



*Climate Responsible Lifestyle Initiative  
@ Raj Bhavan - Kolkata*

**A Replicable Experiment for Sustainability Transition**



**Final Report**

Submitted to The Governor of West Bengal

*by*

Global Change Programme

Jadavpur University, Kolkata 700032, India

2009



*To*  
*Board on a Sustainable*  
*Development Pathway*  
*We need*  
*Conscious Human Choice*

*We need Leadership to Imagine, Implement and  
Inspire with Vision, Mission and Dedication*

*GCP-JU*

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## **CRLI at Raj Bhavan Kolkata**

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During recent years there has been a considerable increase in the general awareness on climate change. However when it comes to actually addressing the problem, a certain sense of helplessness tends to set in. Most common is an apathetic attitude founded upon the misguided view that since the problem has been created by “others”, nothing can be done by us as individuals to rectify or mitigate the situation.

Experts however stress that collective action as well as individual life style changes can significantly diminish harmful carbon emissions that are the root cause of climate change.

This report by Professor Joyashree Roy and her team is an account of a study of the voluntary action (VA) initiated at Raj Bhavan, Kolkata, to conserve energy and reduce emissions.

Raj Bhavan, Kolkata with its 84,000 sq feet building set in a 27 acre compound, is a large consumer of energy. Owing to its status as the office and residence of the Governor, it is supplied with continuous, uninterrupted, as well as unlimited electric power. The fuel consumption for motor cars in the Governor’s convoy and for vehicles used for other official purposes is also considerable.

Electricity is needed in the Raj Bhavan not only for indoor lighting, cooling and running of office appliances, but also for security purposes in the extensive gardens and the four gates. Since the rooms in this heritage colonial building are very large with high ceilings, artificial lighting is needed even during the day. Many rooms and ceremonial halls for State events are illuminated with ornamental chandeliers that may have more than 20 bulbs each. Each of the four wings of the palatial building have long, curving corridors that need to be lit. Lighting apart, numerous air conditioners and fans are needed for cooling of the offices, halls, guest suites and residential quarters. In the offices the lights and air conditioners are switched off overnight. However in the guest wings, when these rooms are occupied, at times they tend to remain on throughout the day and night. Lights at regular intervals all over the garden and at the gates are essential through the night for security reasons.

In view of the reality of climate change and the need for action to be taken as institutions or individuals to bring down carbon emissions, we took certain conscious decisions by way of VA to reduce energy consumption. Some were minor gestures like making sure lights, fans and air conditioners are not left on in unused rooms or put off as soon as any room is vacated. These actions aimed to prevent wasteful or negligent consumption and to promote more responsible use. Also the resumption of regular payment of charges for electricity consumption by senior staff for their residential quarters to encourage more controlled use. Changing over to CFL bulbs was another measure, as was installing a few solar lights in the garden.

A voluntary power cut for two hours every day had been introduced in the Raj Bhavan in May 2008 as a participatory gesture, in the context of fluctuations in power supply all over the state. Subsequently the aim was enlarged to reduce the consumption of electricity. This entails a complete power shut down for the entire campus including the Governor’s Study

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and Secretariat, Governor's suite and staff residences, in two periods of one hour each. We realized that this step also helped us serve the principle of energy conservation. At first there was some concern that these cuts would cause disruptions or inefficiency in the general functioning of Raj Bhavan. But the staff and even their families living within the campus have been cooperative and very soon an easy and comfortable adjustment to the power-off regime has taken shape. Guests at Raj Bhavan have been most cooperative and willingly climb up or down stairways when the lifts are not functioning. Of course during exceptional times such as visits of dignitaries like the President, Vice- President, PM, Chief Justice and others of eminence, and on certain special occasions, the power cut is temporarily discontinued or staggered for reasons of convenience and security.

Monitoring and reducing petrol consumption is another area in which a VA effort has been made. The number of cars in the Governor's convoy has been cut down and the speed of travel has also been reduced, especially on long distance tours. Drivers, when they are on non- ceremonial duty, are encouraged to switch off the engine at traffic signals whenever possible.

It is well known that there can be a general lack of concern for resources that come "free" with a tendency to use them too liberally, even thoughtlessly. There is often also an unwarranted feeling of 'entitlement' among 'high' users. In its extreme cases, there could also be overuse or exploitation, such as using electric stoves instead of gas burners for cooking when the electric supply is free. The concept behind our voluntary action has been to experiment with more thought out responsible actions as opposed to routine or habitual behaviour which often leads to unnecessary or wasteful use of resources. For instance, it used to be a general routine to put on all the lights and ACs or fans at least an hour prior to the time when the Governor enters his office. This was curtailed and the room was kept unlit and fans kept off until seconds before his entry.

The results of this study have proved to be most heartening. They demonstrate that relatively easy measures can make a significant difference to energy conservation and reducing carbon emissions, in addition to tangible financial benefits.

I am grateful to Professor Roy for undertaking this study so enthusiastically. I have requested her to give us recommendations to assist us in our aim to make Raj Bhavan a "carbon-neutral" campus.

I strongly feel that large consumers of electricity and fossil fuel should be the first to reduce their consumption of these resources and eventually adopt alternative energy sources. Raj Bhavans all over the country and other government institutions with extensive campuses as well as private organizations like hotels, business houses, commercial complexes have a greater responsibility in the collective effort to bring down carbon emissions and show the way for smaller institutions and society in general.

February 16, 2009

Gopalkrishna Gandhi

Raj Bhavan, Kolkata 700062

## **CRLI at Raj Bhavan Kolkata**

### **To the Hon'ble Governor and Chancellor –Jadavpur University**

This report tries to cover a number of issues raised and discussed with you and Smt. Tara Gandhi over the past one year in a number of bright, inspiring and enlightening face to face sessions at the historic building, the icon of Kolkata city, the Raj Bhavan. I am thankful for giving me the unique opportunity.

Climate change is a major concern today. Our climate change research at the Global Change Programme, Jadavpur University which started initially out of academic interest, over time has become a passion and self imposed mission for some of us. We volunteer our personal time, regular comfort to find solutions to the hardest challenge to human progress and its future. We have taken this as a mission. We are clear in our vision that it is human action 'today' which can start at individual and community level and who can give leadership to rekindle new hopes and redirect development pathways towards a sustainable future. We urge for dedication from each and every individual to the cause of smooth "transition to sustainability". Your earnest interest in finding solution to the problem with tangible steps reassured and stimulated our enthusiasm and we have come up with this report finally though we took more time than we expected at the beginning.

Raj Bhavan silently started a conscience driven Voluntary Action programme to mitigate climate change since 2005-06. Sir, you have taken up a small experiment with your institution's lifestyle by redirecting demand for climate friendly goods and services. Experts think this can provide 'first best solution' to long term problem of climate stabilisation. I am thankful to you for giving us the chance to take up the case study, to apply our methodology to assess the experiment by first citizen of the state. We are grateful for having your confidence on our expertise and providing us all out support to get access to all relevant information pertaining to Raj Bhavan's lifestyle. We consider ourselves privileged. We tried to translate Raj Bhavan – Kolkata's Voluntary Action as a demonstration Experiment to show what an institutional consumer can decide to do in a small way to deliver 'climate good' and which is able to produce a measurable, verifiable and reportable (MRV) reduction in GHG emissions, a much desired target set by Bali Convention .

On the basis of our discussions and need of the hour both nationally and globally we have tried to address the following frequently asked questions (FAQ) in this report:

- Can we as individual or community do something to alleviate global warming problem?
- How Indians can prioritise climate change issue over poverty, development and sustainable development?

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- What is the key element/ starting point to board on a sustainable growth path-technology or human decision?
- What is the contribution of Raj Bhavan Kolkata as a consumer in Green House Gas emission?
- Is Climate Responsible lifestyle enough to define a sustainable lifestyle?
- Can Raj Bhavan be made carbon neutral or carbon negative in the future?
- Can voluntary actions satisfy MRV (measurable, reportable, and verifiable)?
- Is mitigation affordable for us?
- What can be the least cost pathway for an institutional consumer to attain sustainability on low carbon /carbon neutral/carbon negative pathway?
- Can the case study generate any recommendation or policy guideline or strategies to provide operational content to global negotiation process and National Action Plan for Climate Change of Government of India?



### ACKNOWLEDGEMENT

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The GCP-JU research team humbly expresses their most sincere gratitude to the Hon'ble Governor of West Bengal, Shri Gopalkrishna Gandhi. Without his recognition of the problem of climate change and his sustained interest and support this report would not have taken this shape. His constant encouragement served as the motivating factor and guiding force behind this study. Very special thanks should be accorded to Smt. Tara Gandhi for the guidance received from her during half a dozen discussions on the study.

I must admit this report is culmination of our research efforts over past few years on sustainability transition and Possible Climate Responsible Response Strategies for Consumers. However, I must acknowledge the role of organizers and audience and trainees, of more than hundreds of awareness programmes/workshops/seminars and media persons over past 30 months, who, asked me time and again, after all my public or group speeches set very valid thought provoking questions. I will not use this space to acknowledge each and everyone by name but my heartfelt gratitude to all for taking up the cause of climate change as a serious issue. All gave me a chance to interact with large variety of stakeholders and to come up with an appropriate research question. But I will fail in my duty if I do not mention few landmark events in past 30 months which have triggered my research interest and time commitment to the Lifestyle and climate change issue. The count of 30 months starts from May 2007 when the IPCC (co-sharer of Nobel Peace Prize of 2007, (<http://www.ipcc.ch/>) AR4-WGIII approval session was on in Bangkok. On the last day the challenging question from government of India's delegation made all of us as IPCC CLAs think harder and longer hours to find a satisfactory answer and appropriate place in the final report to scientifically state what is the contribution of Lifestyle choice by consumers in Mitigation of climate change. To be honest IPCC AR4 report focused more on producers and not on consumers and due to lack of enough evidences from rigorous scientific research we the IPCC authors unanimously decided to make just a qualitative statement that both Technology and Lifestyle Choice can solve the problem of climate change. But mitigation potential or method of quantifying contribution of lifestyle choice was left as research gap to be resolved in future. I thank the Government of India's delegation represented by Dr. Subodh Sharma and Mr. Suriya Sethi who could pose a valid research question. In the following month under the leadership of Chairman Prof A.N Basu, West Bengal Pollution Control Board celebrated June 5, 2007 with collaborating partners to raise awareness among various stakeholders about the issue of climate change. My pledge there was to develop a tool which can be used by any consumer to assess their own climate responsible status. I urged to maintain a diary of climate responsible actions to each consumer. Globally 2008-09 was coined as the year to Kick the Habit of CO<sub>2</sub>. I take pleasure to recognize the role of Prof. Basu, first as Vice Chancellor of Jadavpur University and then as Chairman of West Bengal Pollution Control Board for recognizing the local relevance of the problem from the very beginning and for providing all possible support and encouragement to carry forward the climate change research under Global Change Programme of Jadavpur University. In October 2007 with support from Mr Meena the Principal Secretary, Department of Environment we could get various departments in Government of West Bengal to come on board with Global Change Programme of JU to

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host the IPCC dissemination workshop and got the chance to share the historic moment of IPCC winning the Nobel Peace Prize declaration and celebration. All these events led us at GCP-JU to expedite our research efforts on development of a tool for quantification of mitigation potential through Consumer Lifestyle choice. In 2008 when I took up the responsibility of convening lead author of Lifestyle chapter of Global Energy Assessment ([www.globalenergyassessment.org](http://www.globalenergyassessment.org)) the research got even more focused and internationally recognised. Over these 30 months I have seen enthusiasm, concern, criticism around climate change and role of individuals and communities to protect human well being. The final impetus for this report however came in when I was invited to Raj Bhavan –Kolkata accompanied by my ever enthusiastic research team to make a presentation on our thoughts of climate responsibility of consumers. This indeed gave us a boost to finally test our tool and its robustness. We acknowledge with thanks the valid demand from all we have met so far for concrete guidelines and recommendations for solution. All such genuine demands have made it possible for us to refine our methodology and finally to come up with this report.

This report tries to answer a few vital Frequently Asked Questions. We know this report has many new information to trigger behavioural response and help policy implementation and delivery. We apply here scientific tools developed in house by GCP –JU (methodologies CRLI and ResConST). We will appreciate any comment, suggestions and effort to implement the recommendations and new consumers to demand application of the methodology for testing robustness and their CRC and ResConST status. Our goal is finally to make it open source tool that can be used by any one with due acknowledgement to GCP-JU. The judgment on the quality of this report and usefulness of it finally rests with users of it. We are thankful to all the users of this report.

The preparation of this report took the concentrated efforts of a number of individuals over these past few months. Motivation and support from honourable governor to provide access to the GCP-JU research team to all departmental heads at very senior level has been the most crucial decision. Unless decision makers are motivated and take decisions for changing policies realizing the urgency of the problem, an institution cannot achieve its Climate Responsible Consumer (CRC) and Responsible Consumer for Sustainability Transition (ResConST) status.

The GCP-JU team would like to mention Shri Dipak Kumar Gautam, OSD and Special Secretary to Governor for providing us with the much needed administrative support. We would also like to express our gratitude to the all the officials at Raj Bhavan. The research team feels that without their kind and cordial support and cooperation this report preparation could not have been possible.

Heartfelt thanks are due to Shri. Mrinal Kanti Kundu, SGE, Raj Bhavan for providing us with valuable information and knowledge for the study. The team acknowledges his untiring support and cooperation. The twenty three page long document provided by him, reveals his understanding of the subject and his commitment to the cause. This document has been an important source of information for our present report.

During our course of interaction with the officials at Raj Bhavan we were delighted to find that all the offices at Raj Bhavan were keenly aware of the problems of climate change and

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were motivated towards energy conservation and climate change mitigation. A very special mention in this regard would be the estate office which has taken a number of measures to encourage energy conservation and to reduce carbon emission.

We are also very thankful to Shri. S.R. Upadhaya, Joint Secretary to Governor and Comptroller GHS, for his valuable inputs and his cooperation. Special thanks to Mr. Kumarjib Chakraborty ,OSD and Deputy Comptroller for giving us a full orientation of Raj Bhavan in terms of land use pattern.

I would like to acknowledge with thanks my colleague Dr. Biswanath Roy, Reader, Illumination Engineering, Electrical Engineering Department ,Jadavpur University and Joint-Director, School of Illumination Science, Engineering & Design Jadavpur University for providing us necessary support as and when we needed. Thanks are also due to Mr. Aniruddha Sinha Roy, Consultant Engineer [Electronics] and Proprietor of Electro Components & Systems for sharing his knowledge and technical expertise in the preparation of this report.

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Kolkata

Dated May 18, 2009



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**The central messages of the *Climate Responsible Life Style Initiative@Raj Bhavan-Kolkata Report*** are clear: consumers, especially bulk institutional consumers through their purchase policies and service level choices and decisions can contribute to carbon emission reduction. Voluntary mitigation action can become a lifestyle choice for high end consumers in India as well which has high potential to deliver global climate good.

Case of Raj Bhavan is a good example to establish what behavioural response can do going beyond technology and market failure. The study shows what are the scopes of improvement in regulatory mechanism, policy implementation and delivery mechanism in scaling up the lifestyle initiatives.

Urgent need is for institutional mechanism in India to encourage voluntary action (VA) from various types of consumers especially for high end Indian consumers and bulk institutional consumers. CRLI and ResConST methods of GCP-JU shows that VAs are in compliant with Bali Action plan which states need for Measurable, Verifiable and Reportable (MRV) actions.

Sustainability transition through climate responsible initiatives can provide a mutually reinforcing development alternative for India.

From 2006-07 voluntary action by Raj Bhavan started with implementation of both technological and behavioural measures. Unless measured in terms of climate good and accounted for in regular financial accounting framework with augmented resource accounting system global benefit cannot be verified, justified and scaled up.

Using detailed check list of energy using end use behaviour and land use pattern by consumers baseline emission level (BEL) associated with lifestyle patterns can be estimated using CRLI and ResConST methods and tools developed by GCP-JU which satisfies all necessary criteria mentioned in the literature.

Gross BEL of Raj Bhavan in 2005-06 was 408 ton of CO<sub>2</sub> emission per year from energy use. This excludes sequestration within campus. Lighting and space cooling demands are two major hotspots in emission as coal based electricity consumption from grid meets these demands.

Emission has been reduced by 73 tons/yr through Voluntary Actions (VA) at Raj Bhavan. Additional sequestration through land use pattern if added the current net emission is 122 tons/year of CO<sub>2</sub>.

Emissions from lighting service reduced 50% by behavioural measures and 13% by

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technology choice.

Raj Bhavan has gone beyond CRC status towards ResConsST. As responsible consumer Raj Bhavan has taken up the cost burden (consistent with polluter pay principle) to reach out to certified plastic recycling Units, waste segregation at source and disposal, water conservation through water recharge measures. All these activities can be categorized under broad umbrella of sustainable Lifestyle/consumption.

Pursuing climate responsibility ensures sustainability transition but following sustainable pathway may not ensure climate benefit at the beginning unless pursued with explicit goals.

Cost benefit analysis shows that energy efficiency measures and climate mitigation measures are economically viable and generates revenue for reinvestment. However, upfront costs are very high which may prohibit small consumers to adopt behavioural changes. These market failures can be corrected by regulatory interventions, global financing and technology transfer.

To keep India on low carbon pathway a wide variety of technological solutions can also be implemented but due to high mitigation cost global carbon price should be much higher than current CDM market price. India can take forward this strategic knowledge in global climate negotiations.

Mitigation is affordable, financially and economically feasible and provides tripple dividend through private monetary savings, climate good and surplus fund generation for implementing sustainable development goals or climate adaptation projects.

Lifestyle option through voluntary action generate financial savings for Raj Bhavan to the tune of Rs 3,68,923/year. Actions beyond energy consumption like recycling and recharge do involve cost. But interestingly the financial gain from energy efficiency improvement can be used for recycling activity.

Domestic carbon market needs to be encouraged to develop and provide appropriate incentives to small through large consumers and encourage right lifestyle choice in fast growing economy like India. Domestic carbon market with appropriate price tag and regulatory role of government as purchaser or facilitating purchasers can enhance energy efficiency programmes, fuel switch and good behavioural practices through consumer's participation.

Given the urgency of the situation globally any action towards mitigation is welcome. However, unless accounted for no action can be guaranteed to produce sustainability transition. First step to ensure accountability and net production of climate good, baseline emission needs to be known. Investments to produce climate good, water conservation etc. need to be accounted for under "genuine investment category" which is an indicator of sustainable development. This calls for training and mainstreaming of new performance

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accounting practices. Leadership and appropriate motivation is needed from highest government institutions.

Rationalising Institutional Accounting Practice is needed to report performance in terms of sustainable development goals. To attain sustainability transition institutions need to augment current accounting practices with accounts showing genuine savings and genuine investments along with regular savings, investment and consumption expenditure to track down contribution to sustainable development agenda. Accounting for climate responsible actions, environmental stewardship actions needs to be reported both in physical accounts and monetary accounts to show emission balance, resource use balance and monetary costs and return. This will enable institutions to track performances through sustainable development indicators.

Monetary savings from CRLI @Raj Bhavan can be accounted for as self generated fund for sustaining low carbon lifestyle or for financing transition to carbon neutrality. Monetary savings and climate dividends are to be shown in self generated earnings side in double entry book keeping

“CRLI” and “ResConST” as MRV tool can be adopted by institutions and consumers for voluntary disclosure of CRC and ResConST status. The tools can also be adopted under NAPCC for strategic knowledge management and for estimating mitigation potential for Indian consumers. The tool used here can be used to generate carbon labeling, carbon credit estimation and verification,

To achieve twin goals of real emission reduction rather than notional a single policy will be insufficient. A portfolio of actions with varying proportions is must. NAPCC if operationalised with portfolio of action appropriately designed and supplemented by MRV tool can be promoted as most desirable approach to climate change globally. Choosing the least cost path is most efficient theoretically but current market price of carbon as prevalent in CDM market will not be efficient if goal is real climate benefit.

Replicable elements of Raj Bhavan’s VA are for both bulk institutional consumers and individual consumers. Institutional consumer category is: government institutions/departments, hospitals, educational institutions, religious institutions, shopping malls, hotels. Individual consumer category can be individual or households.

Preparation of this report on assessment of Climate Responsible Lifestyle of bulk consumers in India has drawn upon wide variety of literature from multiple disciplines. The “CRLI” and “ResConST”<sup>1</sup> methodologies developed in house at GCP-JU are tools built for achieving emission reduction target from demand side management. Unless there is enough demand for mitigation progress will be slow. How can each citizen assess himself/herself as responsible consumer and gradually move up on the ladder from climate responsible consumer to Responsible Consumer with sustainability transition goal is a major challenge today.

Often times it is argued human behaviour does not change, so only hope and solution lies in technology research and innovation led by a few. This we believe is half truth. Technology is indispensable we do not deny but we believe more in imagination, creativity, good intentions, capability and action of vast humanity that can bring in all changes. Human behaviour is not sticky. It is indeed flexible and may be the most flexible thing on earth! If technology is hardware then software is the human behaviour. It is human decision that leads to technology invention, adoption, diffusion, deployment. So mind set, tastes and preference that are created by past conditioning, family and social values, by corporate ads, by neighbour's /community's /group's tastes and preferences needs to be relied on more to induce human action to invest in climate friendly solutions. Advancement is not synonymous with complex solutions. Complexity in solution is in contradiction with inclusive growth. More complex we make solution, more expensive we make the solutions, and less people will be able to board on the pathway for sustainability transition. Past development processes have not yet been able to include everybody with equal access to resources and technology and equity in well being. So at this juncture major question is can our new pathway for development be sustained and be inclusive of each and every individual? We need right software to run the society and induce human action. Corporates can take CSR that promote climate friendly behaviour. Schools can revise their civics teaching, moral value teachings, GK class contents, News papers in their lifestyle page can showcase right technology, sustainable production practices to change mindset. Above all, individuals, institutional heads can take decision to

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<sup>1</sup> CRLI and ResConST are methodologies and tools developed by GCP-JU consistent with MRV concept of Bali action Plan for reporting voluntary emission reduction by consumers through lifestyle choice. It can represent local specificities. It can be used for voluntary disclosure by any consumer. GCP-JU currently provides expert service from consumers especially bulk consumers on demand. Willing consumer need to send an expression of interest to become a member of “CRLI Alliance”. The member needs to volunteer to share detailed information as per check list of GCP-JU and GCP-JU in participatory approach will use the tools to generate CRC and ResConST status for the consumer with appropriate carbon credit points under it's STI (Sustainability Transition Initiative) and will look for a match from the members or potential members in the Virtual Voluntary Carbon Exchange Market (VVCEM). All these activities are part of GCP-JU outreach activity. For further details please visit [www.globalchangeprogramme.org](http://www.globalchangeprogramme.org)



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adopt alternative governance strategies to purchase policies that reflect the goal of sustainability. We took almost no time to create human likings for mobile technology instead of land telephone lines for communication. We adopt easily the role model's consumption pattern, dress style, mobility style, living style, house décor style. Media has a very high responsibility to promote the climate friendly lifestyle. It is the human behaviour and mindset where we need to bring in the change first. So solution lies not in technology first but human imagination and actions need to be the first driver. It is the human mind where comes first the imagination, desire and plan of action and then technology gets designed, deployed and adopted. Our mission is to dedicate some of our personal time to restore confidence in human action, choice and decision and creatively design a transition pathway to realise the vision of sustainable development that ensures equity and justice to all till eternity.

In preparation of the report we kept in mind that the individuals, institutions and communities will replicate. We are aware of our height, weight and age but are we aware of carbon footprint of our lifestyle? It needs to be like another statistic to be reported by each and everybody. Every product while reporting vitamin content must also report on the label the carbon emission status. Status report can be by three labels to start with: 'Carbon positive', 'Carbon negative' or 'Carbon neutral'. How can these become status symbol, rather than owning a small car or bigger car is the social value engineering that we need to work on. Policies can deliver a number of good actions if designed properly.

When the question is one of “Climate change mitigation action” any magnitude of action small or big is welcome. Be it voluntary or mandatory. The historic attempt towards global cooperation building and debate on how burden can be shared between major and small emitters under compensation mechanism under polluter-sufferer paradigm can continue both at political, international and national levels but the crux of the matter which is “mitigation action” cannot wait. The basic logic is bulk consumers of energy and producers can contribute more by taking mitigation action. Early voluntary actions by bulk consumers can set the ball rolling. To overcome any impasse what is needed today is responsible action to demonstrate possible, feasible actions and if they are measurable, verifiable and reportable, then both demonstration effect for scaling up and crediting for measurable reduction can be considered as environmental good which is socially in high demand.

Mistakenly many a times mitigation action is considered as production sector and thus supply side action programme. But this ignores the huge mitigation potential that can be achieved by consumer’s participation, consumer choice, consumer satisfaction and consumer’s responsible purchase behavioural response and leadership in upholding social values. In one word “Consumer’s Lifestyle Choice” is a very important driver of climate change and can be very powerful route to achieve climate mitigation as well. This route of mitigation: lifestyle choice and climate change mitigation connection has remained unexplored so far in burden sharing debate as well as mitigation negotiation debate.

#### **Leadership of Raj Bhavan-Kolkata**

When a bulk consumer makes a positive move to express it’s desire and decides to volunteer for taking up some positive steps to share ‘Responsibility’ towards climate change and looks for ways and means to change the institution’s operational Lifestyle- it provides a great opportunity for researchers and experts to evaluate and analyse what can be achieved and what can be done to activate the “Climate change Mitigation through Lifestyle choice route”. Such a detailed case study can provide a framework for consumer led mitigation action programme that can be formalized, scaled up, recognized as MRV, and that can enlarge participation of consumers through voluntary reduction route. Based on sequence of discussions we decided to present a report to cover the following **Objectives**.

## **CRLI at Raj Bhavan Kolkata**

### **Objectives of the Report are:**

- To describe Lifestyle in operation at Raj Bhavan-Kolkata that has direct relevance in the context of Climate Change and Mitigation to know Baseline Emission Load (BEL).
- Voluntary Action by Raj Bhavan –Kolkata towards energy efficiency since 2006-07 and beyond
- Are VAs (Voluntary Actions) Measurable?
- Cost of Voluntary Actions
- Voluntary Actions beyond energy efficiency
- To Evaluate the carbon emission balance of Operational Lifestyle of Raj-Bhavan-Kolkata as on date
- To Evaluate how viable is low carbon sustainable future of Raj Bhavan Kolkata financially
- To Evaluate alternative routes to make Raj Bhavan Kolkata carbon neutral.
- To depict the least cost path for carbon neutrality as Climate Responsible Consumer
- To show how strategic knowledge generation (8<sup>th</sup> Mission of NAPCC) through research and management is needed to provide operational content to National Action Plan for Climate Change of Government of India (NAPCC).

To achieve the objectives mentioned above, a wide variety of methodologies and strategies need to be adopted and implemented. The following sections are devoted to each of the objectives to describe methodology and strategies.

### *Objective 1. Lifestyle in Operation to know the BEL (Baseline Emission Load)*

In the context of climate change and consumer responsibility it is important to identify the end use activities and their operational style which comprehensively represent Lifestyle.

Raj Bhavan is Office as well as House of the Governor. But both the operations have common accounting system so far as energy service is concerned. So no attempt has been made to separate the two.

When considering consumer perspective we assume all consumers consume energy services to meet certain end use activity demand which we call here as Raj Bhavan operations. Following operations within Raj Bhavan have been considered in this report as contributor to carbon emission load. It depends mainly on how end use activities are organized to provide amenity services. The responsibility and liability will depend mainly on how these end use activities are being met.

- Nutritional service through cooking activity
- Illumination through artificial lighting
- Living and workspace ambience temperature control service or air-conditioning by cooling or heating activity.
- Mobility Service through elevator and vehicles
- Waste Disposal Service
- Access to water to meet multiple services like drinking, cooking, cleaning and gardening
- Water Heating

Consumers' share in emission load will vary depending on what energy resources they use to meet the above mentioned end use service demand. Table 1 represents current energy resource use for operational lifestyle. The energy use pattern is solely dependent on architectural design, building structure and the 'technology choice' and 'end use' activity level choices made by Raj Bhavan through its internal decision making process.

## CRLI at Raj Bhavan Kolkata

**Table 1. Fuels in Use Currently at Raj Bhavan-Kolkata.**

<b>Type of Fuel</b>	<b>Lifestyle activity</b>	<b>Location of activity</b>
LPG	Cooking	Onsite
Electricity Supply through grid connection from offsite generation	Water recharge	Onsite
	Water Heating	Onsite
	Water Pump	Onsite
	Elevators : Vertical mobility	Onsite
	Air conditioning	Onsite
	Lighting	Onsite
Transport fuel (Petrol and diesel)	Transportation using cars: horizontal mobility	Offsite

### **To know the BEL from Lifestyle**

The question of BEL (Baseline Emission Level) is important to know as our objective is to translate voluntary action to Measurable, Reportable and Verifiable. Since conscious decision as bulk consumer of power at Raj Bhavan for Voluntary actions to assume Climate Responsibility was undertaken from 2006-07, we take 2005-06 as the pre-action or Baseline year to arrive at BEL. Methodologically, it is important to know the source wise break up of total energy use by a consumer and how that is related to each of the consumer lifestyle service operation. This is useful to design climate responsible strategy based on hotspot identification in consumption pattern.

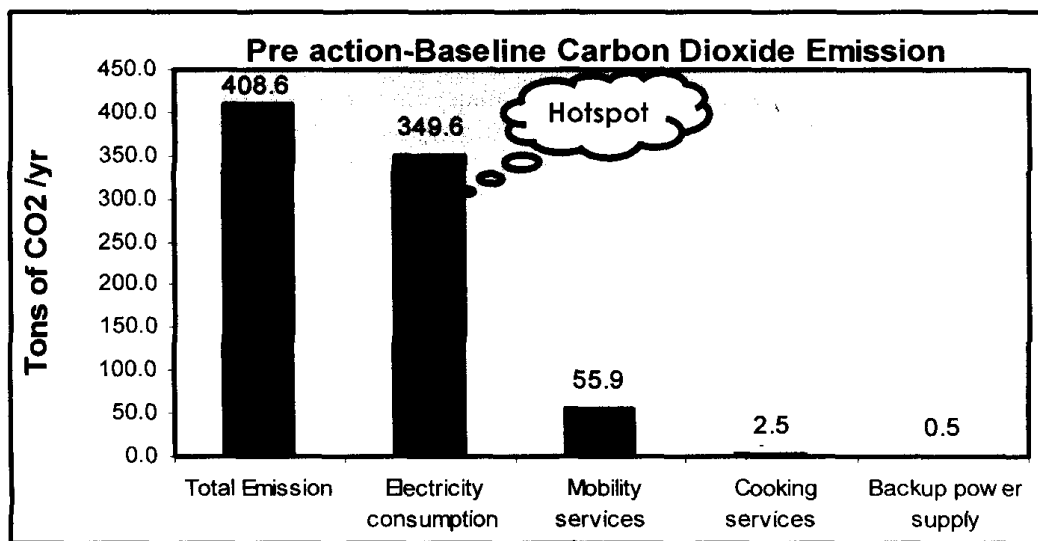
## CRLI at Raj Bhavan Kolkata

Raj Bhavan Estate Department supplied us with all the necessary and detailed data that we used for our purpose.<sup>2</sup>

**408 tons per year**

**Base line carbon dioxide emission from energy use as of year 2005-06**

Figure 1: BEL of Raj Bhavan energy service demand on 2005-2006



Source of carbon emission is not only from energy use but non energy end use activities as well. In our emission estimation we include both land use pattern in Raj Bhavan and waste handling activity as non-energy use activities that causes green house gas emission.<sup>3</sup>

- Hotspot is electricity using energy service
- Electricity is used for cooling (AC, Fans, Refrigerators), water heating, lighting, pumping water, running elevators, and operating office equipments

<sup>2</sup> Details of the methodology, data template are the copyright of GCP-JU 2009

<sup>3</sup> Emission Factors as per literature

## CRLI at Raj Bhavan Kolkata

### *Objective 2. Voluntary Action by Raj Bhavan –Kolkata since 2006-07 and beyond*

Voluntary Actions can have varying targets.

#### **To reduce energy use in provision of:**

##### ❖ **Lighting Services**

###### ➤ Purchase of efficient technology

- Energy saving Lamp installations (CFLs)

In the electricity sector a comprehensive plan of converting the lamps to energy efficient CFL lamps were carried out. However there has been no early retirement but during 2006-08 of the total 2972 new installations, 843 were CFL.

###### ➤ Curtailment of demand

- 100% Black out in the Auditing Area for 2 hrs daily

##### ❖ **Mobility Services**

###### ➤ Efficient use of vehicles

- Number of cars in the convoy reduced from five to four
- Shared occupancy in cars increased.

Total energy consumption is determined by level of activity and efficiency of energy conversion technologies.

***Total energy consumption = (Total Activity level) X (Efficiency of the technology to provide the service)***

Raj Bhavan adopted both the actions.

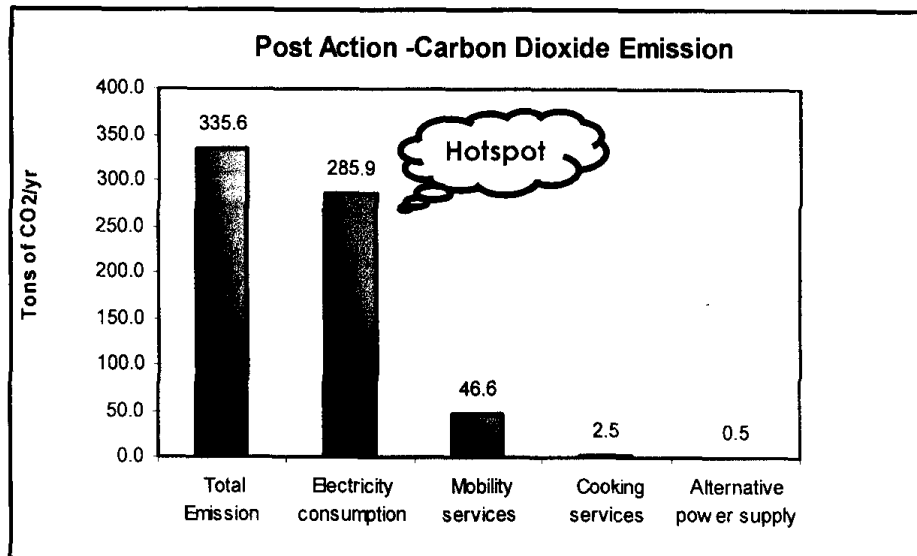
## CRLI at Raj Bhavan Kolkata

### *Objective 3 . Are Voluntary Actions Measurable?*

Raj Bhavan decision to adopt Voluntary action has been initially motivated by reduction in energy use. As a part of voluntary actions various technological and behavioural measures have been taken. The post action emission level is

**335.6 tons per year**  
**Post Action Carbon dioxide Emission as of year 2007-08**

Figure 2 : Post Action Carbon Dioxide Emission



**Emission Reduction due to Voluntary Actions is 73 tons**

Over the period from 2005-06 to 2007-08 Raj Bhavan has been able to save 9.3 tons of CO<sub>2</sub> in Transport, 63.7 tons in electricity sector annually.



Figure 3 : Carbon Dioxide Emission: Baseline vs. Post Action

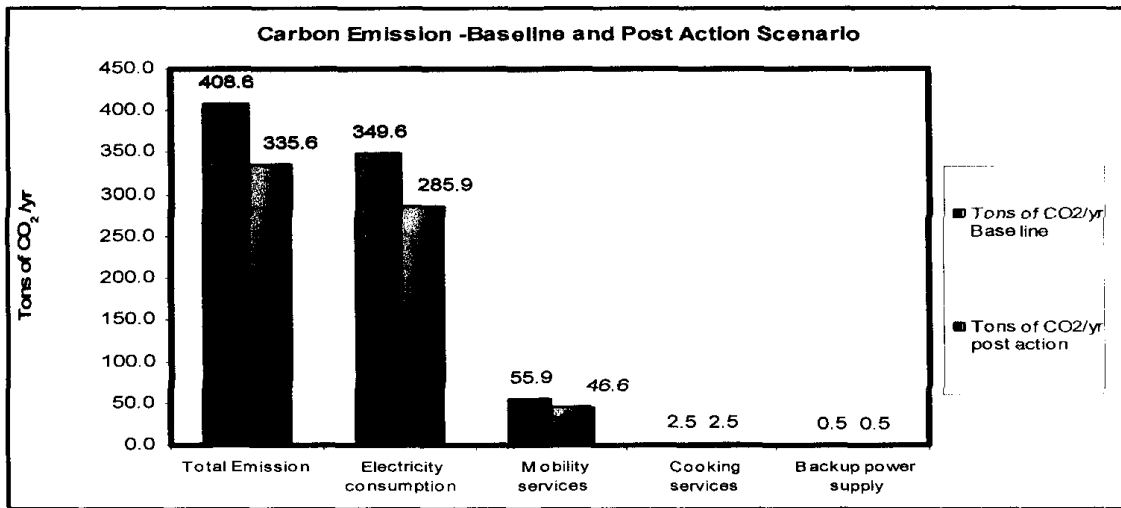
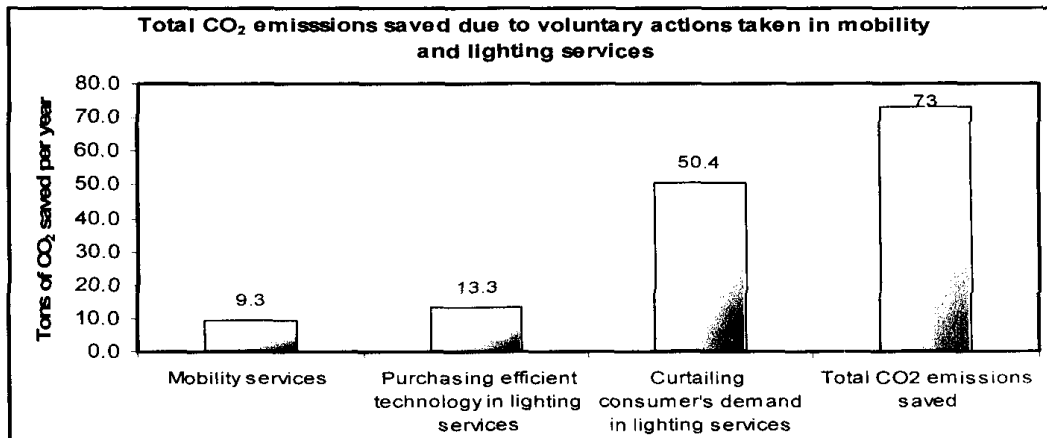


Table 2.

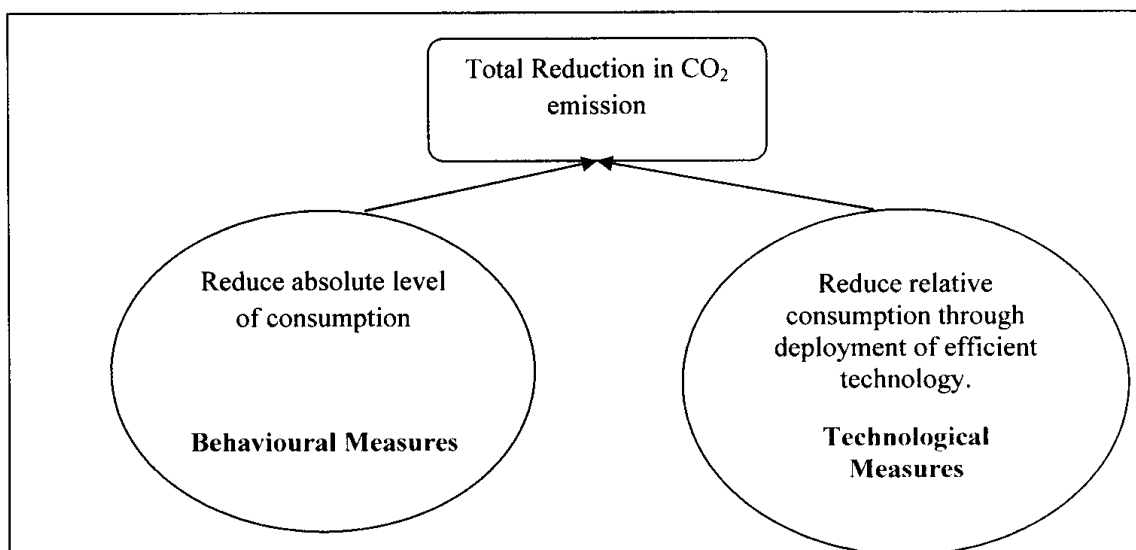
	Tons of CO <sub>2</sub> saved per year
CO <sub>2</sub> emission saved in mobility services through efficient utilization of vehicles	9.3
CO <sub>2</sub> emission saved in lighting services through purchase of efficient technology	13.3
CO <sub>2</sub> emission saved in lighting services through curtailment of consumers demand	50.4
<b>Total CO<sub>2</sub> emissions saved</b>	<b>73</b>

Figure 4:



### **Objective 4. Cost of Voluntary Actions**

Raj Bhavan has undertaken both technological and behavioural measures towards climate mitigation.



Mitigation action yields benefits as well. However there is cost involved in adopting mitigation.

- **Voluntary Action 1.**

- In Lighting Services:

- One time upfront cost of Rs. 1, 09, 590/- in the year 2006-07.
- However one time upfront cost is not the actual burden. The annualized cost of purchasing energy efficient technology is Rs. 8,766/- assuming CFL lamps have a lifetime of 10 years. So the annualized cost of mitigation is Rs. 8,766/-.
- The annual saving in electricity bill is Rs. 2,70,402/-

- **Voluntary Action 2.**

- In mobility services:

- The action had a negative cost i.e., net benefit by way of annual savings is to the tune of Rs. 98,520/-

## CRLI at Raj Bhavan Kolkata

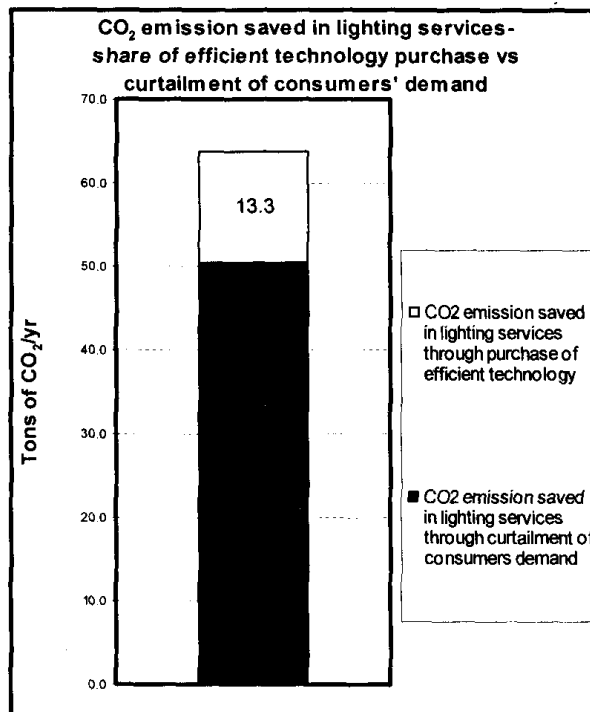
In the illumination services a comprehensive plan of converting the appliances to energy efficient lamps were carried out. Of total 2972 new installations, 843 lamps were CFL. Apart from technological actions, behavioural changes were undertaken to lower the wastage of energy. This has led to savings in electricity bill of the House as well as reduction in CO<sub>2</sub> emissions. Annual electricity bill has been reduced from Rs. 18,49,792/- in 2005-06 to Rs. 15,79,390/- in 2007-08. There has been

**15 % reduction in electricity bill owing to voluntary actions.**

**18% reduction in CO<sub>2</sub> emissions from electricity consumption as a result of the voluntary actions**

CO<sub>2</sub> emission from electricity consumption has reduced from 349.8 tons in 2005-06 to 285.9 tons in 2007-08. In total 63.7 tons of CO<sub>2</sub> emission from electricity sector was saved, out of which 50.4 tons of CO<sub>2</sub> is saved through behavioural measures and 13.3 tons of CO<sub>2</sub> emission is saved through technological measures.

Figure 5:



## CRLI at Raj Bhavan Kolkata

In the mobility services certain voluntary actions were taken which led to savings in both expenditure on fuel and reduction in CO<sub>2</sub> emission. It however needs mention that all the cars comply with energy environment norms specified by Bharat Stage II etc. Shared occupancy is introduced and the number of cars in convoy has been reduced from 5 to 4.

The reduction in the convoy size has led to savings of Rs. 98,520/- (annual) in expenditure on diesel. This has also reduced carbon dioxide emission by 9.3 tons annually.

Figure 6:

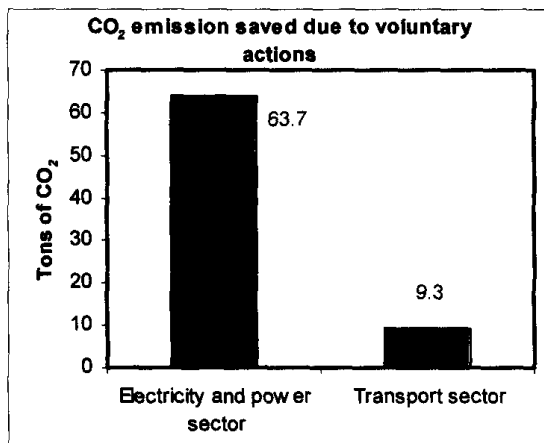
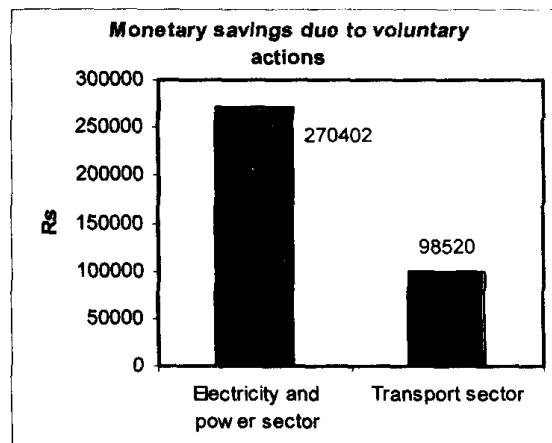


Figure 7:



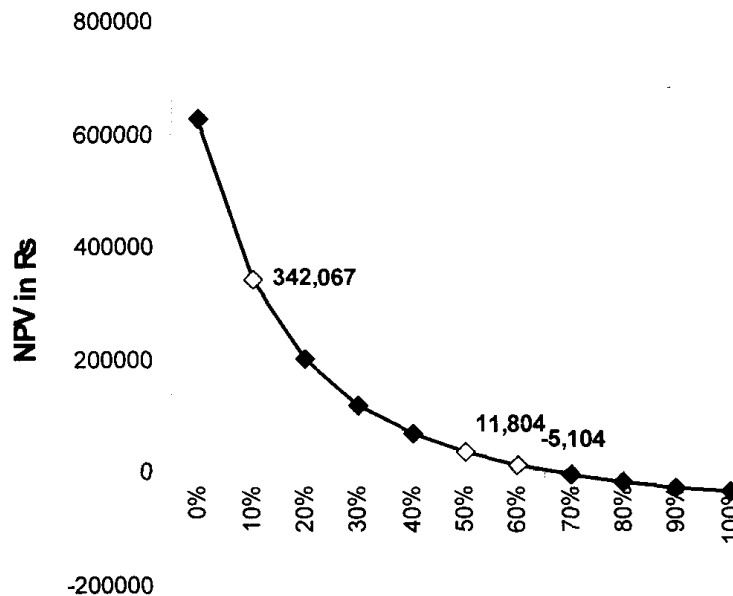
*Economic Feasibility of Investment in Energy Efficiency*

So far we have analysed climate benefits. Let us pose the problem from a standard consumer's perspective. Let us consider institutional consumer Raj Bhavan has adopted investment decision on buying "Energy Efficiency Service". The question is 'Does this investment project yield economically viable return and make good business sense from investor's /consumer's point of view?' Analysis by GCP- JU shows that it does make good business sense. Net present value of this project is Rs. 3,42,067/-, assuming the lifetime of the lamps is 10 years. The initial investment is refunded in one and a half years time period.

**The pay back period of VA is 1.5 years**

Though there is an initial investment but such projects are financially viable. Upfront cost is high but payback period makes very attractive form consumer's point of view.

Figure 8:



The horizontal axis shows the various interest rates (rates of return) used for calculation. The internal rate of return is 66.67%

## CRLI at Raj Bhavan Kolkata

### *Energy use: Cost burden at a glance*

Electricity serves 62% of the end use energy demand but it commands more than 70% of the total energy cost whereas LPG contributes to 2% of the energy supply and shares 1% of the energy cost.

Figure 9:

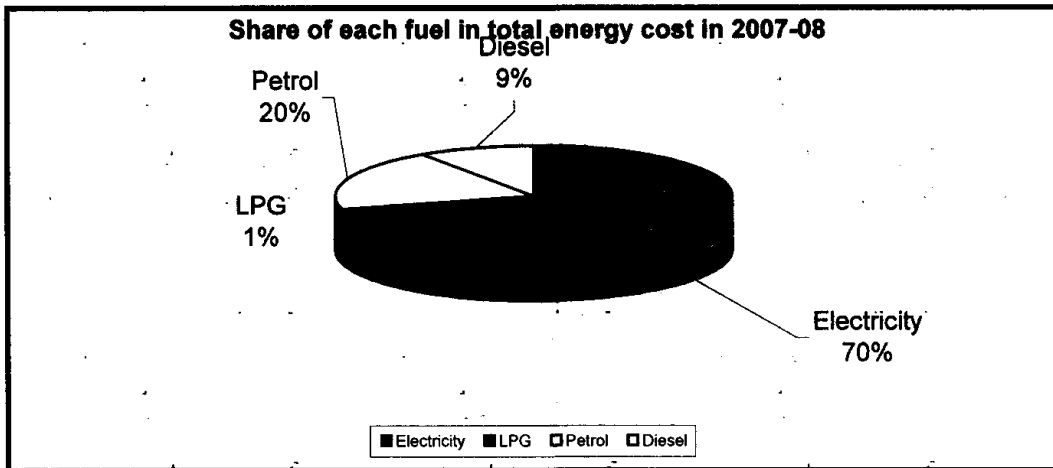
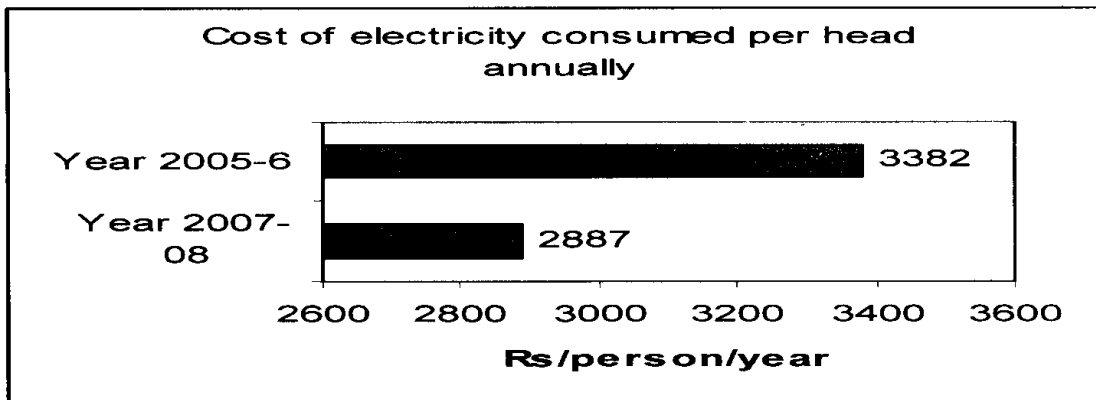


Figure 10:



Due to voluntary actions undertaken in power and electricity, the per capita cost of electricity bill has come down from Rs. 3,382/- per year to Rs. 2,887/- per year. Without changing the occupancy rate in Raj Bhavan the per capita cost of electricity consumption has declined by almost 15%.

## **CRLI at Raj Bhavan Kolkata**

### ***Objective 5. Beyond energy use and climate change: Towards sustainability transition***

Raj Bhavan is adopting a variety of sustainability <sup>4</sup>compatible practices:

#### **Socially Responsible Voluntary Actions**

##### **❖ Water and Waste Management**

- Surplus water is recharged in underground aquifers.<sup>5</sup>
- Paper and plastic wastes are segregated at source
- Paper is sent for recycling at Belur Recycling Plant
- Plastic is sent for recycling to H. C. Plastics <sup>6</sup>.
- Green Waste is transported to designated dumping site

##### **❖ Land Use Pattern**

- Decision to maintain land use pattern between built up area, water body and green open area.

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<sup>4</sup> Indicators of Sustainability and approaches to achieve sustainability are available in (Roy , Chatterjee, Basak , Nandy 2007,2009).

<sup>5</sup> Raj Bhavan report on water recharge (2006)

<sup>6</sup> The first pollution free Plastic SME recycling unit located in Rajpur Sonarpur Municipality. CRLI Alliance Member.

## CRLI at Raj Bhavan Kolkata

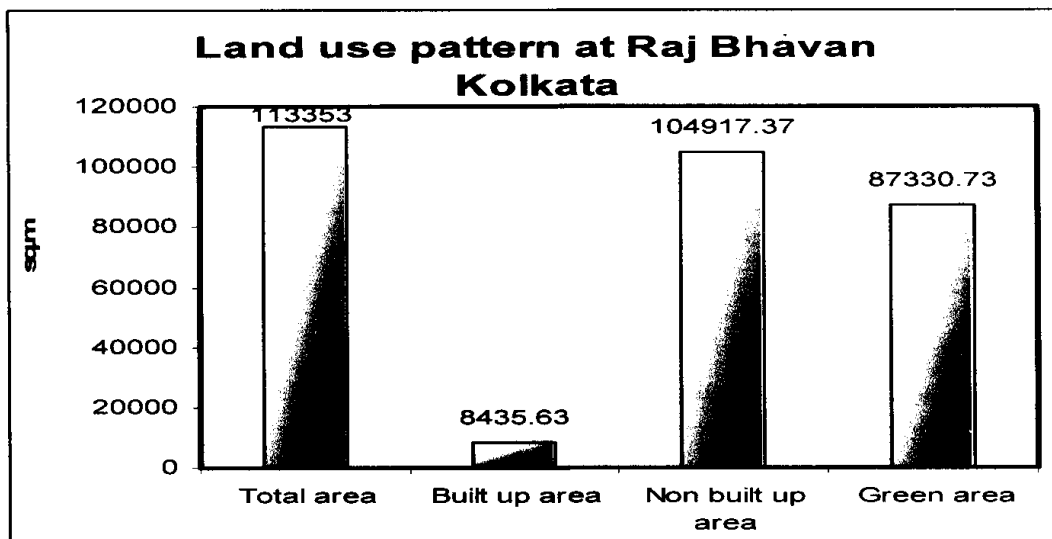
### *Objective 6. To Evaluate the carbon emission balance of Operational Lifestyle of Raj Bhavan-Kolkata*

As mentioned in objective 1 to assess carbon emission balance we consider non energy sources of carbon emission as well by considering Raj Bhavan's land use pattern.

Table 3.

Land Use Pattern at Raj Bhavan Kolkata (values in sq. m)	
Total area	113353
Built up area	8435.63
Non built up area	104917.4
Green area	87330.73

Figure 11:



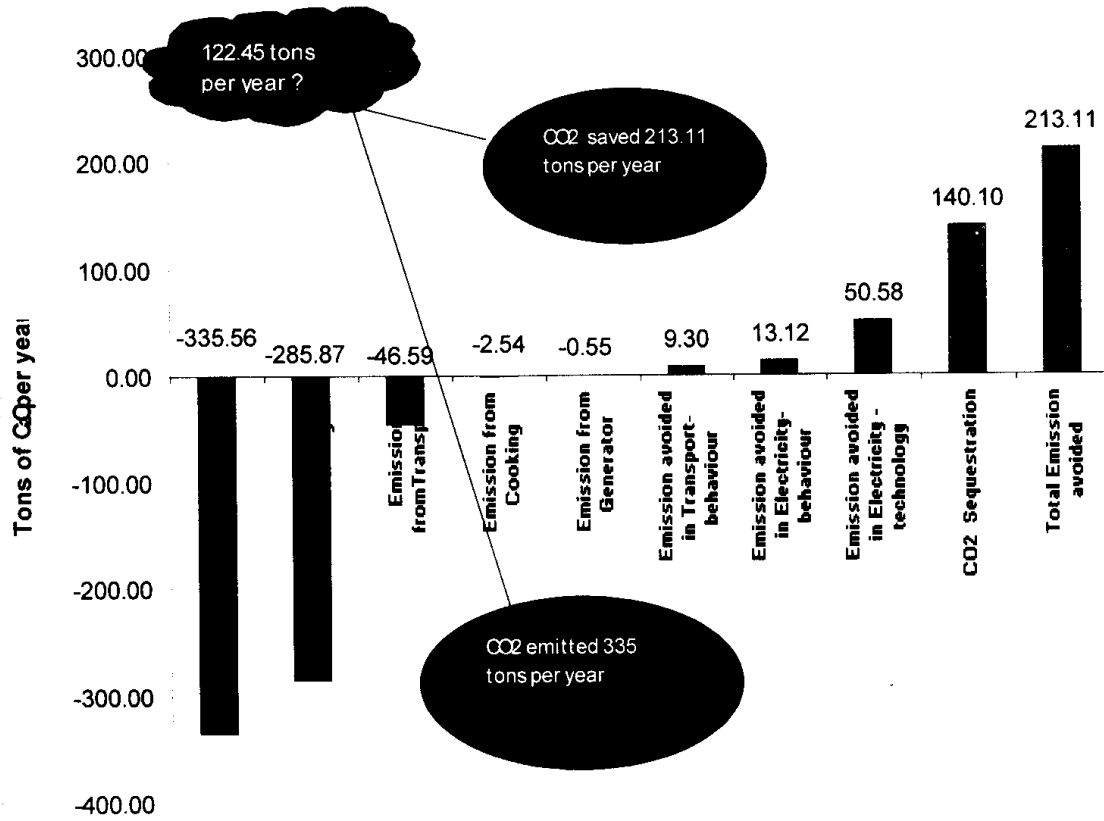
Study of emission as well as sequestration from the energy and non energy sources within the boundary of Raj Bhavan Kolkata is shown in the figure 12. The annual sequestration from the green area is 140.10 tons of CO<sub>2</sub>. Total carbon dioxide mitigation at Raj Bhavan is 213.11 tons, of which 73 tons is mitigated as described under the objective 3, and 140 tons of CO<sub>2</sub> is sequestered.



# CRLI at Raj Bhavan Kolkata

Figure 12:

## Carbon emission and sequestration within Raj Bhavan Boundary



<b>Total Emission of CO<sub>2</sub> –Post Action</b>	<b>335 tons</b>
<b>Total CO<sub>2</sub> sequestered</b>	<b>140 tons</b>
<b>Total CO<sub>2</sub> mitigated</b>	<b>73 tons</b>
<b>Raj Bhavan still needs to balance</b>	<b>122 tons of CO<sub>2</sub></b>

## CRLI at Raj Bhavan Kolkata

### *Objective 7. How Viable is Low Carbon Sustainable future of Raj Bhavan financially?*

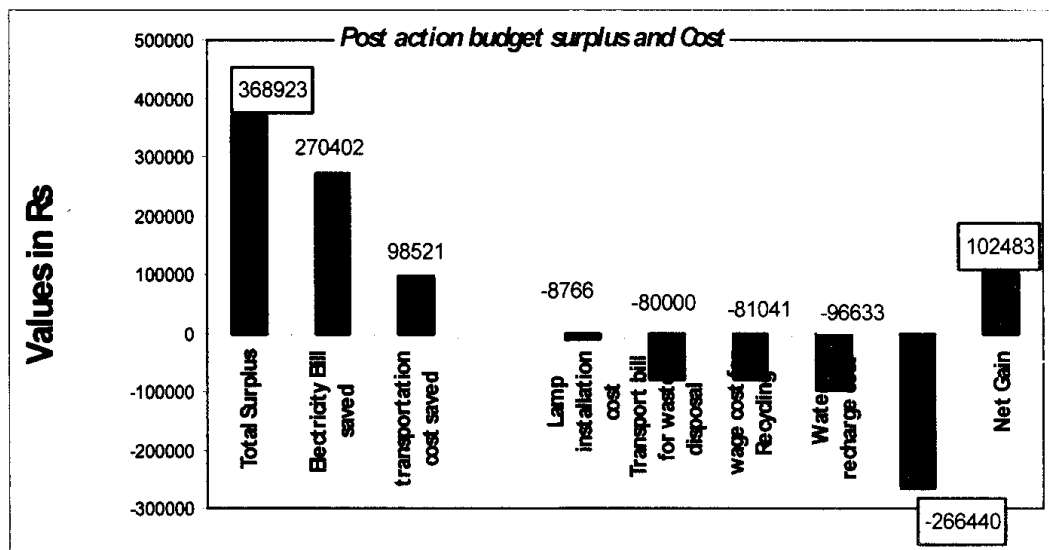
Comparing pre action and post action scenarios we find that mitigation and sustainable lifestyle option through voluntary action generate financial savings for Raj Bhavan to the tune of Rs 3,68,923, where majority of the savings come from electricity bill (Rs 2,70,402), followed by savings in transport fuel expenditure (Rs 98,521).

Actions beyond energy consumption like recycling and recharge do involve cost. But interestingly the financial gain from energy efficiency improvement can be used for recycling activity. Usually consumers throw their wastes outside their private premises in open public spaces at no private costs and thereby imposing high social cost and introducing huge cost burden on civic bodies which far exceeds any civic tax paid currently by the citizens of the city there by making the service below optimal or unsustainable. Raj Bhavan’s approach to transport waste to dumping ground is an example of theoretically approved “Polluter Pay Principle”. A detailed understanding of practices at Raj Bhavan shows that there are two costs involved:

- Transportation Cost :Transportation of waste to designated disposal sites – Rs 80,000 per annum
- Labour Cost :Cost of segregation at source – Rs 81,041 per annum

The total cost of these actions is Rs 2,66,440 which comprise of transport bill for waste disposal, wages to the workers for recycling, annualized water recharge installation and maintenance, annualized cost of installing CFLs. Thus savings from Responsible Consumption outweigh the cost by Rs 1,02,483 which is the net gain (Figure 13).

Figure 13:



### *Objective 8. Low Carbon to Carbon Neutral Raj Bhavan*

Since it is voluntary action consumer has full freedom to choose level of emission reduction. Raj Bhavan has expressed desire for carbon neutrality. Voluntary Actions so far has put Raj Bhavan on Low Carbon Path without any compromise with overall well being. This indicates that there are mitigation options which generate more benefit and well being.

The goal is to neutralise<sup>7</sup> the balance 122.45 tons of CO<sub>2</sub> emission of Raj Bhavan which gives a carbon footprint of 36.7 tons (*Fig 12*). This can be done in a number of alternative ways.

We provide first a set of technically feasible alternative suggestions based on hot spot analysis in emission load and a whole range of technological options available. But it needs mention that actual action will depend on financial viability and market readiness of the technology.

#### **Carbon Neutrality Goal: Feasible solutions**

Raj Bhavan can become carbon neutral through few more energy use related actions.

Since we focus only on climate change issue the location of emission source whether mobile or stationary does not matter. What matters is whose use behaviour is under consideration. Who is the decision maker of energy source choice and activity level and type of choice. Here the identification of actor is clear 'Raj Bhavan'. To provide further recommendation it is important to know the operational behaviour reflected in appliance stock to identify hotspots in CO<sub>2</sub> emission load from Raj Bhavan by looking into **Detailed Post Voluntary Action End Use Scenario** to explore scope for rationalization.

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<sup>7</sup> Neutrality or Zero emission and negative emission goals are more valid in the short term given the current global decarbonisation target. But by the turn of the century it may be relaxed if responsible behaviour now can achieve stabilization goal.

## CRLI at Raj Bhavan Kolkata

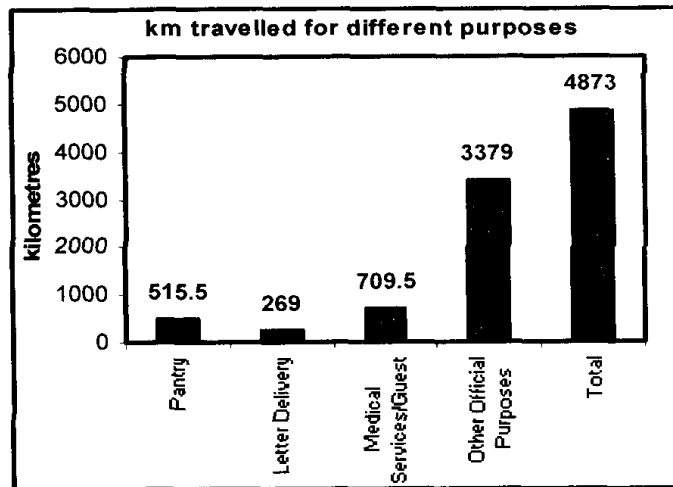
### Mobility Services:

The data obtained from House Keeping Department of Raj Bhavan Kolkata and analysed by GCP-JU shows that on an average mobility services demand 4873 kms every month (2007-08). The break up of travel purposes is given below

**Table 4.**

Purpose	Values in Km
Pantry	515.5
Letter Delivery	269
Medical Services/Guest	709.5
Others	3379
<b>Total</b>	<b>4873</b>

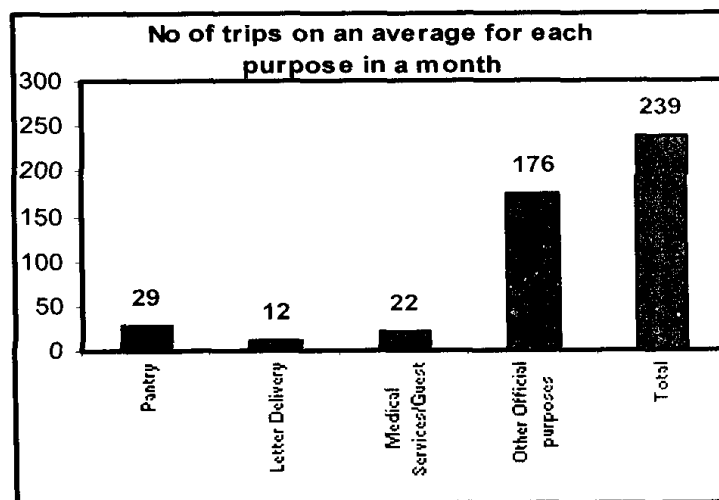
**Figure 14**



**Table 5.**

No of Trips	Average
Pantry	29
Letter Delivery	12
Medical Services/Guest	22
Other Official purposes	175.5
<b>Total</b>	<b>238.5</b>

**Figure 15:**



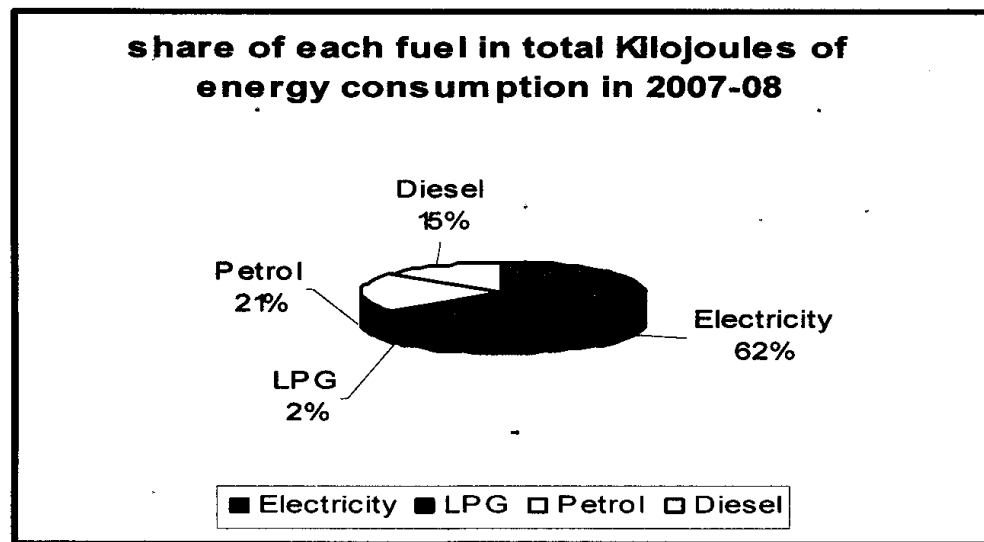
## CRLI at Raj Bhavan Kolkata

### Cooking services:

The fuel used for cooking at Raj Bhavan is LPG. Using the data obtained from House Keeping Department and analysed by GCP-JU, it has been observed that the annual consumption of LPG amounts to 852 kg in 2007-08. The CO<sub>2</sub> emission from use of LPG is calculated to be 2.54 tons annually. There has not been any energy saving measures adopted in this service.

LPG is used exclusively for cooking purpose. Electricity is used for cooling (AC and Fans), water heating, lighting, pumping water, running elevators and operating office equipments. Petrol is used as fuel in cars. Diesel is used for twin purposes of running cars and for providing fuel for alternative power supply (Generators).

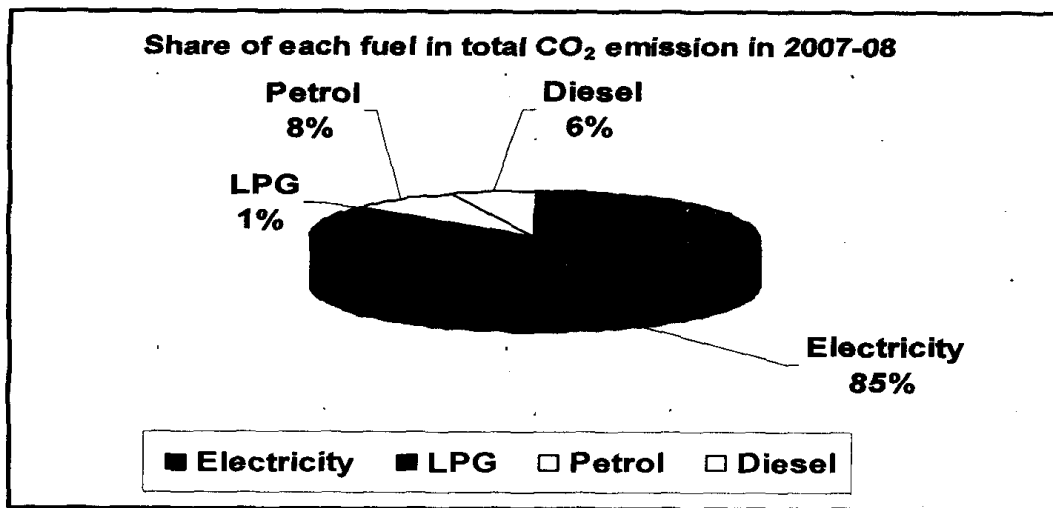
Figure 16: Fuel wise break up of total energy use by Raj Bhavan-Kolkata in 2007-2008.



## CRLI at Raj Bhavan Kolkata

It is interesting to note that if fuel used is converted into emission we can identify where more action is needed to reduce emission. Fig 17. Shows that electricity usage is responsible for 85% of Raj Bhavan's emission as it comes from coal based power.

Figure 17:



The largest use of electricity in Raj Bhavan operation is for space cooling (46%), followed by lighting (32%), office equipment (13%) and others 9% (figure 19). Space Cooling equipments include air conditioners which consume 35% of total power energy, fans which consume 7% of total electrical energy and refrigerators consume 4% of power. The other sources of electricity consumption come from elevators, pumps and geysers. In order to understand lock in effect we have done a detailed stock taking of all technologies/appliances used for power supply. Stock assessment along with their usage rate gives us to rank the equipments and energy service in terms of their emission load.

Figure 18

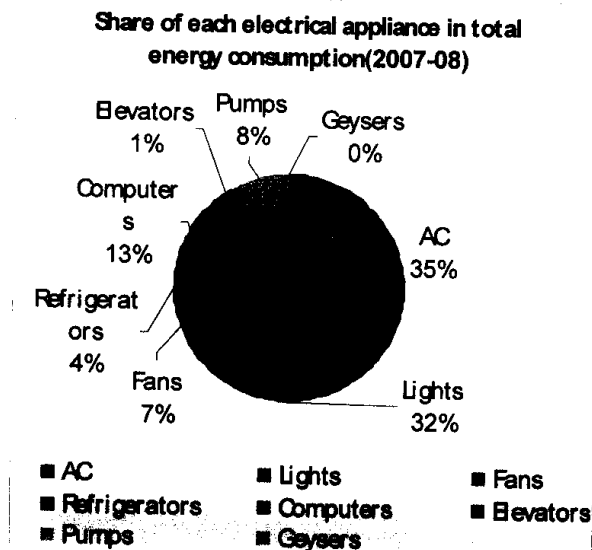
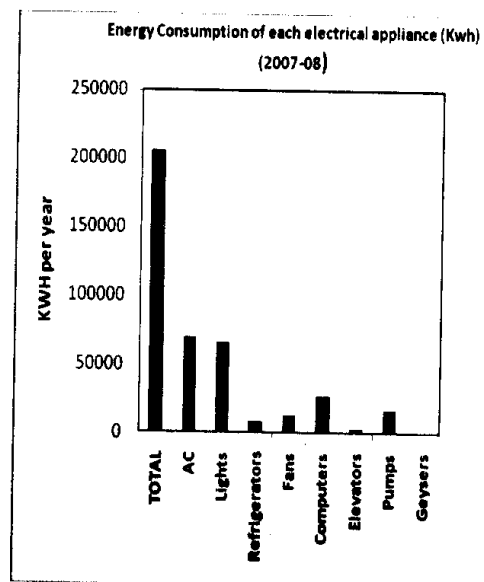


Figure 19



The consumption is dependent on technology choice as it leads to lock in effect. Lock in effect here means any choice of technology to deliver energy service demand e.g fan for space cooling, tube lights for lighting locks in the energy use for the lifetime of the technology. So technology stock at any point of time is very crucial and how technology choice is being made. A detailed study is needed to determine whether the present electric circuit system at Raj Bhavan Kolkata is a barrier or facilitator for intelligent building management system. So consumer purchase behaviour at any point of time has major implication on how a consumer unit – be it household/institution like Raj Bhavan, nation, globe commits itself to a level of energy consumption and emission load.

After detailed mapping of electricity and fuel use in post Voluntary Action period very minor scope is left for demand management .So at this stage what we need is supply side management. Given the detailed breakup best way to approach at this stage may be to save emission from the largest emitter- electricity. This is because electricity is generated offsite through coal based fuel on which consumer has less control. It is important to rationalize further the electricity use and replace coal with cleaner fuels but within the purview of single consumer. Besides this may not be possible for both economic and other valid social reasons at macro level but micro units can gradually act towards decoupling through a variety of routes.

## CRLI at Raj Bhavan Kolkata

### Alternative I

#### Consumer Point Generation of Electricity Using Solar Radiation

Figure 19 shows emission hotspots are electricity<sup>8</sup> purchase and use for lighting service demand and space cooling demand as offsite generation is mostly coal based. We propose gradual transition to alternative fuel sources to meet these demands.

i. HVAC

Most market ready reliable technology to straightaway derive at least 20-25% electricity savings with high reliability in the hotspots mentioned above is to make Raj Bhavan an intelligent building which can install HVAC system<sup>9</sup>.

**Intelligent Building Management System has the potential to reduce CO<sub>2</sub> emission of Raj Bhavan- Kolkata by 71 tons per year.**

ii. Use solar energy for 100% boundary and street lights

The data obtained from estate office, Raj Bhavan Kolkata and analysed by GCP-JU revealed that on an average the energy demand for lighting up the boundary lights is 33 Kwh per day. This energy demand is calculated for the boundary/street lights that are used on a regular basis and are fitted with CFL lamps. Each lamp post can be fitted with standalone solar panels and can be powered by solar energy. Detailed economic analysis shows that solar installation worth Rs 20 lakhs (one time installation cost/capital cost) is required to meet the daily demand of 33 Kwh of electricity. This action could save electricity drawn from grid connection to the tune of 12038 Kwh per year and thereby save Rs 60,000 in electricity bill per annum.

**Standalone solar installation for boundary and street lighting has the potential to reduce CO<sub>2</sub> emission of Raj Bhavan- Kolkata by 11 tons per year.**

<sup>8</sup> Hotspot status is derived from primary energy use to get electricity

<sup>9</sup> All calculations in this section are based on voluntary expert advice from our CRLI Alliance Members Mr S Kar , and Mr K Mandal based on existing new consumer installations. For getting an optimized system calculations need to be refined further based on onsite continuous user behaviour analysis and technical details of existing system and retrofit need assessment.



## CRLI at Raj Bhavan Kolkata

A detailed information on the use of standalone solar panels is given in Table 6 .

**Table 6.**

Current installations	Proposed installations*	Feasibility	Actual demand per day	Demand proposed to be met by solar sources* (per day)	One time Capital cost (Rs. lakhs)*	Benefits (per annum)		
						Reduction in energy withdrawal from grid (kwh)*	Savings in electricity bill* Rs.	Reduction in CO <sub>2</sub> (Tons)
Boundary lights fitted with CFL	standalone solar panels	Good.  No additional land area required	33 Kwh	33 kwh	20.35	12038	60192	11

Source: \* based on discussions with Dr. Biswanath Roy, 2009. Details are available with GCP-JU.

- iii. **Use solar energy to generate electricity to meet the (1/3 rd=100 kw) partial demand of indoor lighting and space cooling.**

*Given the total indoor lighting and cooling demand experts<sup>10</sup> feel it is not feasible at the current state and cost of solar technology to meet the total demand from solar sources using roof top panels cost effectively. Since land use pattern should not be disturbed as it is helping in carbon sequestration and pond area can have much better alternative use (which we state later) we thought of an alternative measure to supply energy to meet a portion (one third) of the lighting and cooling demand at Raj Bhavan, Kolkata can be done through roof top installation without interfering the visual aesthetics of the heritage building. This installation can be coordinated through intelligent building management systems (IBMS<sup>11</sup>) to avoid human error and ensure verifiable*

<sup>10</sup> Prof. Saswati Majumdar and Mr. S. P Gon Chowdhury

<sup>11</sup> Kar and Mandal.

## CRLI at Raj Bhavan Kolkata

measurability. This process requires land area for installation of solar panels which we identify as roof top without changing the current land use pattern.

Table 8.

In house generation of electricity using solar grid system	Process	Feasibility*	Energy Demand met by alternative sources*	Capital Cost (lakhs)*	Savings(per annum)		
					Units Kwh	Rs.	Tons CO2
	100 Kw solar grid system	8500 sq.ft land area required	34 Kwh per day	300	12500	62500	11

Source: \* based on discussions with Mr. S.P Gonchaudhuri, 2009

**Roof top solar panel installation to meet one third of electricity demand for indoor lighting and space cooling demand of Raj Bhavan- Kolkata can reduce additional CO<sub>2</sub> of 11 tons per year.**

**Alternative II.**

**Fuel Switch to replace fossil fuel to meet Mobility Service Demand of Raj Bhavan**

**(i) Raj Bhavan Ponds as viable source of bio fuel to replace fossil fuel for mobility services**

Raj Bhavan has water body of area 637 square metres. Algal (local specie) cultivation can produce 1574 gallons of algal oil (bio fuel of fourth generation)<sup>12</sup> per year. Currently total fossil fuel (diesel) demand at Raj Bhavan is 6,145 litres (1,623 gallons) per year. 26% of the current diesel demand can be met by bio fuel feedstock generated within the boundary.

**Mitigation Potential of biofuel is 20.2 tons per year**

**Algae feedstock grown within the boundary can reduce 1.2 tons of CO<sub>2</sub> emission through sequestration and when used in liquid fuel form for mobility service can save 19 tons of CO<sub>2</sub> emission by replacing diesel.**

The CO<sub>2</sub> emission from transport sector is 46 tons as of date. It can be lowered to 26 tons by using bio fuel generated from feedstock generated within Raj Bhavan-Kolkata Boundary.

**Table 9.**

Target	Process	Feasibility	Actual demand	Energy Demand met by alternative sources	Capital Cost (lakhs)	Operational cost per annum (lakhs)	Savings (per annum)		
							Units	Rs.	Tons CO <sub>2</sub>
Replace diesel by bio diesel as transport fuel	Open pond algae cultivation	637 sq m of open pond	1623 gallons of diesel per year	1574 gallons	3 to 4	0.47 to 0.63	1574 gallons of diesel	2 lakhs per annum	20.2

Source: , Roy, Chaudhuri, Pal and Sengupta (2009)

The cost savings from reduced diesel purchase will be approximately Rs. 2 lakhs per annum , which is the cost of purchasing 1574 gallons of diesel at current market rate.

Given the cost of installation around 3 to 4 lakhs 50% of the capital cost can be

<sup>12</sup>Climate Smart Entrepreneurs Alliance ([www.globalchangeprogram.org](http://www.globalchangeprogram.org)), Eco Life-Biofuels ([www.ecolifebiofuels.com](http://www.ecolifebiofuels.com)) , Roy, Chaudhuri, Pal and Sengupta (2009)

## CRLI at Raj Bhavan Kolkata

recovered in the first year itself which makes it economically viable with very high return.

**(ii) Replace diesel operated cars by electrically operated cars.**

The diesel operated cars at Raj Bhavan can be replaced by electricity operated vehicles. Technical feasibility<sup>13</sup> has been checked by mobility service provided by these cars considering both passenger km travelled and distance travelled each day.

**Replacement of diesel cars by electric car has net mitigation potential of 16 tons of CO<sub>2</sub> annually.**

**Table 10.**

Target	Feasibility	Actual demand	Energy Demand met by alternative sources	Capital Cost (lakhs)	Operational cost per annum (lakhs)	Savings (per annum)		
						Units	Rs.	Tons CO <sub>2</sub>
Replace diesel powered vehicles by electricity operated cars	Technology is market ready	34800 passenger km travelled by diesel cars per year	34800 passenger km	16 lakhs for four cars	0.19	6145 litres	207332	16

If the diesel operated cars are replaced by electricity operated cars then 6145 litres of diesel can be saved which would yield a saving of Rs. 2,07,332/- per year.

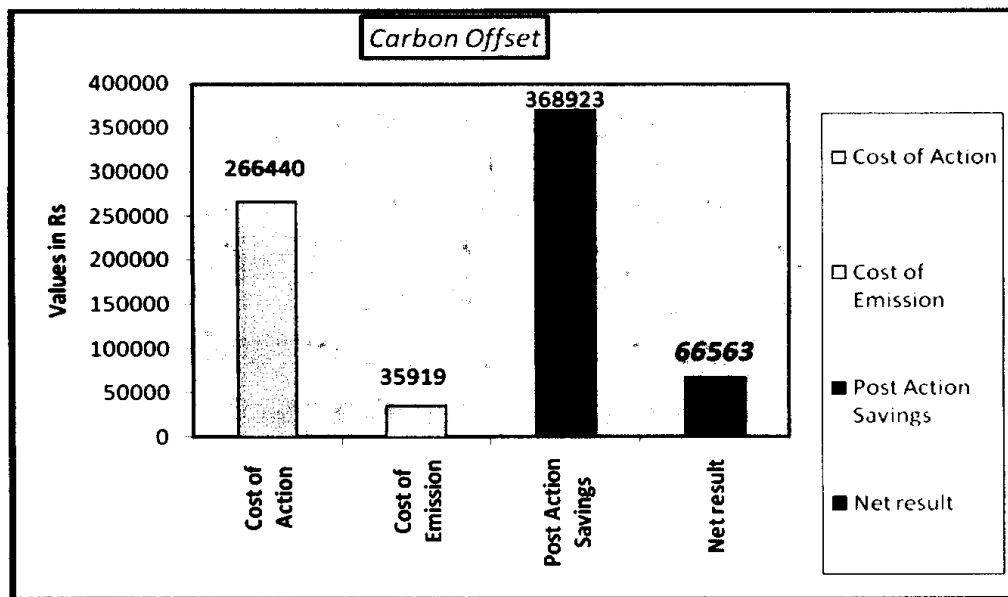
<sup>13</sup> Pal and Sengupta from Climate Smart Entrepreneurs Alliance

**Alternative III.**

**Purchase Carbon Offset from Voluntary Carbon Exchange Market (VCEM)<sup>14</sup>**

One alternative to achieve carbon neutrality is to participate in voluntary carbon exchange market to buy carbon credits<sup>15</sup>. The current carbon trading price is Rs 977.8 per ton of Carbon in CDM market. If we assume Raj Bhavan buys carbon offset in KVCEM voluntary market it will have to pay Rs. 35,919 to buy credit which will eventually be used by a third party to take up development project that will sequester at least the same amount i.e produce a carbon good of 36.7 tons ( 122 tons CO<sub>2</sub>). Let us now assume Raj Bhavan uses post action budget surplus of Rs.1, 02,483. Raj Bhavan can buy offset by paying Rs.1, 02,483 to get carbon neutrality certification and still be left with surplus of Rs 66,563. The Carbon Exchange market will use the sum of money Rs. 35,919 to get carbon reduced by 36.7 tons per year through various sequestration projects. These may be on campus or off campus.

Fig 20



Point to be noted here that our detailed economic and financial analysis shows that carbon price in the CDM market now is too low to produce equivalent amount of carbon good. Given all our calculations based on abatement cost through alternative technology routes or through sequestration projects by maintenance of green and forest cover we see that at CDM market carbon price no real climate benefit commensurate with the potential be delivered.

<sup>14</sup> A voluntary initiative at Kolkata (KVCEM) under STI of GCP –JU and CRLI Alliance to facilitate sustainability transition.

<sup>15</sup> Wide variety of schemes and examples are available on voluntary carbon markets in operation across countries as per national circumstances.

## **CRLI at Raj Bhavan Kolkata**

Price is too low to provide any optimal solution. The price for transaction of carbon credits should be many times higher than current CDM market price. It is an important finding of this detailed case study and empirically validate many theoretical and intuitive claims in the literature that has developed over past few years. .

Financing mechanism under current CDM market carbon price (Rs 978 per ton of Carbon or 20 USD) is way below optimal.

CDM market has set carbon credit price arbitrarily at too low level which cannot deliver mitigation potential consistent with global goal.

New Carbon Market mechanisms such as voluntary carbon markets or sectoral carbon market<sup>16</sup> provide better option to get carbon prices right.

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<sup>16</sup> Roy J and Roy M(2009) , Roy J(2009).

### *Objective 9. Recommended Road Map for Carbon Neutral Raj Bhavan*

Our criteria for Climate Responsible Consumer require consumer not only to choose least private cost solution but also to take responsibility for delivery of full 'climate good or carbon credit' potential either as first party actor or through third party actor in voluntary carbon markets. We estimate technical potential of each technology to make Raj Bhavan carbon neutral and combined with annualized cost of the investment at current market price we estimate the market potential. Economic potential is assessed using per unit abatement cost. We find that to make Raj Bhavan carbon neutral there cannot be any single solution. It has to be portfolio of actions and given the financial implication it has to be achieved in several phases over time.

We recommend a set of actions based on least cost solutions to deliver potential climate good worthy for carbon credit in Voluntary Carbon Exchange Market (VCEM). Before that we present climate good delivery potential of various actions. Feasible Portfolio of actions and mitigation potential of each individual actions.

- i. Use solar energy for 100% boundary and street lights: **Mitigation potential** 11 tons per year
- ii. Introduce intelligent Building Management system compatible with HVAC: **Mitigation potential** 71 tons per year
- iii. Use solar energy to generate electricity to meet the (1/3=100 kw) partial demand of indoor lighting and space cooling: **Mitigation potential** 11 tons per year
- iv. Raj Bhavan Ponds as viable source of bio fuel to replace fossil fuel for mobility services: **Mitigation potential** 20.2 tons per year
- v. Replace diesel operated cars by electrically operated cars. **Mitigation potential** 16 tons per year
- vi. Purchase carbon offset for rest of the carbon balance: **Mitigation potential** will vary as this is the residual. This is the very important component as it defines the crucial role of carbon market beyond micro units : it may be national, regional or global. But all needs to be internally consistent to deliver the potential /target climate good.

Decision to achieve carbon neutral lifestyle by a consumer finally boils down to make choices to purchase 'climate good' which we define here as 'carbon mitigation potentials' at

## **CRLI at Raj Bhavan Kolkata**

a price from climate smart service providers. Based on our detailed analysis of potentials we come up with Action Plan that can place Raj Bhavan at affordable price on carbon neutral pathway with potential for further improvement in future. It needs to be realized that it is a process and has to be measured, reported and verified on a dynamic scale. Both baseline and level of achievements are dynamic. Without going into further details on these theoretical issues we present below details of Phase I programme and possible directions of actions for phase 2. The tradeoff of action across time can be worked out in detail without changing major conclusions of this study. This case study has very important and strong policy implication. Macro (it may be national, regional, global) Carbon Market, carbon price structure have very important implications for climate stabilization as technology alone cannot deliver all the mitigation potential available from micro units estimated through bottom up approach. So Consumer behaviour and its potential through carbon market must be combined with technical potential to deliver climate stabilization target.

### **Phase I.**

As per our CRLI Criteria in one year time Raj Bhavan can go up in the ladder of carbon neutrality path as shown in Figure 11. It shows one year action plan and climate responsible efficient purchase plan. This one year plan can make Raj Bhavan Carbon neutral not with first best options as we include cheap offset purchase as immediate term solution in phase I. The CRC status as per CRLI criteria can be improved in next phases by either revising offer for offset price or by carbon neutral high cost solution options. One year Recommended Programme for Raj Bhavan is given in figure 21 is consistent with mitigation costs (cost to deliver climate good) as given in table 11.



## CRLI at Raj Bhavan Kolkata

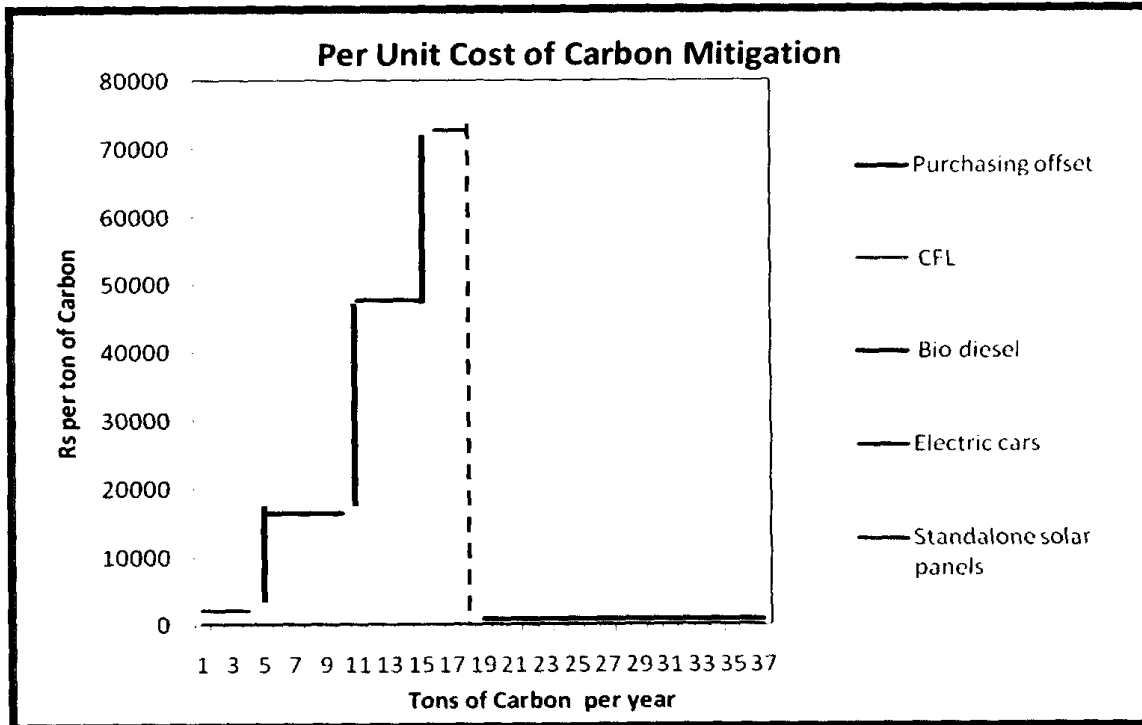
Table 11.

Portfolio of feasible actions with associated carbon good delivery potential	Delivery Potential in tons of CO <sub>2</sub> per annum	Cost of delivery Rs/ ton of Carbon
Purchasing offset at current CDM market price	122 *	984
Installation of CFL	13	2197
Generation of bio diesel	20	16502
Replacing diesel vehicles with electric cars	16	47708
Installation of Standalone solar panels	11	72727
HVAC	71	74214
Solar Grid System	11	964356

Note : \* though it provides cheapest alternative we do not recommend this action for bulk consumers as it does not deliver potential climate good as current CDM market price is too low. This we suggest as last resort option. However, this can be converted to recommended option at a revised corrected price offer.

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Figure 21:



Our recommended actions for implementation can be refined based on financial affordability and which can only be done in close consultation with the consumer as they need to be cross checked with CRLI and awarded a an appropriate CRC status.

### Phase II : A follow up of Phase I

The Assessment of HVAC implementation assessment which starts in year one need to be finalized and recommended in phase II. Integration of solar PV route for indoor demand for electricity can be assessed and implementation strategy be decided.

## **CRLI at Raj Bhavan Kolkata**

### **CRC to ResConST status for Raj Bhavan : Recommendation**

To mainstream Climate Responsible Lifestyle Initiatives at Raj Bhavan-Kolkata and to attain ResConST status one extra step is to undertake as per ResConST criteria “Climate Responsibility Accounting and Reporting” in genuine investment framework. It needs to become a part of the regular administration. The task of the new department would be two fold-one of coordination and one of knowledge generation and management. Raj Bhavan can set up one person department to continue with CRLI and ultimately to emerge as ReConST (Responsible Consumer for Sustainability Transition) which will function with strategic knowledge support from GCP-JU as its CRLI Alliance member initially but over a period five years it can be mainstreamed and would become a fully, independently functional department with appropriately trained personnel. GCP-JU can provide necessary initial training on its CRLI and ResConST tools so that Raj Bhavan department eventually becomes self reliant.

## CRLI at Raj Bhavan Kolkata

***Objective 10 . What Raj Bhavan case study has to say for operationalising NAPCC and provide strategic knowledge for international Negotiation.***

Raj Bhavan case study shows that consumers can play an important role to deliver climate good through Measurable, Reportable and Verifiable voluntary mitigation actions. We provide answers to the FAQs the report stated with:

1. We as individuals, community, institution can decide to become Responsible Consumers by taking up Voluntary Actions to earn CRC status or ResConST status.
2. Prioritising climate change issue the high end/bulk consumers/individual consumer can adopt CRLI and earn 'climate dividend' . The monetary gain by way of climate dividend can be ploughed back for upgradation of self image as CRC (Climate Responsible Consumer), or assume the role of ResConST (Responsible Consumer for Sustainability Transition). The latter would mean transfer of dividend money for poverty alleviation, climate adaptation etc.
3. Raj Bhavan experiment proves that human behaviour changes are more important than technology in solving climate change problem. Also behavioural changes are least costly and in no way well being reducing options.
4. Raj Bhavan-Kolkata contributes as of now net 122 tons/yr of CO<sub>2</sub> to the atmosphere.
5. Climate responsible lifestyle is one very important component but for sustainability transition a number of other criteria also need to be fulfilled by a consumer. It is desirable to follow both simultaneously.
6. Raj Bhavan can become Carbon neutral or Carbon negative <sup>17</sup>in near future by following some additional actions as per recommendation.
7. We apply CRLI and ResConST methods to prove that Voluntary Actions by consumers are Measurable, Reportable and Verifiable (MRV).
8. Mitigation is not only affordable but economical and revenue generating option as well.
9. It is possible to get a least cost pathway to attain carbon neutrality.
10. A large number of important findings of this detailed case study applying our methodology are of much relevance for NAPCC.

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<sup>17</sup> Often times a conceptually wrong terminology "carbon positive " is used . Carbon is bad so "carbon negative" is good. Goals need to be set for carbon negative solutions.

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The study provides strategic knowledge on climate change: How mitigation potential can be generated from various sources in India to operationalise National Solar Mission, National Mission for Enhanced Energy Efficiency, Tradable Certification of energy efficiency and fiscal measures, National Mission on Sustainable Habitat: Energy Conservation Building Code; Urban Waste Management, National Water Mission, National Mission for a Green India, National Mission on Strategic Knowledge on Climate Change

Knowledge generated in this report shows strategies need to be designed to activate the lifestyle route to provide climate good. More knowledge can be generated in the same line by replicating this case study to assess potential for India in this route along with investment cost need assessment ,This will help in international negotiation especially in Copenhagen to make concrete bargain point for better carbon price in CDM market, need for augmentation of carbon market to make energy efficiency happen under global financial and technology flow.

## CRLI at Raj Bhavan Kolkata

### Few interesting facts about Raj Bhavan Lifestyle

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Raj Bhavan as an institutional consumer and contributor to climate change can be defined by its land use pattern, floor area, occupancy rate etc. to arrive at some per capita equivalent concept.

Table 11.

	Year 2007-08	Year 2006
Electricity units consumed per unit of built up area	38(Kwh/sq. m/year)	47 (Kwh/sq. m/year)
Value of Electricity consumed per unit of built up area	187 (Rs/sq. m/year)	219 (Rs/sq. m/year)
Per capita units of electricity consumed annually	589 (Kwh /person/year)	720(Kwh/person/year)
Cost of electricity consumed per head annually	2887(Rs/person/year)	3382(Rs/person/year)
Per capita carbon dioxide emission	0.53( tons /person/year)	0.64(tons/person/year)

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Figure 22

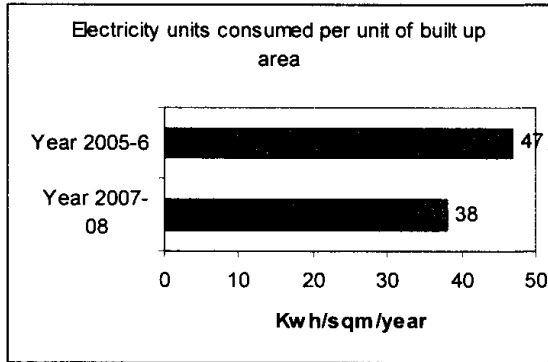


Figure 23

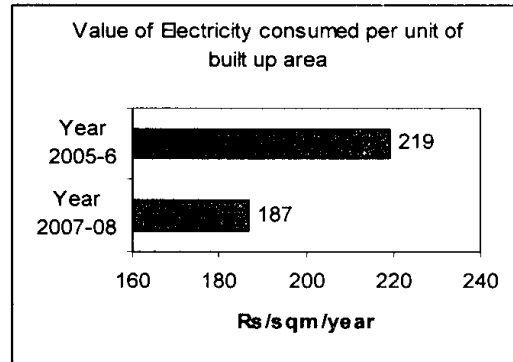


Figure 24

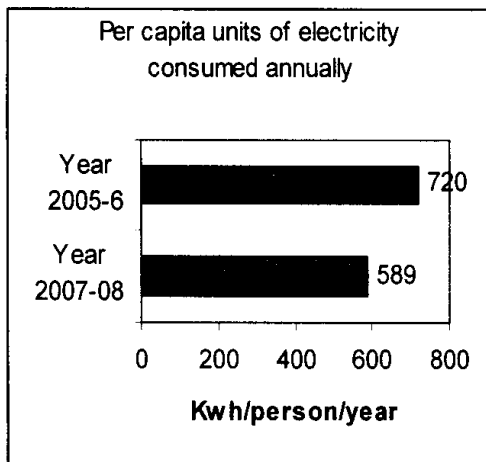
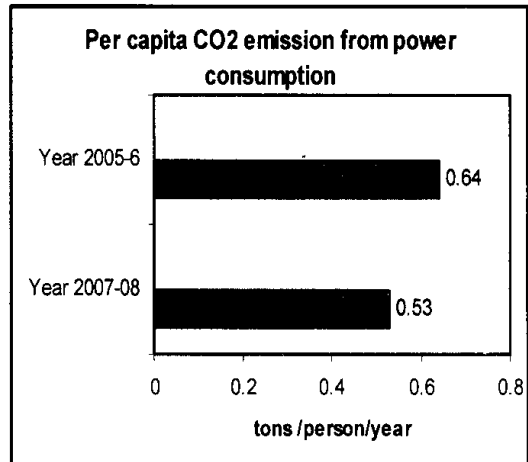
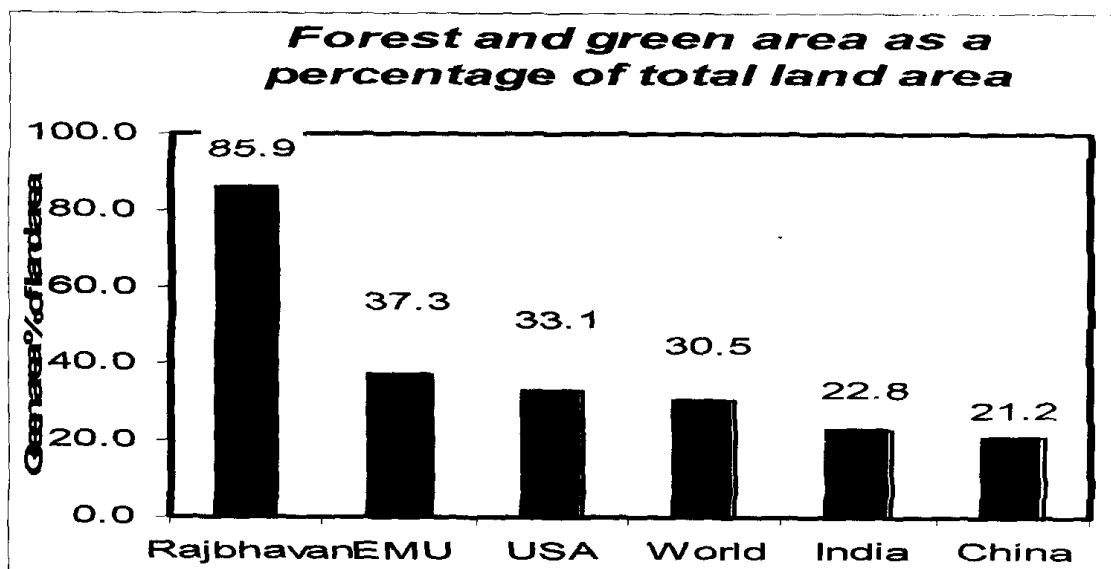
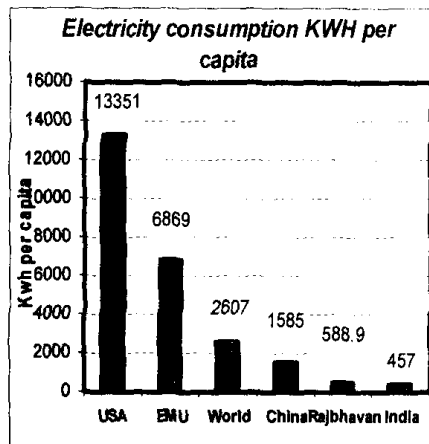
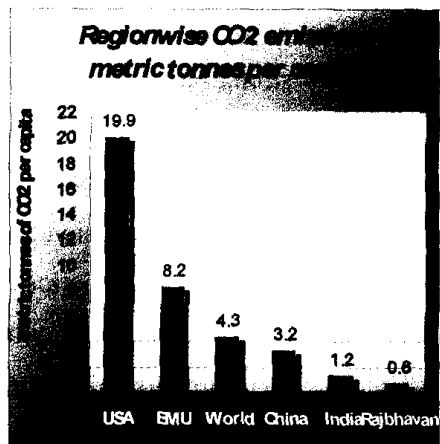


Figure 25



*Raj Bhavan vis-a-vis rest of India and Rest of the world - Comparative Position of Raj Bhavan*



It is important to know green lifestyle (Greening India Mission) has much to deliver in terms of climate change mitigation. What we need is MRV and maintenance of the forest cover. Problem with this climate good production action is fragile nature of the good. It is like wooden glass versus porcelain glass. Latter looks charming but fragile. Forest as climate producing sector is fragile due to fire threat, human act of cutting trees etc.

So quality of climate good created by way of mitigation action vary. Raj Bhavan lifestyle is climate friendly historically for land use pattern. Land use planning is very important.



### Concluding Remarks

This report can be considered first quick edition of CRLI Report for Raj Bhavan. It leaves scope for refinement and extension. This case study has a very strong message. The report demonstrates what kind of strategic knowledge generation, dissemination can bring in behavioural changes. It shows what incentives are needed for consumers in India to adopt climate responsible lifestyle choices. It also provides estimates of mitigation potential and costs associated. This is useful for pushing forward the global deal in post 2012 period from Indian perspective. It tells how much it costs to maintain high growth rate for India without adding to global emission. This can be of great value for designing burden sharing strategy along the lines of common but differentiated responsibility rule of Kyoto. This report can be a sample case study for replication under Eighth Mission of NAPCC.

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Natural pond and wooden bridge at Raj Bhavan, Kolkata.

Artist : Swaroop Mukerji