ENGINEER 2010 Carbon Footprint Control Project

'Realise' & 'Neutralise' Project Report

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1 Executive Summary

Eliminate Carbon Emissions (ECE) Pvt. Ltd was contracted by the 'ENGINEER 2010' CORE to calculate their Carbon Footprint Calculation (i.e. an inventory of the total Greenhouse Gas Emissions (GHGs) that contribute to Climate Change), resulting from direct and indirect resource consumption through the annual technical fest's operations.

The Total Carbon Footprint of ENGINEER 2010, estimated to be 29.3 tons CO2e, is comprised of the following activity-related Footprints, in order of decreasing magnitude: Travel and Logistics (11.2 tons CO2e – 38.4%), Electricity (9.6 tons CO2e – 32.8%), Food, Beverage, and Waste (4.4 tons CO2e – 14.9%) and Cooking & Diesel Fuel (4.0 tons CO2e – 13.5%). These activities would be considered to be the 'Key Source Category' activities for ENGINEER 2010

The Carbon Footprint estimate of 29.3 tons CO2e, to serve a outstation participants (1233) and local visitor base (3000) of 4,233 persons lead to a per-participant served Carbon Footprint of approximately 6.9 kg CO2e.

The results make it clear that the primary stakeholder contributions arise from activities related to the ENGINEER CORE (9.7 tons CO2e – 33.0%), Event Participants and Visitors (5.3 tons CO2e – 18.0%), Food Court (4.9 tons CO2e – 16.6%), and Judges/Guest Speakers (4.8 tons CO2e – 16.4%).

A noteworthy aspect of the event organization was the fact that guest accommodation was handled using in-house facilities; this elimination of luxury hotel accommodation helped curb a component of Carbon Footprint which is usually significant for most mass events. This arrangement allows for energy efficiency control and monitoring within the event premises and diminishes the likelihood of extravagant energy consumption prevalent in the hospitality industry in India.

2 Introduction

Eliminate Carbon Emissions (ECE) Pvt. Ltd was contracted by the 'ENGINEER 2010' CORE to calculate their Carbon Footprint Calculation (i.e. an inventory of the total Greenhouse Gas Emissions (GHGs) that contribute to Climate Change), resulting from direct and indirect resource consumption through the annual technical fest's operations.

'Engineer 2010' embarked upon this unprecedented approach towards achieving total environmental accountability motivated by personal conviction about the reality of Climate Change and its direct relationship with resource consumption of educational enterprises. NIT (K)'s ENGINEER 2010 CORE recognized its prestigious position amongst all Technical Fests held in India and clearly identified the immense leveraging possibilities available to it to infuse climate change consciousness into its student and participant base; inspiring its network of stakeholders to recognize their potential as individual Climate Change 'solvers'.

This report encompasses the first phase i.e. 'Realise', of the three-phase project comprising of Carbon Footprint Calculation ('Realise'), Carbon Footprint Minimisation ('Minimise') and Carbon Footprint Neutralisation ('Neutralise'). Pre-Tournament Carbon Footprint Estimation commenced in September 2010 subsequently followed by the final Carbon Footprint Activity data gathering research process commencing during the Festival held from 21st to 24th October 2010. The time-period of analysis chosen was the entire planning, execution and hosting period – including pre-event activities and consumption related directly with the festival planning.

3 Project Goals

The goals of the 'Realise' phase of the project were to determine, with the greatest possible degree of accuracy, the following for ENGINEER 2010:

1. Total Resource Consumption Inventory.
2. Total Carbon Footprint
3. Activity-Differentiated Annual Carbon Footprint
4. Stakeholder-Differentiated Annual Carbon Footprint..
5. Contextualization of Total Carbon Footprint and Carbon Emissions Intensity of Stakeholder Operations.

The collective analysis of the above aspects of operation would represent the GHG Emissions Baseline for the Annual Event against which future efforts would be benchmarked for assessing the magnitude and impact of measurable and verifiable Carbon Footprint mitigation measures.

Finally, the aggregate and dissected Carbon Footprints were to be understood and explained in the context of easily understandable terms (i.e. commonly understood units of Climate Change impacts) to provide perspective that serves to inspire and define actions towards participative (i.e. involving all Stakeholders) mitigation of impact on Climate Change through footprint minimization.

Results of the above research and analysis were intended to serve as a diagnostic tool to synthesize a rational, prioritized roadmap for Carbon Footprint and Resource consumption Minimization without hindering the fundamental pre-requisites of ENGINEER's operations and service delivery.

4 Project Scope

Boundaries for the Carbon Footprint Calculation process were defined in consultation with ENGINEER Management. Defining boundaries involved two key-decision making areas: activities to be included (i.e. defining a comprehensive yet manageable set of resources who's consumption was to be inventoried) and stakeholders to be considered as part of the organization's footprint (i.e. defining which sets of peoples/groups/functions are to be included within the footprint boundary).

Since Carbon Footprint Reporting for events in India is not mandated by the Indian Government , nor by the United Nations Framework Convention for Climate Change (UNFCCC), and ENGINEER's initiative to address it's Climate Change Impacts are purely voluntary, no set of pre-established guidelines were required to be followed for boundary definition. In the absence of explicit guidelines for GHG Emission Reporting by Indian Businesses, the globally accepted methodologies for National GHG Emissions Reporting (adopted by India as part of the Kyoto Protocol) laid down by the IPCC (Inter-Governmental Panel on Climate Change) as part of the 2006 Guidelines were used for guidance wherever appropriate. However, given the fact that events are a hybridized 'service' activity, the overall methodology reflects a confluence of standard protocols and business-appropriate approaches which would provide an accurate estimate of its Climate Change Impact .

4.1 Activity Boundaries

In order for Carbon Footprint calculation to be considered comprehensive it is essential to include all activities that impact it. However, since every activity involves some resource or energy consumption, each has a footprint. Clearly, this would render the entire exercise impossible to complete in a finite time-frame. The twin goals of comprehensiveness and manageability are achieved be defining activities known as 'Key Source Categories' and analyzing them comprehensively while paying lesser attention to those outside that framework. 'Key Source Categories' categories are defined as those who's collective contribution account for 95% of the total footprint (when added incrementally in the order of decreasing contribution). It is evident that technically 'Key Source Categories' can therefore only be determined following the completion of the Carbon Footprint calculation – thereby defeating its utility as a guiding principle for defining activity boundary. However, irrespective of the nature of anthropogenic or business activity being analyzed, certain categories of activities can safely be presumed as being 'Key Source Categories'. Beyond these, others need to be identified based on rational considerations related to the specific nature of the business and following a detailed understanding of its operations. This process yielded the following activities as comprising the activity domain for Carbon Footprint calculation:

1) **Scope 1 Emissions:** Contributing Directly to Carbon Footprint – activities where direct control can be exercised over the magnitude of activity and the emission coefficient through technological choices.

2) **Scope 2 Emissions:** Contributing Indirectly to Carbon Footprint - activities where direct control can be exercised over the magnitude of activity but not the emission coefficient through technological choices.
3) **Scope 3 Emissions:** Contributing Indirectly to Carbon Footprint - activities where direct control can neither be exercised over the magnitude of activity nor the emission coefficient through technological choices.

Table 1 - Activity Boundary Summary

No.	Activity Sub-Type	Activity Group	Scope Type
1	Cooking Fuel	Fuel	Scope 1
2	Generator Fuel	Fuel	Scope 1
3	Petrol	Fuel	Scope 1
4	Fireworks	Flammables	Scope 1
6	Vehicular Travel - 2 Wheeler	Travel	Scope 1
7	Vehicular Travel - 4 Wheeler	Travel	Scope 1
8	Vehicular Travel - HMV	Logistics	Scope 1
9	Electricity	Electricity	Scope 2
10	Water	Water	Scope 2
11	International Air Travel	Travel	Scope 3
12	Domestic Air Travel	Travel	Scope 3
13	Rail Travel - Local	Travel	Scope 3
14	Rail Travel - Long Distance	Travel	Scope 3
15	Bus Travel - Local	Travel	Scope 3
16	Bus Travel - Long Distance	Travel	Scope 3
17	Taxi Travel	Travel	Scope 3
18	Autorickshaw Travel	Travel	Scope 3
19	Meat	F&B	Scope 3
20	Seafood	F&B	Scope 3
21	Dairy	F&B	Scope 3
22	Alcoholic Beverages	F&B	Scope 3
23	Bottled Water / Drinks	F&B	Scope 3
24	Waste Generation	Waste	Scope 3
25	Paper	Consumables	Scope 3
26	Plastic	Consumables	Scope 3

4.2 Stakeholder Boundaries

Stakeholders are defined as those groups of persons, service providers, beneficiaries, customers etc. that directly or indirectly participate in Carbon Footprint creation activities of a organization. As in the case of activity boundaries, this list too is technically nearly infinite since the 'indirect' contributors to an organization's footprint is an unbounded set of groups engaged in enterprise all across the globe. Since voluntary Carbon Footprint calculation and emission inventorying falls outside the domain of any internationally binding IPCC guidelines, 'Stakeholder Boundary' is determined through consultation with the Client. While accountability for those entities directly part of its own operations is the cornerstone of the exercise, organizations are at liberty to select some operations outside its direct control but one's that are logically connected to or natural extensions of its direct operations. The outcome of these discussions with Management is the Stakeholder Boundary presented in the table below.

Table 2 - Stakeholder Boundary Summary

ID	Stakeholder Name
Sub-Entity 1.01	Engineer CORE
Sub-Entity 1.02	Committees
Sub-Entity 1.03	Volunteers
Sub-Entity 1.04	Event Participants & Visitors
Sub-Entity 1.05	Online participants
Sub-Entity 1.06	Food vendors
Sub-Entity 1.07	SS stalls
Sub-Entity 1.08	FC, Amul, Reddy's etc
Sub-Entity 1.09	Guest house
Sub-Entity 1.10	Engineering & maintenance
Sub-Entity 1.11	Judges/Guest speakers

4.3 Life-cycle Boundaries

Carbon Footprint is essentially the product of multiplying activity data with GHG Emissions Factors (EFs). Emission Factors are indicative of the quantity of GHGs emitted per unit of activity. As an illustration, an EF of 1 kgCO2e per kWh of electricity indicates that generation/consumption of 1 unit of electricity (i.e. 1 kWh) causes the emissions of 1.56 kg of Carbon Dioxide Equivalents. It must be emphasized that these are 'indicative' since the true EF for any activity is technically unbounded; the reasoning for this is identical to the rationale provided in relation to the infinite nature of Activity and Stakeholder Impacts on Carbon Footprint. As an activity's EFs are investigated further-back into its life-cycle to include, beyond primary influences, secondary and tertiary impacts, the mathematical magnitude of the EF increases albeit to a gradually diminishing degree. Revisiting the example of electricity emission factors, the value of 1 kgCO2e/kWh would increase if analysis boundaries were expanded beyond the impacts of direct combustion of coal, diesel and other fossil fuels used for power generation to then include the energy expenditure to mine the fossil fuels. Its magnitude would further increase if the analysis boundary were radially extended to envelop the resource and energy consumption to create the capital goods (machinery, factories etc.) required to harness these natural resources. This expansion can be understood as 'penetrating deeper into the life-cycle of a product or service. Concisely stated, EF magnitudes are a dynamic function of the extent of life-cycle impacts selected for analysis in relation to the manufacturing process involved in creation of goods and services for human consumption.

Any Carbon Footprint analysis, so greatly dependent on the mathematical magnitude of EFs chosen, is therefore, by induction, a function of EF life-cycle analysis (LCA); selecting only primary aspects of LCA (such as direct emissions of fossil fuels) yields lower values of EFs while a more extensive LCA magnifies the impacts of the same activity and leads to a more conservative Carbon Footprint; a footprint that tends towards the 'true' Carbon Footprint of an activity. The following table presents the extent of LCA incorporated into the Emission Factors selected for the Carbon Footprint calculation.

Table 3 - Emission Factor LCA Status

No.	Activity Type	Emission Factor Status
1	Cooking Fuel	Direct Combustion
2	Generator Fuel	Direct Combustion
3	Petrol	Direct Combustion
4	Fireworks	Direct Combustion
6	Vehicular Travel - 2 Wheeler	Direct Combustion
7	Vehicular Travel - 4 Wheeler	Direct Combustion
8	Vehicular Travel - HMV	Direct Combustion
9	Electricity	Direct Combustion
10	Water	Direct Combustion
11	International Air Travel	Direct Combustion
12	Domestic Air Travel	Direct Combustion
13	Rail Travel - Local	Direct Combustion, Electricity
14	Rail Travel - Long Distance	Direct Combustion, Electricity
15	Bus Travel - Local	Direct Combustion
16	Bus Travel - Long Distance	Direct Combustion
17	Taxi Travel	Direct Combustion
18	Autorickshaw Travel	Direct Combustion
19	Meat	Partial LCA
20	Seafood	Partial LCA
21	Dairy	Partial LCA
22	Alcoholic Beverages	Partial LCA
23	Bottled Water / Drinks	Partial LCA
24	Waste Generation	Partial LCA
25	Paper	LCA
26	Plastic	LCA

5 Research Methodology

5.1.1 General Activity Data Research

The research methodology followed for the project was centered around the idea of dissecting the organization's operations and disaggregating consumption of resources to understand the consumption patterns 'ground-up'. While this approach was more time-consuming, as opposed to tracking all activities through a 'centralized' approach, it helped construct a detailed footprint-map that would be invaluable as an analysis tool to identify stakeholder contributions to overall footprint. The research methodology can be largely defined through the following components:

Activity data research for prior to the event was conducted through periodic meetings with ENGINEER CORE representatives. Questionnaires were used to define relevant Stakeholder groups, relevant activities as well as to create a 'activity vs. stakeholder mapping'. This process lead to a matrix which clearly identified the key direct and indirect emission sources for each stakeholder (i.e. Scopes were defined for each stakeholder – since what is direct emission sources for one stakeholder might be an indirect emission source type for another).

Electricity, Water and Fuel consumption data was obtained from previous year's data to begin developing a pre-event estimate. Subsequently, Scope-wise questionnaires were designed for use during the festival for activity data collection. A 8-member team devoted to this effort was charged with the responsibility of collecting daily activity data followed by a final aggregation at the end of the event. Data was collected through a combination of interviews with key stakeholder representatives and actual measurement and recording of observations (through site walk-arounds) wherever plausible and relevant.

Questionnaires used for activity data collection are presented in Appendix A.

Data not available through on-site investigation was procured post-facto and obtained in electronic form through email correspondence with relevant Management personnel representing Stakeholders.

5.1.2 Visitor Travel Activity Data Research

A significant part of the emissions generated during the tournament was anticipated to be caused directly through the travel of the visitors, participants, guest and speakers to the event. In usual cases, their accommodation at Luxury Hotels would have also been included in the activity boundary. However, a noteworthy aspect of the event organization was the fact that guest accommodation was handled using in-house facilities; this elimination of luxury hotel accommodation helped curb a component of

Carbon Footprint which is usually significant for most mass events. To ensure an exhaustive GHG Emissions Inventory of the Tech Fest, it was imperative to analyze the footprint of the participants that physically attended the event. Note: this excluded travel conducted by other stakeholder groups such as Judges, Guests Speakers, and the ENGINEER 2010 Management CORE/Committees/Volunteers prior to and during the event.

Methodology

A detailed, quantitative audience research was conducted to measure the emission whose various elements are as under:

a) Sample Size: A sample size of 101 respondents (approximately 10% of the overall expected attendance) was covered to ensure a statistically valid base. Since many of these participants traveled in groups, the total population 'represented' by the survey was 432.

b) The respondents were chosen at random – to ensure no bias while conducting the research.

c) Questionnaire and Administration:

The questionnaire was of the close-ended, multiple choice type and administered by surveyors who were specifically trained to record the various elements of information required for the overall study. Each questionnaire contained 12 questions and required approximately 2 minutes to record.

The questionnaire used for capturing travel activity data is presented in Appendix A.

6 Analysis Methodology

6.1 Resource / Activity Tagging

The activities included within the footprint boundary were further differentiated into multiple activity sub-types. Each resource/activity inventoried during research was tagged and collated under footprint-head groups. The table below presents the list of Activity Groups, Types and Sub-Types used for data classification. The governing principle for the elaborate data classification was to provide intrinsic intra-stakeholder and cross-stakeholder analytic capability across any specific Activity Group and aggregated footprint analysis across Stakeholders to compare relative Stakeholder impacts.

Table 4 - Resource / Activity Tagging

Activity Group	***Activity Type***	***Activity Sub-Type***
Electricity Consumption		
Electricity	Electricity	Electricity
Water Consumption		
Water	Water	Water - Municipal
Water	Water	Water - Tanker
Water	Water	Water - Well
Fuel Consumption (Non-Travel)		
Fuel	Cooking Fuel	LPG - Commercial
Fuel	Cooking Fuel	PNG
Fuel	Cooking Fuel	Wood
Fuel	Cooking Fuel	Electricity
Fuel	Cooking Fuel	Charcoal
Fuel	Generator Fuel	Diesel
Fuel	Petrol	Petrol
Flammables	Fireworks	Fireworks
Travel		
Travel	Domestic Air Travel	Dom. Air - Short
Travel	Domestic Air Travel	Dom. Air - Medium
Travel	Domestic Air Travel	Dom. Air - Long
Travel	International Air Travel	Int. Air - Short
Travel	International Air Travel	Int. Air - Medium
Travel	International Air Travel	Int. Air - Long
Travel	Intercity Travel - Public	Long Dist. Rail
Travel	Intercity Travel - Public	Long Dist. Bus
Travel	City Travel - Public	Local Rail
Travel	City Travel - Public	Local Non AC Bus
Travel	City Travel - Public	Local AC Bus
Travel	City Travel - Private	Autorickshaw
Travel	City Travel - Private	Non AC Taxi

Activity Group	***Activity Type***	***Activity Sub-Type***
Travel	City Travel - Private	AC Taxi
Travel	City Travel - Private	2 Wheeler - 4ST Petrol
Travel	City Travel - Private	Petrol 4-Door Car - City
Travel	Intercity Travel - Private	Petrol 4-Door Car - Highway
Travel	City Travel - Private	Diesel 4-Door Car - City
Travel	Intercity Travel - Private	Diesel 4-Door Car - Highway
Travel	City Travel - Private	CNG 4-Door Car - City
Travel	Intercity Travel - Private	CNG 4-Door Car - Highway
Travel	City Travel - Private	LPG 4-Door Car - City
Travel	Intercity Travel - Private	LPG 4-Door Car - Highway
Travel	City Travel - Private	Bio-Diesel 4-Door Car - City
Travel	Intercity Travel - Private	Bio-Diesel 4-Door Car - Highway
Travel	City Travel - Private	Electric 4-Door Car - City
Travel	Intercity Travel - Private	Electric 4-Door Car - Highway
Travel	City Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - City - Ambient
Travel	City Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - City - Frozen
Travel	City Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - City – Refrig.
Travel	Intercity Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - Highway - Ambient
Travel	Intercity Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - Highway - Frozen
Travel	Intercity Travel - Logistics	Diesel Heavy Motor Vehicle (HMV) - Highway – Refrig.
Food, Beverage, Waste		
Food & Beverage	Meat	Avg. Meat
Food & Beverage	Meat	Mutton
Food & Beverage	Meat	Pork
Food & Beverage	Meat	Chicken
Food & Beverage	Meat	Beef
Food & Beverage	Seafood	Fish
Food & Beverage	Dairy	Milk - Avg.
Food & Beverage	Dairy	Cheese
Food & Beverage	Dairy	Paneer
Food & Beverage	Dairy	Butter
Food & Beverage	Dairy	Fresh Cream
Food & Beverage	Rice	Rice
Food & Beverage	Alcoholic Beverages	Beer - Domestic
Food & Beverage	Alcoholic Beverages	Beer - International
Food & Beverage	Bottled Water / Drinks	Water - 20 Liter Jars
Food & Beverage	Bottled Water / Drinks	Water - 1 Liter PET Bottles
Food & Beverage	Bottled Water / Drinks	Avg. Soft Drink
Waste	Waste Production	MSW - Landfilled
Waste	Waste Production	MSW - Recycled
Paper, Plastic & Consumables		
Paper, Plastic & Cons.	Paper	Other Paper
Paper, Plastic & Cons.	Packaging	Cardboard Carton
Paper, Plastic & Cons.	Plastic	Other Plastic

Data collation done in such a manner allowed for quantities (i.e. liters, kgs, pieces of items, kilometers of air travel etc.) of the same resources or activities to be aggregated across Stakeholders. This would prove to be of utility as an overall planning and organizational tool for tournament operations redesign and other administrative interventions, if desired, beyond the purposes of Carbon Footprint analysis.

6.2 GHG Emission Factors

Activity data collated according to the framework described earlier was multiplied by the appropriate Greenhouse Gas (GHG) Emissions Factors specifically developed for India. These coefficients are presented in Appendix B. The product of the resource quantities and the GHG Emission Factors yielded the Carbon Footprint for the particular activity.

7 Results

7.1 Resource Consumption Inventory

The following table presents the extrapolated aggregated resource consumption inventory for ENGINEER 2010.

Table 5 - ENGINEER 2010 Resource Consumption Inventory

	Footprint Head	*Qty.*	*Meas. Unit*
	Total Participants	4,233	persons
1	***Scope 1 (Direct Emissions)***		
1.1	Fuel - Cooking Fuel	722	kgs
1.2	Fuel - Generator & Motor Fuel	533	kgs
1.3	Fuel - Other Fuel	0	kgs
2	***Scope 2 (Indirect Emissions - Electricity & Water)***		
2.1	Electricity	6,152	kWh
2.2	Water	NOT MEASURED	
3	***Scope 3 (Indirect Emissions - Other)***		
3.1	***Travel & Logistics***		
3.1.1	Domestic Air Travel	12,104	pass-kms[1]
3.1.2	International Air Travel	22,936	pass-kms[1]
3.1.3	Public Road & Rail Travel	571,724	pass-kms[1]
3.1.4	Private Vehicular Travel[3]	5,809	v-kms[2]
3.1.5	Logistics	NA	MULTI-UNITS[4]
3.3	***Food, Beverage, Waste***		
3.3.1	Meat & Seafood	65,186	kgs
3.3.2	Dairy	51,128	kgs
3.3.3	Rice	38,124	kgs
3.3.4	Alcoholic Beverages	47,941	kgs
3.3.5	Bottled Water / Drinks	778,987	kgs
3.3.6	Solid Waste	611,340	kgs
3.4	***Paper, Plastic, Consumables***		
3.4.1	Paper & Cardboard	84,648	kgs
3.4.2	Plastic	56,600	kgs
3.4.3	Fertilizers & Pesticide	101,915	kgs

Key:
1 - pass-kms: Passenger kilometers (accounts for shared vehicle occupancy)
2 - v-kms: Vehicle kilometers (accounts for distance driven by vehicle only)
3 - includes autorickshaw, taxi and private 4-wheeler travel
4 - 209 liters Diesel (HSD) and 1,184 kms of HMV, MMV & LCV travel

7.2 Total Carbon Footprint

The Total Carbon Footprint of ENGINEER 2010, for the activities presented in Table 1 and stakeholders presented in Table 2, is estimated to be **29.3 tons of CO2e.**

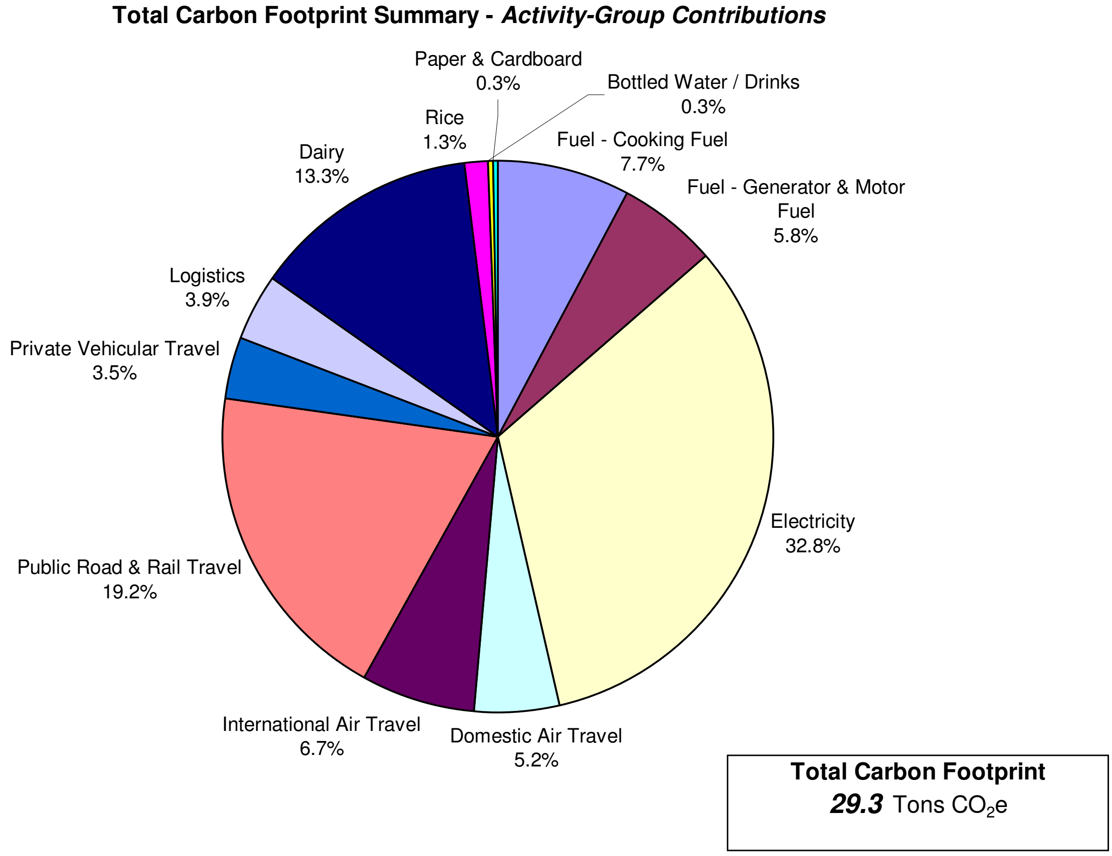
7.2.1 Activity-Differentiated Carbon Footprint

The following table presents the contributions to Total Carbon Footprint differentiated across all activity groups. The percent contributions are depicted in Figure 1. The results make it clear that the primary activities contributing to the ENGINEER 2010 Carbon Footprint are Travel and Logistics (11.2 tons CO2e – 38.4%), Electricity (9.6 tons CO2e – 32.8%), Food, Beverage, and Waste (4.4 tons CO2e – 14.9%) and Cooking & Diesel Fuel (4.0 tons CO2e – 13.5%). These activities would be considered to be the 'Key Source Category' activities for ENGINEER 2010 as defined earlier in the report.

Table 6 - ENGINEER 2010 Activity-Differentiated Total Carbon Footprint

	Footprint Head	*Carbon Footprint (tons CO2e)*	*% Contribution*
1	***Scope 1 (Direct Emissions)***		
1.1	Fuel - Cooking Fuel	2.3	7.7%
1.2	Fuel - Generator & Motor Fuel	1.7	5.8%
1.3	Other - Fireworks & Other Fuel	0.0	0.0%
	Sub-Total	***4.0***	***13.5%***
2	***Scope 2 (Indirect Emissions - Electricity & Water)***		
2.1	Electricity	9.6	32.8%
2.2	Water	NOT MEASURED	
	Sub-Total	***9.6***	***32.8%***
3	***Scope 3 (Indirect Emissions - Other)***		
3.1	Travel & Logistics		
3.1.1	Domestic Air Travel	1.5	5.2%
3.1.2	International Air Travel	2.0	6.7%
3.1.3	Public Road & Rail Travel	5.6	19.2%
3.1.4	Private Vehicular Travel	1.0	3.5%
3.1.5	Logistics	1.1	3.9%
	Sub-Total	***11.2***	***38.4%***
3.3	***Food, Beverage, Waste***		
3.3.1	Meat & Seafood	0.0	0.0%
3.3.2	Dairy	3.9	13.3%
3.3.3	Rice	0.4	1.3%
3.3.4	Alcoholic Beverages	0.0	0.0%
3.3.5	Bottled Water / Drinks	0.1	0.3%
3.3.6	Solid Waste	NOT MEASURED	
	Sub-Total	***4.4***	***14.9%***
3.4	***Paper, Plastic, Consumables***		
3.4.1	Paper & Cardboard	0.1	0.3%
3.4.2	Plastic	NOT MEASURED	
	Sub-Total	***0.1***	***0.3%***
Total	***(tons CO2e)***	**29.3**	**100%**

Figure 1 – ENGINEER 2010 Activity Contributions to Carbon Footprint



7.2.2 Stakeholder Contributions to Activity-Differentiated Carbon Footprint

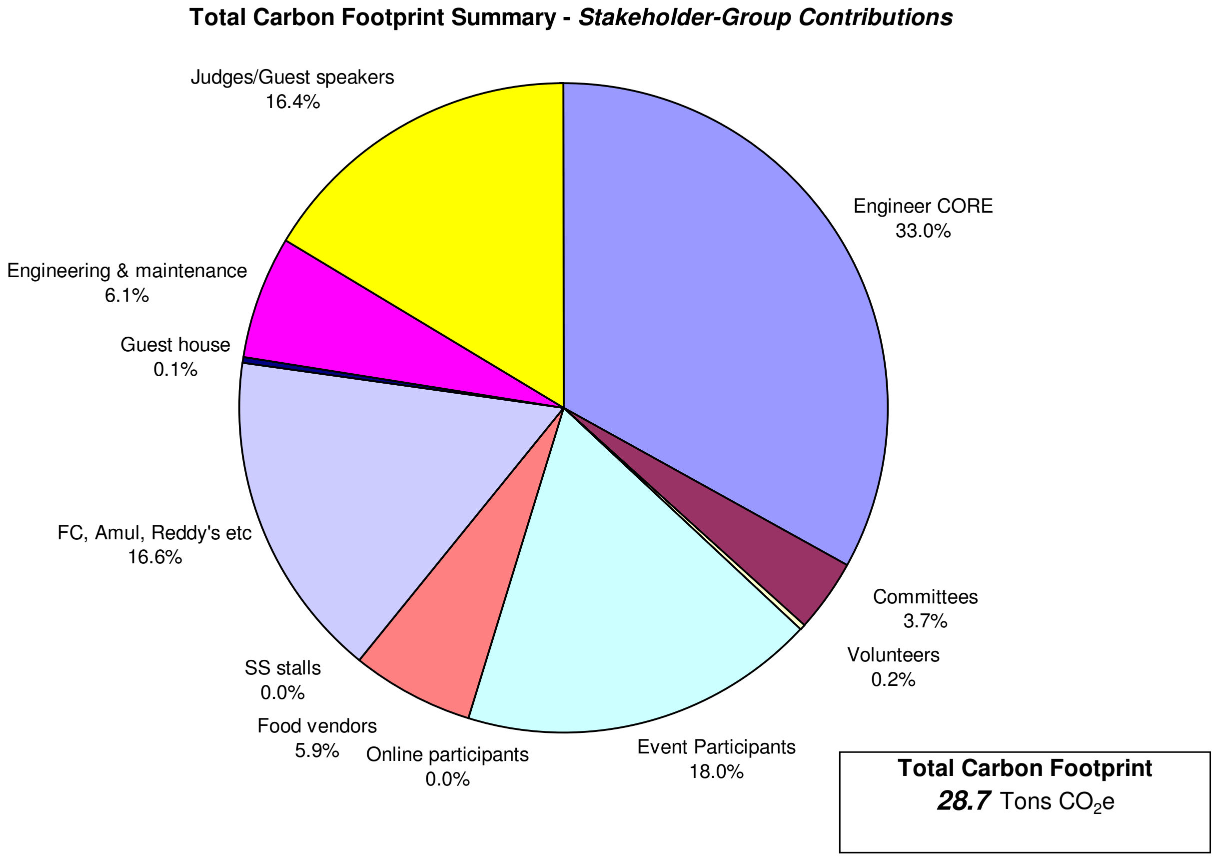
Table 7 presents the stakeholder contributions to the Carbon Footprints of all activities included within the footprint boundary. Percentage contributions are depicted in Figure 2 and indicate the relative importance of the various sources of resource consumption demands. Mitigating the Carbon Footprint of a particular activity would essentially involve a participative process that intersects with the key stakeholders that create a majority of the footprint (i.e. the largest contributors indicated in the pie-charts) of a given activity The results make it clear that the primary stakeholder contributions arise from activities related to the ENGINEER CORE (9.7 tons CO2e – 33.0%), Event Participants and Visitors (5.3 tons CO2e – 18.0%), Food Court (4.9 tons CO2e – 16.6%), and Judges/Guest Speakers (4.8 tons CO2e – 16.4%).

Further dissection of the Carbon Footprint exerted by major stakeholder groups reveals that ENGINEER CORE's primary impact arises from electricity use prior to (i.e. electricity consumption during meeting sessions), and during the event (i.e. electricity consumed during events in indoor climate-controlled rooms); electricity accounts for 9.6 tons of the 9.7 ton CO2e Footprint of the CORE. The Food Court's primary impacts are related to Diary consumption (2.3 tons CO2e) and Cooking Fuel consumption (1.8 tons CO2e). The impact of Judges/Guest Speakers arises mainly due to International Air Travel (2.0 tons CO2e) and Domestic Air Travel (1.5 tons CO2e). The Carbon Footprint of Event Participants and Visitors is a consequence of the Long Distance Bus and Rail Travel. However, it must be noted that the 'Carbon-Efficiency' of this Stakeholder group is very high due to the reliance on mass transit systems and relatively lower reliance on private vehicular transport to the event; the magnitude is a consequence of the greater population size that comprises this group as opposed to others.

Table 7 - ENGINEER 2010 Stakeholder-Differentiated Total Carbon Footprint

	Stakeholder	***Carbon Footprint (tons CO2e)***	***% Contribution***
1.01	Engineer CORE	9.7	33.0%
1.02	Committees	1.1	3.7%
1.03	Volunteers	0.0	0.2%
1.04	Event Participants & Visitors	5.3	18.0%
1.05	Online participants	0.0	0.0%
1.06	Food vendors	1.7	5.9%
1.07	SS stalls	0.00	0.0%
1.08	FC, Amul, Reddy's etc	4.9	16.6%
1.09	Guest house	0.0	0.1%
1.1	Engineering & maintenance	1.8	6.1%
1.11	Judges/Guest speakers	4.8	16.4%
Total		**29.3**	**(tons CO2e)**

Figure 2 – Total Carbon Footprint Summary – Stakeholder Groups Breakdown



8 Context of Total Carbon Footprint

The ENGINEER 2010 Carbon Footprint estimate of 29.3 tons CO2e was created by activities to serve a participant and visitor base of 4,233 persons. Based on this, the per-participant Carbon Footprint is estimated to be approximately 6.9 kg CO2e.

The quantity of Carbon Dioxide absorbed by a tree is a direct function of the growth stage (young, mature or old tree), the specific species of the tree, the quantity of foliage (leaves), size of tree etc., and hence it is incorrect to think of the Carbon Dioxide absorption capacity of a tree as being a simple static number that applies in all instances. However, for indicative purposes (to present some perspective on the relative Climate Change impacts of activities) it becomes necessary to arrive at some general consensus about the number of trees that would be required to 'offset' the Greenhouse Gas emissions from human activities. Research presented by the United Nations Environment Program (UNEP) as part of its 'Billion Tree Campaign' states that an average tree absorbs 12 kgs of CO2 per year. Assuming an average life-span of 20 years for a tree (accounting for tree-planting mortality rates etc.), this equates to 240 kgs or approximately 0.25 tons of CO2e as the Carbon Dioxide absorption capacity of a tree over its lifetime. Thus, a Carbon Footprint of 1 ton of CO2e can be thought of as requiring the planting of approximately 4 trees to 'neutralize' its impact. It must be emphasized that this shouldn't be misconstrued as an endorsement of tree planting for neutralizing carbon footprint.

Based on the above approximations, the Total Carbon Footprint of ENGINEER 2010 can be thought of as requiring 117 trees to 'neutralize' its impact on Climate Change.

9 Discussion

9.1 Assumptions

Electricity:

1) Energy consumption of fans, lighting fixtures and Air Conditioning/Cooling equipment not measured values; obtained/calculated from technical literature or power ratings displayed on appliance.
2) Room usage hours (for defining electrical energy use profile) for pre-event and during event use based on approximations by ENGINEER CORE and not actual measured time values.

Paper, Plastic:

1) Paper content assumed to contain 0% post-consumer recycled content and assumed to be equivalent to A4 copier paper for the purposes of GHG inventorying.
2) Plastic not measured

Bottled Water:

1) Soft drinks assumed to be equivalent to Bottled Water for the purposes of GHG inventorying.
2) Proportion of plastic/water weight assumed to be constant across various bottled water categories and hence only total litres measured to estimate GHG emissions.

Food:

1) GHG Emissions coefficients for Chicken, Cheese, Cream, Butter and Yogurt based on international LCA data from 'Gemis 45' database.
2) All Ice Cream modeled as Fresh Cream
3) All Yogurt modeled as Milk

Travel:

1) All inter-city flight distances calculated using travelmath.com
2) All Car Travel (unless explicitly stated by Client) was assumed to be Petrol-fuel based

Water:

1) Quantity not measured. Based on pre-event interviews with operations personnel no extra water is purchased for event.

9.2 Data Gaps

The existing resource consumption inventory and Total Carbon Footprint magnitude is influenced by a few clearly identified data-gaps (in the context of the finite Footprint calculation boundary). Their impact on Total Carbon Footprint and the resultant Activity and Stakeholder differentiations is not expected to be significant but nonetheless critical for purposes of completeness. Primary amongst these data gaps are:

1. Lack of measurable verifiable data for Water Consumption during festival.
2. Electricity Billing information for all Event facilities.
3. Marketing and Advertising related Paper and Plastic (flex) consumption.
4. Solid Waste generation data to estimate methane emissions from landfilling of Municipal Solid Waste and determining recyclable resource wastage / potential for recycle during future events.

10 Limitations

10.1 Water Footprint

Water is a scarce resource and warrants study as a distinct entity beyond the Carbon Footprint implications involved in its processing and public supply distribution systems as well as on-site pumping. However, while this does study does quantify the total annual quantity of water used and its associated Carbon Footprint, it does not provide an estimate of the other (and possibly more significant) ecological impacts associated with high quantities of water usage. Moreover, the study does not include the 'embedded' Water Footprint implicit in the resources purchased and consumed themselves. Including this quantity would possibly exponentially increase the Total Water Footprint of ENGINEER 2010. However, state-of-art prevents such an exhaustive assessment to be conducted at this point in time.

11 Conclusions and Recommendations

11.1 Conclusions

The Total Carbon Footprint of ENGINEER 2010, estimated to be 29.3 tons CO2e, is comprised of the following activity-related Footprints, in order of decreasing magnitude: Travel and Logistics (11.2 tons CO2e – 38.4%), Electricity (9.6 tons CO2e – 32.8%), Food, Beverage, and Waste (4.4 tons CO2e – 14.9%) and Cooking & Diesel Fuel (4.0 tons CO2e – 13.5%). These activities would be considered to be the 'Key Source Category' activities for ENGINEER 2010

The Carbon Footprint estimate of 29.3 tons CO2e, to serve a participant and visitor base of 4,233 persons lead to a per-participant served Carbon Footprint of approximately 6.9 kg CO2e.

The results make it clear that the primary stakeholder contributions arise from activities related to the ENGINEER CORE (9.7 tons CO2e – 33.0%), Event Participants and Visitors (5.3 tons CO2e – 18.0%), Food Court (4.9 tons CO2e – 16.6%), and Judges/Guest Speakers (4.8 tons CO2e – 16.4%).

Activity analysis for the major Stakeholder groups reveals that ENGINEER CORE's primary impact arises from electricity use - accounting for 9.6 tons of the 9.7 ton CO2e Footprint of the CORE. The Food Court's primary impacts are related to Diary consumption (2.3 tons CO2e) and Cooking Fuel consumption (1.8 tons CO2e). The impact of Judges/Guest Speakers arises mainly due to International Air Travel (2.0 tons CO2e) and Domestic Air Travel (1.5 tons CO2e). The Carbon Footprint of Event Participants is a consequence of the Long Distance Bus and Rail Travel. However, it must be noted that the 'Carbon-Efficiency' of this Stakeholder group is very high due to the reliance on mass transit systems and relatively lower reliance on private vehicular transport to the event; the magnitude is a consequence of the greater population size that comprises this group as opposed to others.

A noteworthy aspect of the event organization was the fact that guest accommodation was handled using in-house facilities; this elimination of luxury hotel accommodation helped curb a component of Carbon Footprint which is usually significant for most mass events. This arrangement allows for energy efficiency control and monitoring within the event premises and diminishes the likelihood of extravagant energy consumption prevalent in the hospitality industry in India.

11.2 Carbon Footprint Offsetting Recommendations

An innovative offsetting method that is recommended for ENGINEER 2010 is a 'portfolio' of in-house measures to optimize resource and energy consumption. This approach, as compared to a conventional approach of purchasing CERs, is far more potent in its potential for creating sustainable behavioral change and inculcation of individual accountability for Climate Change amongst the students of NIT (K). Besides, these measures can be seen as net financial gains as they will invariably reduce operating costs for the educational facility as opposed to the increased expenses resulting from purchasing of expensive Carbon Credits from the international CER or VER market.

The recommended offsetting portfolio of in-house measures comprises the following:

1) Establishing a committee of students that will propagate the 'upby2' campaign devised by the Climate Change Research Analysis and Outreach Body - no2co2.in. A target of 8,000 'upby2' actions during December 2011 to October 2012 is suggested. This will lead to a estimated Carbon Footprint 'offsetting' of 2 tons CO2e.
2) 2 'earth-hours' per week (i.e. 8 per month) during December 2011 to October 2012 – with atleast 2,000 numbers of 40W tubelights switched-off for 1-hour. This would 'offset' an estimated 10 tons CO2e.
3) Setting up/fabricating low-cost in-house composting systems (community scale models – 'Manthans' – available through www.dailydump.org) for composting . Composting approximately 75 kgs biodegradable waste per day for a 12-month period will 'offset' the remainder of the 17.3 tons CO2 Carbon Footprint.