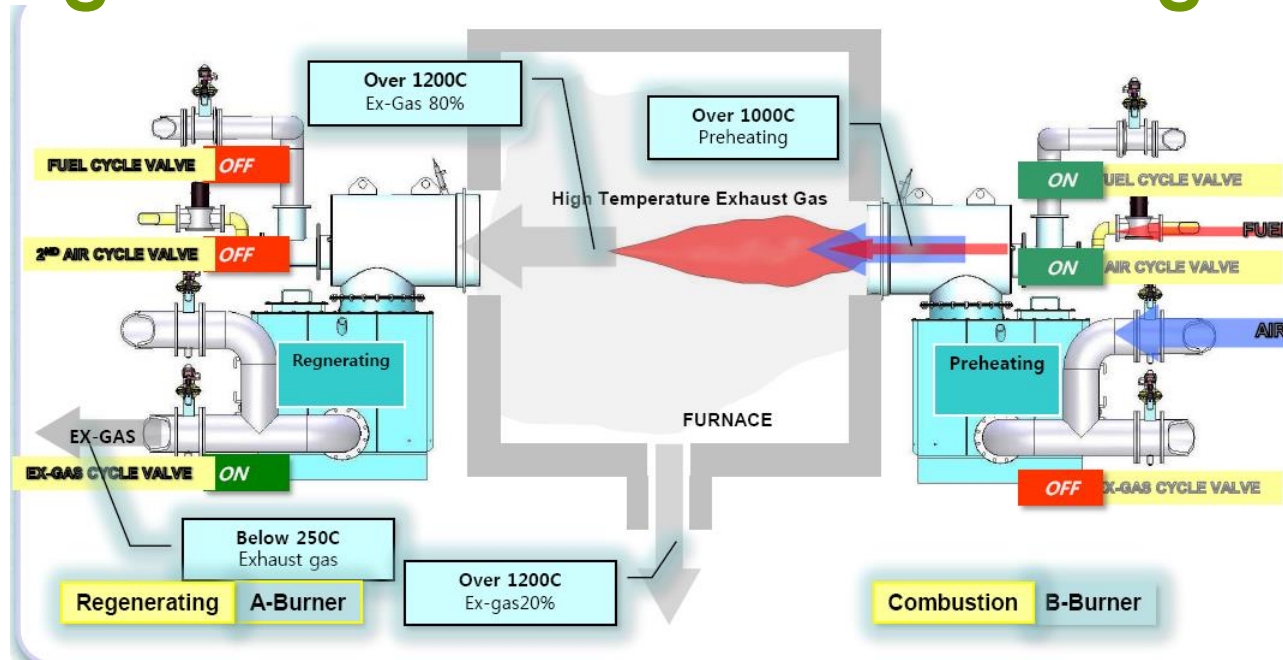
Case Study -2: Energy Conservation Through Process Re-Engineering & Innovation

L&T Special Steels and
Heavy Forgings Private Limited





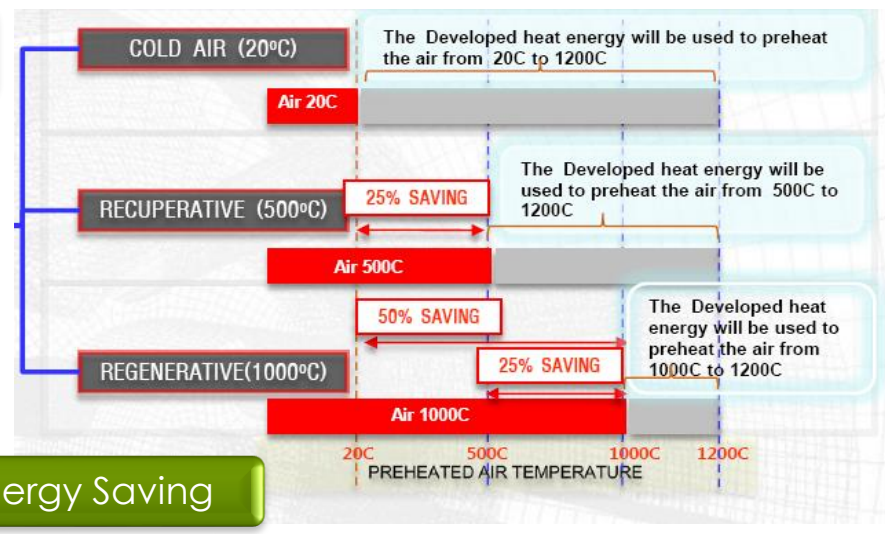
Regenerative Burner for Reheating Furnace



Regenerative burners work together in pairs



12/07/2008



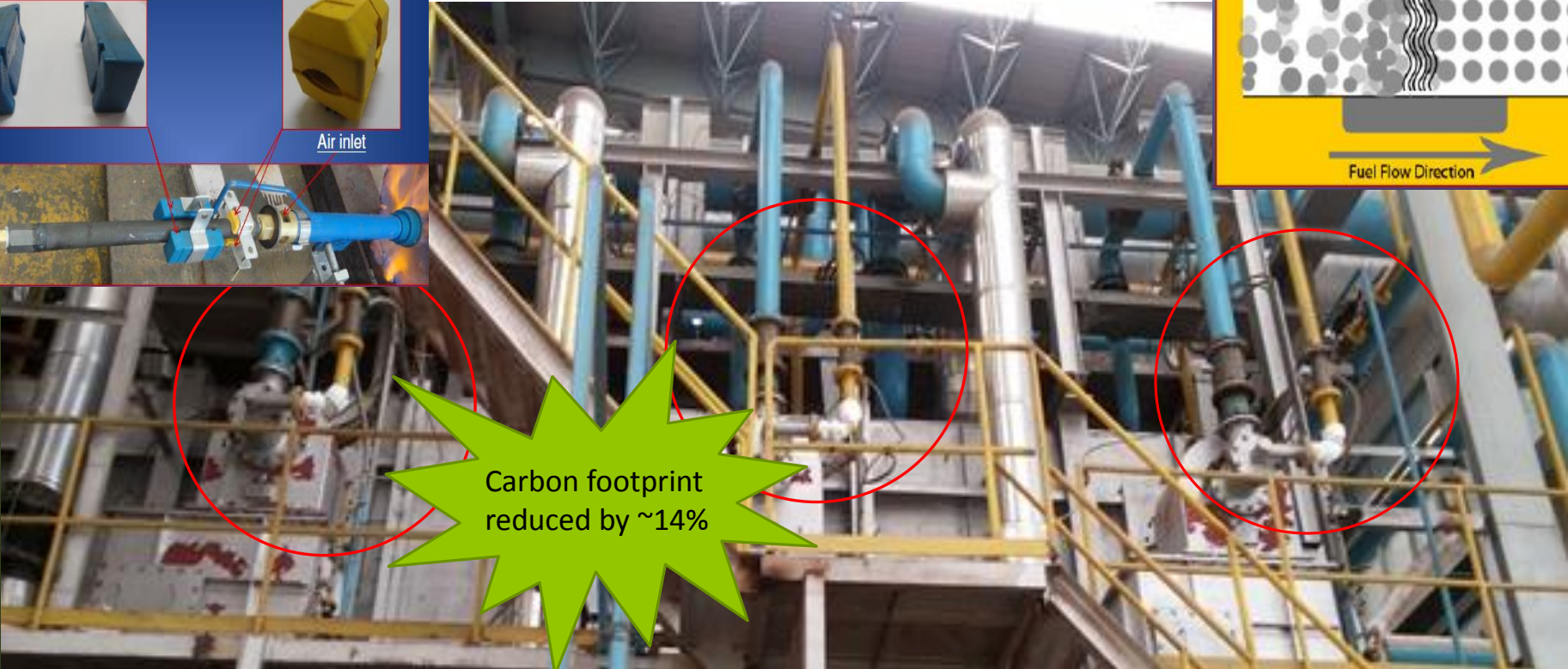
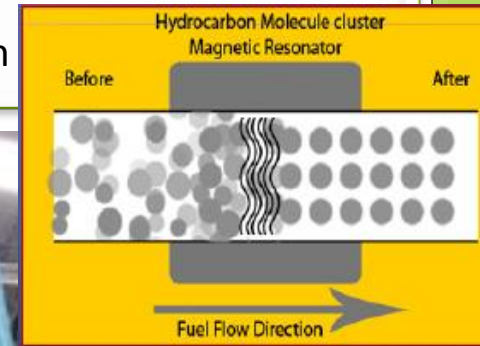
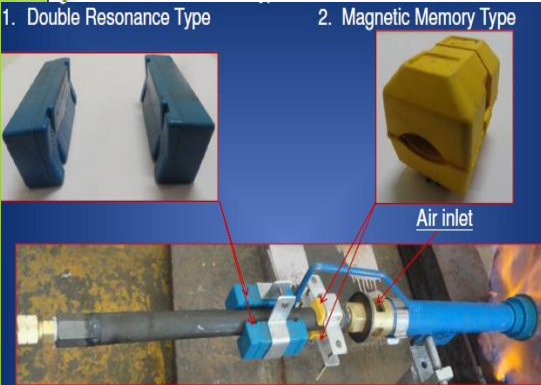
Energy Saving



Magnetic Resonators on Reheating Furnace

Natural Gas consumption reduced by providing Magnetic Resonator in RH 300 furnace

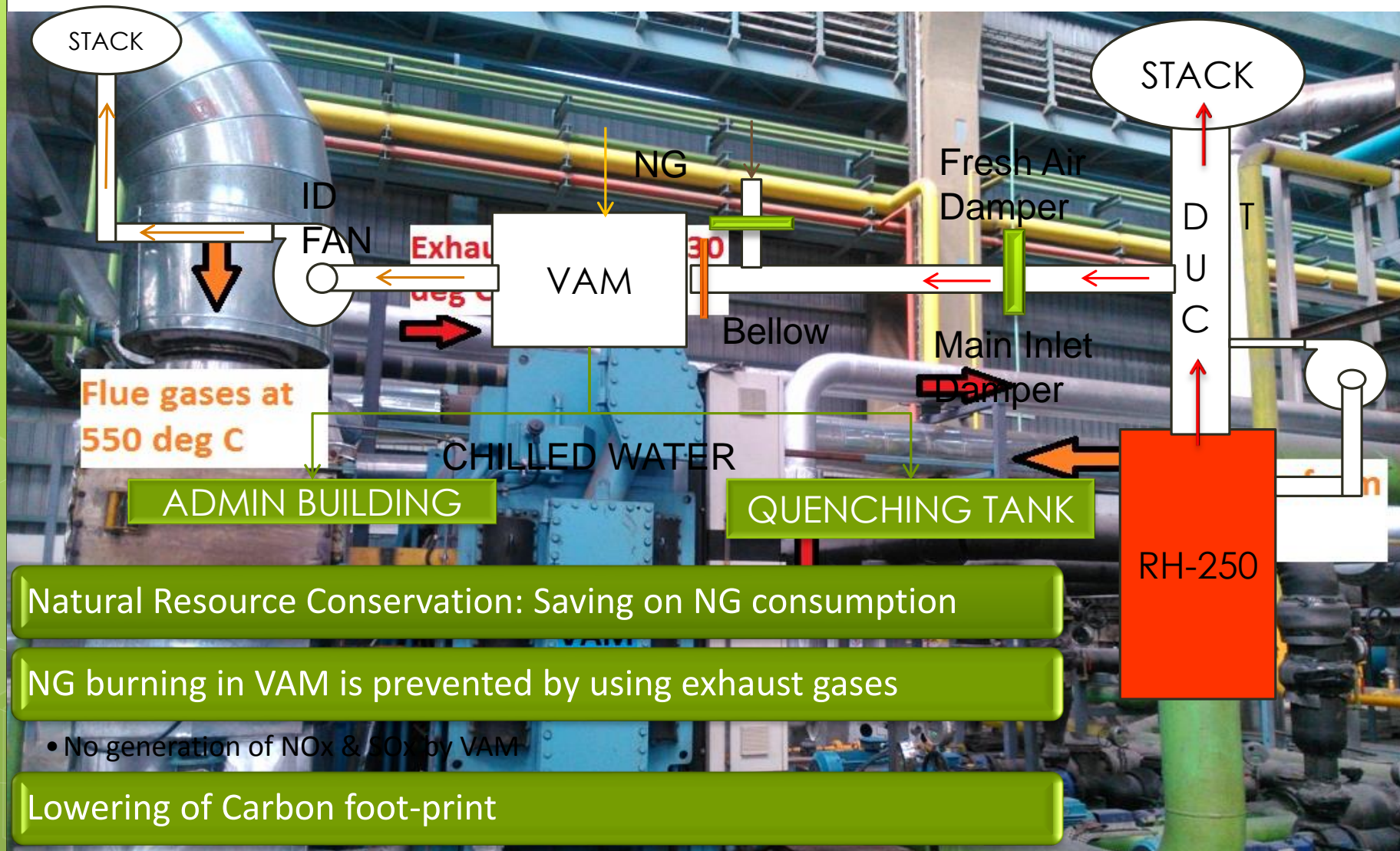
- Magnetic resonance technology improves specific contact between inlet air & fuel molecules by polarising fuel & expanding fuel clusters
- Experiments conducted on burners show ~ 15% increase in efficiency wrt fuel consumed per degree of temperature rise
- Approximate natural gas saving is 0.5 mil Ncm/annum: 10% Reduction



Carbon footprint reduced by ~14%



Heat Recovery from Flue Gases of RH250 to operate Vapour Absorption Machine (VAM) for Quenching Operations & Facility Cooling



Natural Resource Conservation: Saving on NG consumption

NG burning in VAM is prevented by using exhaust gases

- No generation of NOx & SOx by VAM

Lowering of Carbon foot-print



L&T's SUSTAINABILITY INITIATIVES

Climate Change
Carbon footprint
mapping



Energy
Conservation



Water
Conservation



Material
Management



Safety



Community



Sustainability
Report 2014

Sustainability report
'GRI Checked' A+

Thrust Areas

1st Indian E&C
Company to report
Sustainability

1st Indian E&C Company to do organization wide carbon footprint mapping



Steps for Sustainable Growth

Weight reduction

- Design Optimisation
- Use of High Strength materials



Material Substitution

- Composites
- Alternative Materials for Construction
 - 13.5 %Increase in use of cumulative fly ash
 - 7.5 %Increase in use of cumulative crushed sand



Recycle steel without melting

- Re-Use excess metal in Manufacturing of Jigs, Fixtures
- Steel recycled 4,282.41 tons
- Zinc recycled 53.74 tons



Recycling of Scrap

- 4915 T of Ferrous Scrap recycled in FY14





L&T's Sustainability initiatives – Green campuses

HZW – Technology Block



Talegaon – Main Block



LTSSH – Admin Building



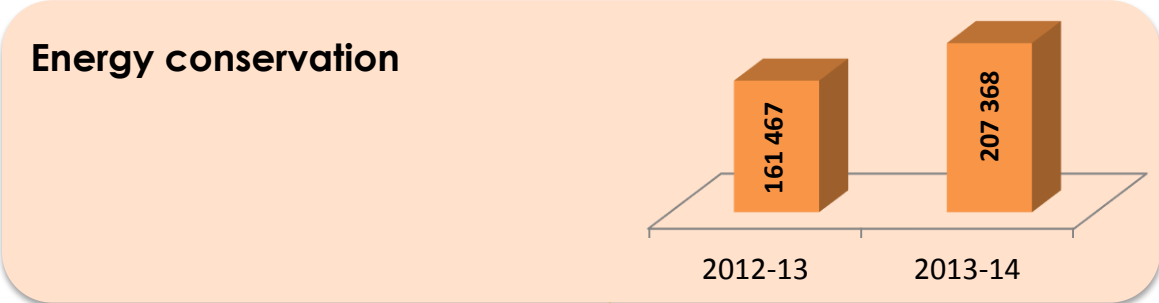
Kattupalli – Admin Building



HZW – SBU Block



Aligned with National Action Plan on Climate Change & UN Millennium Development Goals



Parameter	Values
Energy Consumption (GJ/employee)	132.82
Direct GHG Emissions (Tons/employee)	7.80
Water Consumption (m3/employee)	155.81

- Renewable power contributes 7.9 % of indirect energy
- Food waste processing plants for treatment of organic waste

- All 28 L&T Campuses are zero wastewater discharge
- 5 Campuses are water positive





Companies in the emerging economies are focusing on sustainability across the value chain as an integral part of growth:

1. Green Growth is necessary
2. Green Growth is measurable
3. Green Growth is affordable

Thank You

Small Acts when Multiplied by Millions of people will transform the World

- Howard Zinn

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