



International Resources Group

A horizontal decorative bar consisting of nine colored squares: olive green, orange, brown, olive green, blue, olive green, orange, brown, and olive green.

Profiling Indian Commercial Building Sector

BATF Break-Out Presentation

November 16, Washington, DC

Dr. Satish Kumar, Chief of Party, IRG



Definition of “Commercial Building”

- ⇒ **According to Energy Information Administration: “Any building that is used for neither residential, manufacturing, nor agricultural purposes.”**
- ⇒ **Main Types of Commercial Buildings**
 - ⇒ **Office Buildings**
 - ⇒ **Hotels**
 - ⇒ **Restaurants**
 - ⇒ **Retail malls and shops**
 - ⇒ **Hospitals**
 - ⇒ **Educational institutes**



Outlook for India's Commercial Real Estate Market¹

⇒ Major Assumptions

⇒ GDP growth over next 10 to 12 years: 6% per year

⇒ 600 new shopping centers by 2010

⇒ Nominal retail sales to grow at 10% per year

⇒ Service sector revving up demand for office space

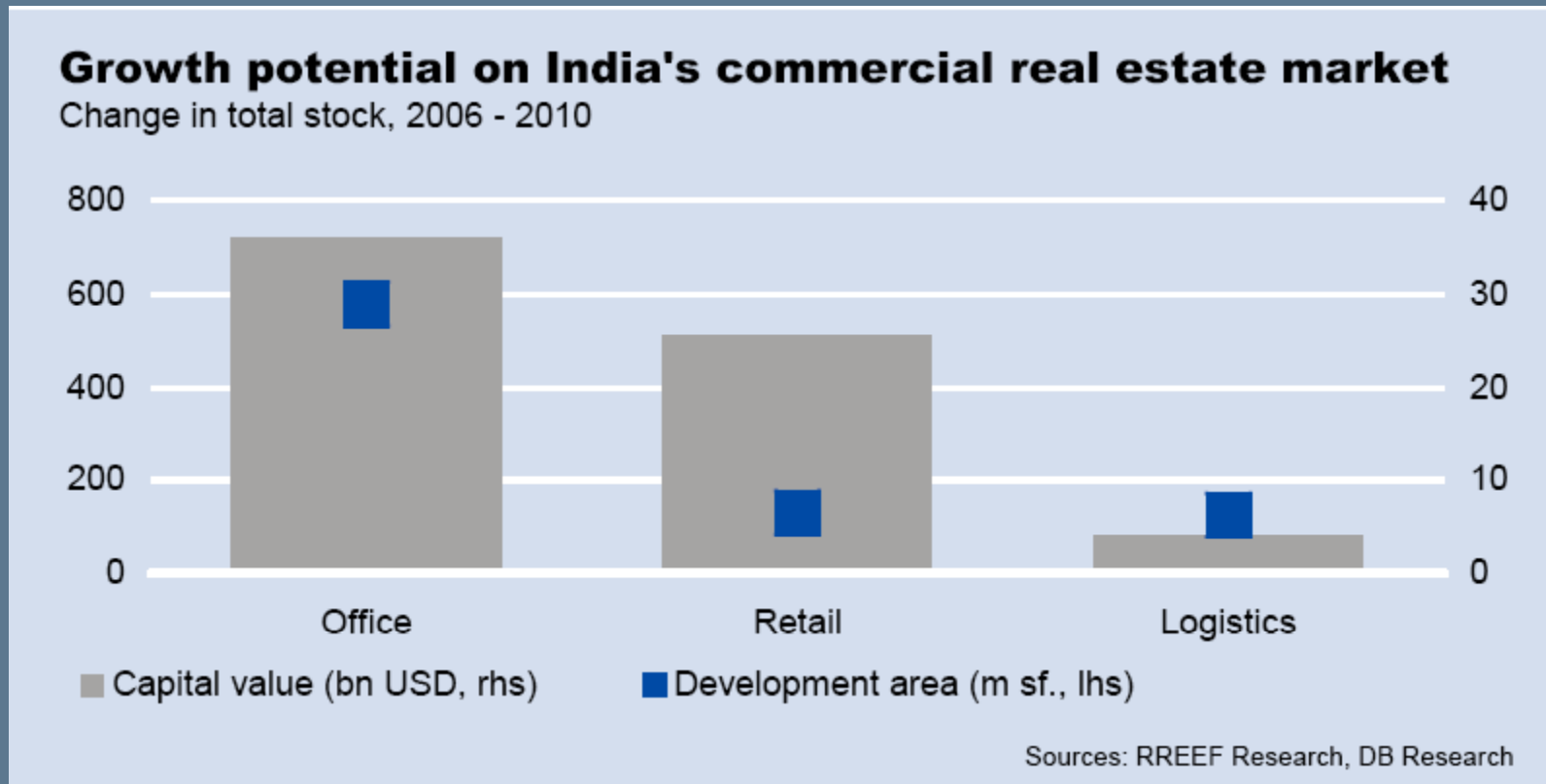
⇒ 55 million sf of premium office space needed

⇒ Total value of commercial real estate: \$300 billion

⇒ Invested markets account for only \$4 billion

⇒ Situation changing at astonishing pace in the last 12 months: US private equity firms and hedge funds putting in massive resources in this sector by tying up with Indian local partners that are going public to raise capital

IRG Outlook for India's Commercial Real Estate Market¹



¹Deutsche Bank Report on India's Commercial Real Estate Market



Profile of Indian Commercial Sector¹

⇒ OFFICE SPACE in India (demand driven by)

- ⇒ Office space supply shifting from Central Business Districts to secondary centers (office and IT parks)
- ⇒ Modern office buildings in newly developed areas enable the higher quality standards that are essential for IT services
 - ⇒ Major implications for ECBC adoption/implementation
 - ⇒ Constituency should be targeted as early adopters of ECBC
- ⇒ All India office market
 - ⇒ 70% by IT Services companies (more than 7000 No.) in India
 - ⇒ 15% by financial service providers & pharmaceutical sector
 - ⇒ 15% by other sectors
 - ⇒ Office stock must increase nearly 20 million sf/year in New Delhi, Mumbai, Bangalore to keep pace with growing demand
 - ⇒ Conservative estimate (for India): Approx. 55 million sf/year

⇒ SHOPPING CENTRES/MALLS

- ⇒ By the end of 2008, space of 79 million sf in 257 centers are estimated in 15 largest cities of India



A peek at India's Commercial Real Estate at Three Metros¹

⇒ **Mumbai – India' Financial Center**

- ⇒ **Limited space within the City for new const. Old industrial/factory sites sold to private developers. New developments include:**
 - ⇒ 2005: 3.2 million sf
 - ⇒ 2006 (est): 3.5 million sf
 - ⇒ 2007 (est) : 2.5 million sf
 - ⇒ Out of 58 industrial sites with 60 million sf, 23 sites to be completed in 2007.

⇒ **Bangalore – India's IT Centre (Known as "India's Silicon Valley")**

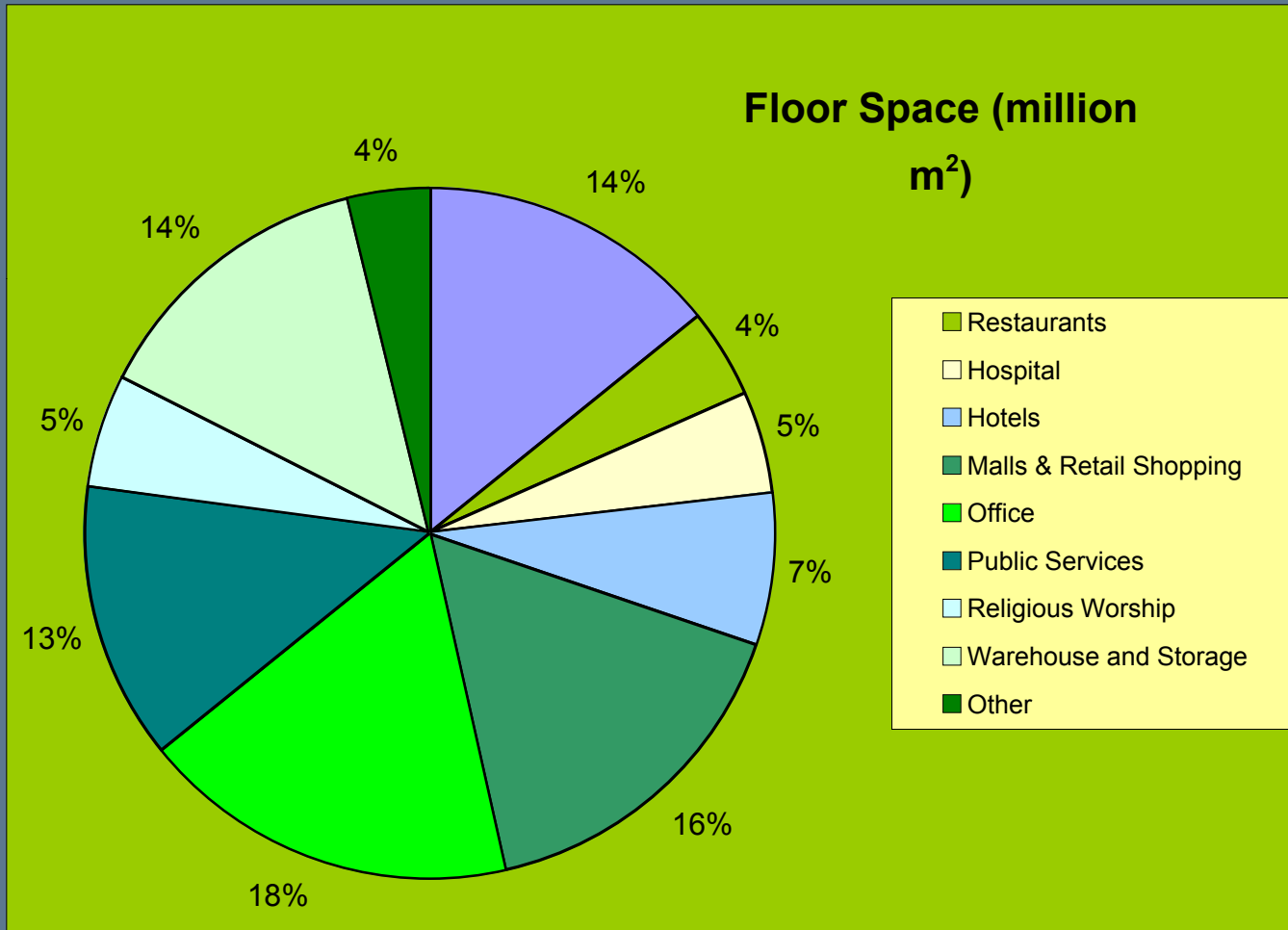
- ⇒ **Office Stock: 28 million sf in 2006**
- ⇒ **Annual Demand of office space: 7 million sf**

⇒ **Delhi – Capital City**

- ⇒ **Delhi Office market extends to National Capital Region (NCR) - Gurgaon, Noida & Greater Noida. Main source of demand is from IT companies. New developments include:**
 - ⇒ **Present Office Space: 20 million sf.**
 - ⇒ **2004: 3 million sf**
 - ⇒ **2005: 3.3 million sf – was insufficient to meet the demand**
 - ⇒ **2006 (est): 7.5 million sf**



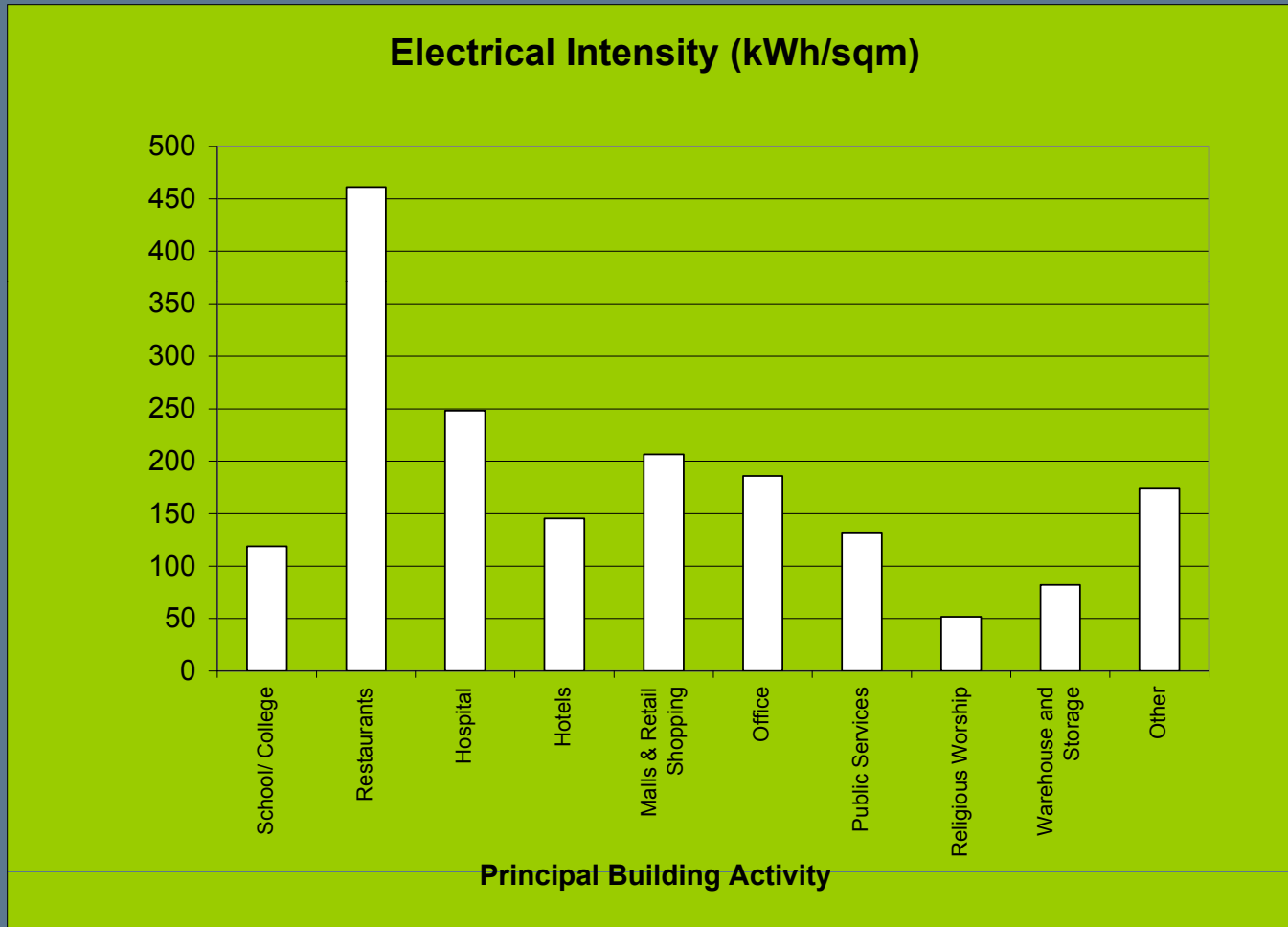
US Commercial Building Sector: Floor Area Distribution^a



^a Commercial Building Energy Consumption Survey (2004), Energy Information Administration



US Commercial Building Sector: Electrical Intensity^a



^a Commercial Building Energy Consumption Survey (2004), Energy Information Administration



Purpose of Benchmarking

- ⇒ **Assessing the energy performance of buildings to an established standard or baseline**
- ⇒ **Acts as a first step for energy audits, optimizing building energy use and implementing energy savings measures.**
- ⇒ **Different for different user group type –**
 - ⇒ **Building owners/facility managers**
 - ⇒ **Compare buildings' energy use and performance with other buildings.**
 - ⇒ **Utility companies**
 - ⇒ **Track energy use and combine energy data from various buildings**
 - ⇒ **ESCOs and Building Energy Auditors**
 - ⇒ **Communicate energy performance of buildings in terms of “typical” vs. “best practice” benchmark**

Benefits of Benchmarking

- ⇒ **Determining how a building's energy use compares with others**
- ⇒ **Setting targets for improved performance and monitoring them on an ongoing basis**
- ⇒ **Facilitating assessment of property value**
- ⇒ **Gaining recognition for exemplary achievement**
- ⇒ **Identifying energy saving strategies**

Types of Benchmarking

⇒ Internal Benchmarking

- ⇒ Comparison of energy performance of buildings against itself (over a period of time) or between a group of similar buildings
- ⇒ Typically used to compare performance before and after retrofit measures have been taken

⇒ External Benchmarking

- ⇒ Comparison of energy performance of buildings. against standards or baseline as established part of benchmarking tool
- ⇒ Typically used as a method to set targets for future performance.



Key Factors to Consider in Benchmarking

Type of Benchmarking	Internal
	Extrenal
Building Data	Building Space Distinction based on user group or space utility
	Occupancy no. and hours
	Building Characteristics and Technology (window type, shell type, construction details, appliances)
Weather Data	Climate
	Location/Zip code
Energy Use Data	Site/Source Energy Distinction
	Annual/Monthly
	Fuel Type
Data Source / Benchmarking Metric	CBECS
	CEUS
	User Data



Key Factors to Consider in Benchmarking

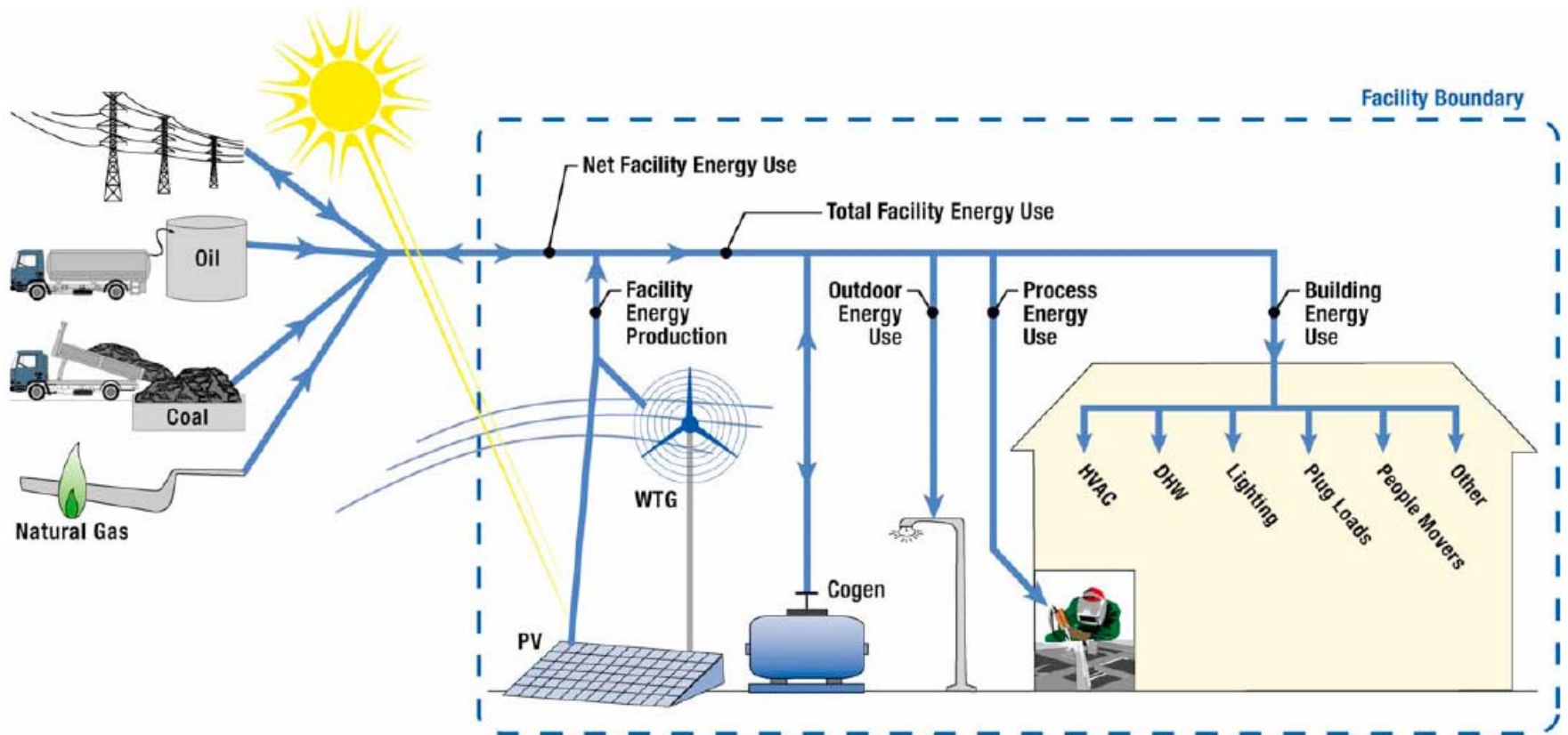
Benchmarking Output	Multiple Bldg Comparison
	Graphical
	Spreadsheet
	Rating
	Future Action Plan
Misc. Information	Environmental Performance
	Financial Performance
	Facility Performance
Founding Organization	Industry/ Educational/ Utility Company
	Government Sponsored
User Support	Online Availability
	Downloadable
	User Tracking
	Accreditation / Authorized personnel evaluation
	Demo or User Guide
	Sample Benchmarking Studies
	Category Description/Help



Degree Days- Quantifiable Metric to Capture Climatic Effects

- ⇒ A degree day gauges the amount of heating or cooling needed for a building using 65 degrees F as a baseline.
- ⇒ To compute heating/cooling degree-days, take the average temperature for a day and subtract the reference temperature of 65 degrees.
- ⇒ If the difference is positive, it is called a "Cooling Degree Days". If the difference is negative, it is called a "Heating Degree Days".
- ⇒ Electrical, natural gas, power, and heating, and air conditioning industries utilize heating and cooling degree information to calculate their needs.
- ⇒ Critical for doing building energy analysis and running regression models.

IRG Energy Assessment Boundary



Credit: Procedure for Measuring and Reporting Commercial Building Energy Performance, Technical Report by NREL

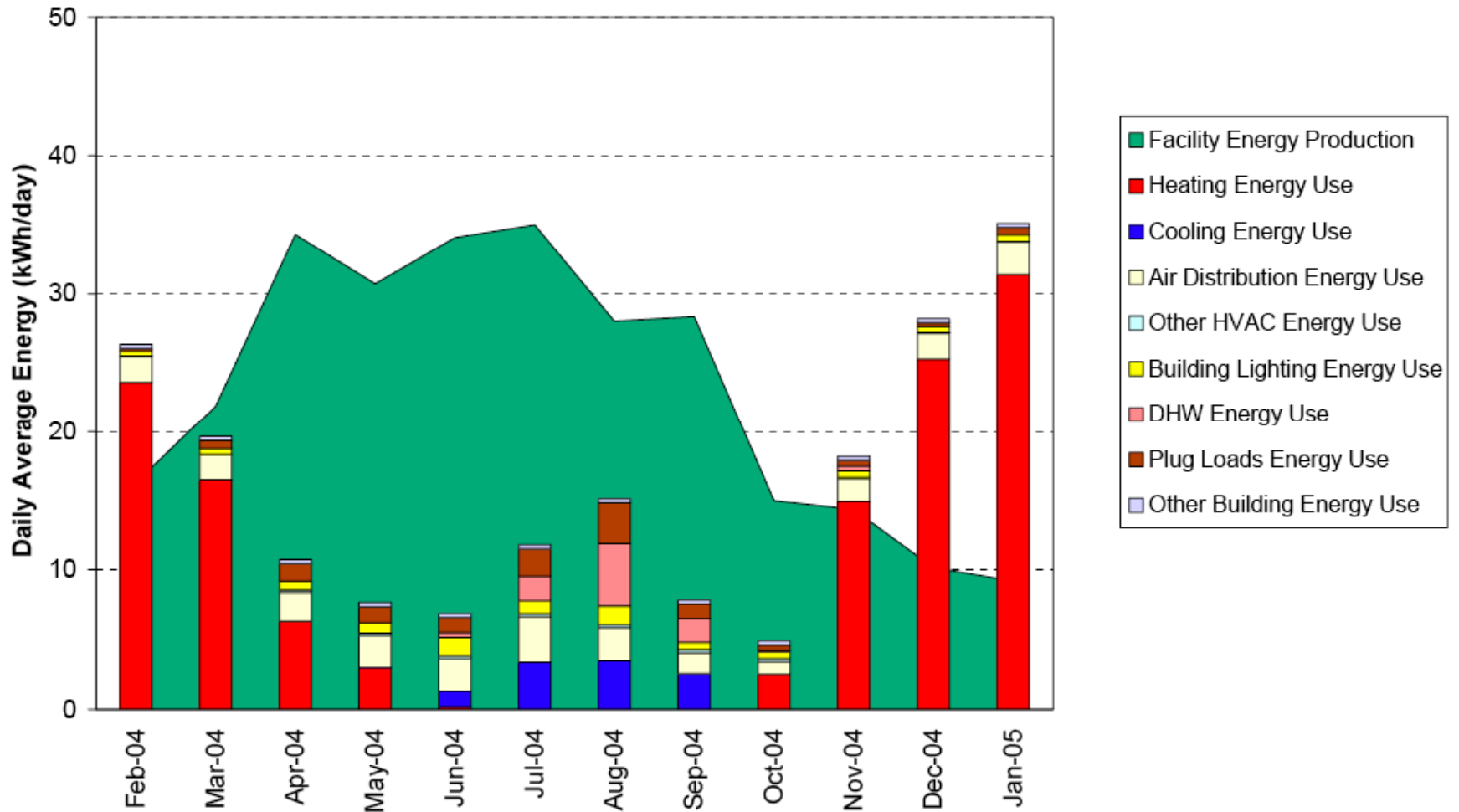


Sample Monthly and Annual Metrics

METRIC	Units	Month												ANNUAL
		Feb 04	Mar 04	Apr 04	May 04	Jun 04	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	
Gross Interior Floor Area (Science House)	ft ²	1367												
Functional Area (Science House)	ft ²	1367												
Installed Lighting Energy Use	kWh	10.4	13.5	19.0	22.7	39.3	29.4	43.1	15.6	14.7	14.2	13.4	15.0	250.4
Plug-In Lighting Energy Use	kWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facade Lighting Energy Use	kWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Building Lighting Energy Use	kWh	10.4	13.5	19.0	22.7	39.3	29.4	43.1	15.6	14.7	14.2	13.4	15.0	250.4
Heating Energy Use	kWh	684.3	511.6	191.0	93.6	6.0	0.0	0.0	0.0	78.5	447.9	783.7	974.0	3770.6
Cooling Energy Use	kWh	0.0	0.0	0.0	0.8	33.1	105.1	108.8	77.7	0.0	0.0	0.0	0.0	325.5
Air Distribution Energy Use	kWh	54.9	55.2	61.3	70.7	70.7	102.6	73.7	44.9	28.8	49.2	58.9	72.9	743.6
Other HVAC Energy Use	kWh	1.1	1.6	4.5	6.0	6.0	6.3	6.4	6.9	6.8	2.6	1.0	0.9	50.1
HVAC Energy Use	kWh	740.4	568.4	256.7	171.1	115.8	214.0	188.8	129.6	114.1	499.6	843.5	1047.8	4889.9
DHW Energy Use	kWh	0.0	0.0	0.0	0.0	11.5	52.2	136.3	50.8	3.4	11.4	0.0	0.0	265.6



Average Daily End-Use Energy Consumption and PV Energy Production by Month





ECO-III Project - Contact Information

International Resources Group

Dr. Satish Kumar (skumar@irgltd.com)

Phone: +91-11-2685-3110

Fax: +91-11-2685-3114

Email: eco3@irgssa.com

Web Site: www.eco3.org (under construction)