Energy Efficiency and RE Integration in Buildings

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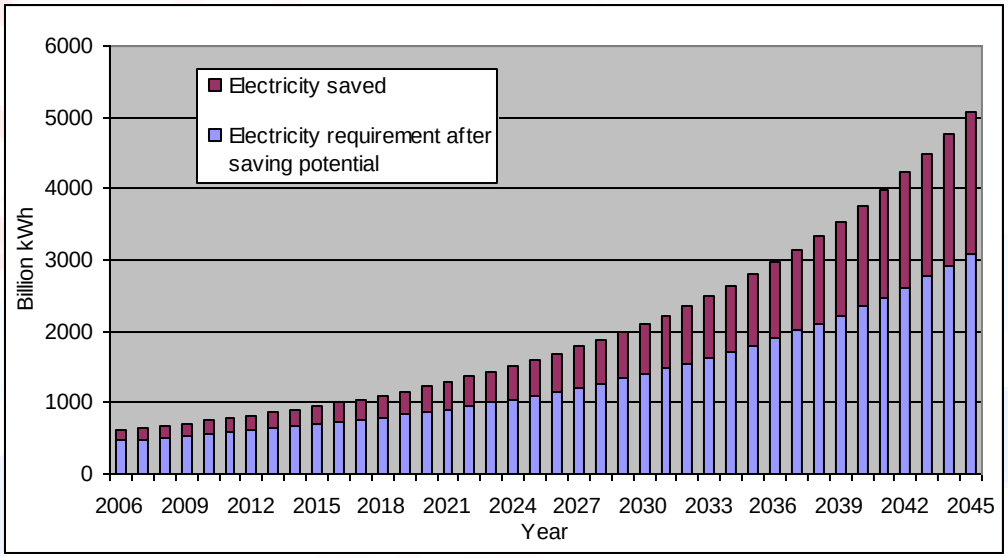
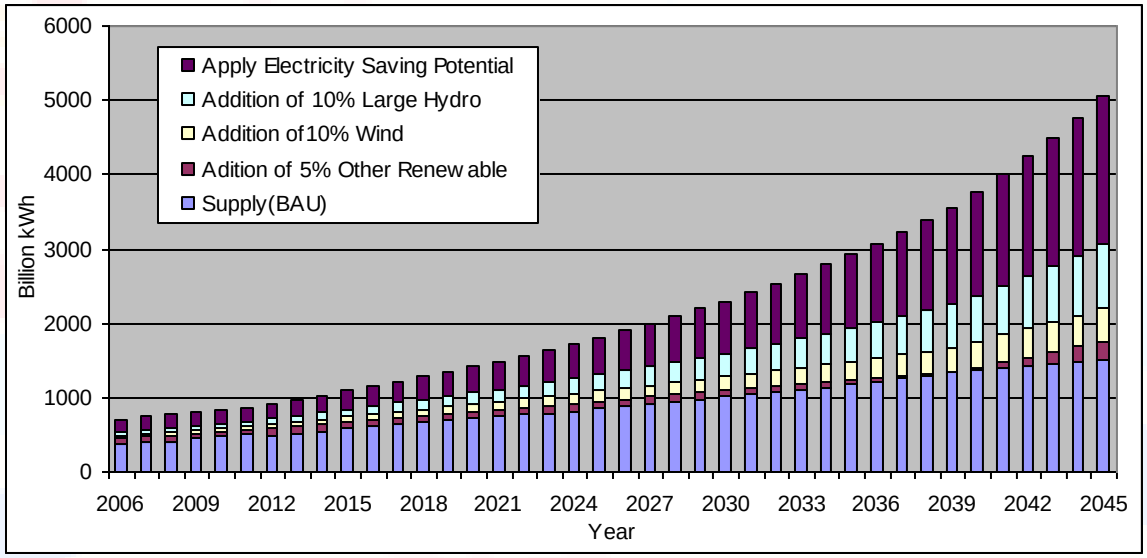
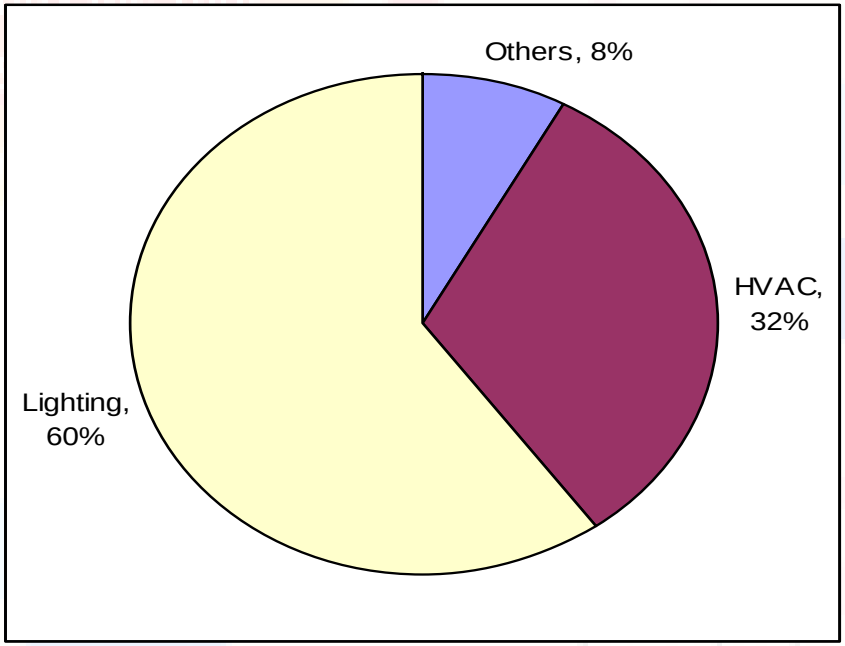
Total electricity requirement after applying saving potential



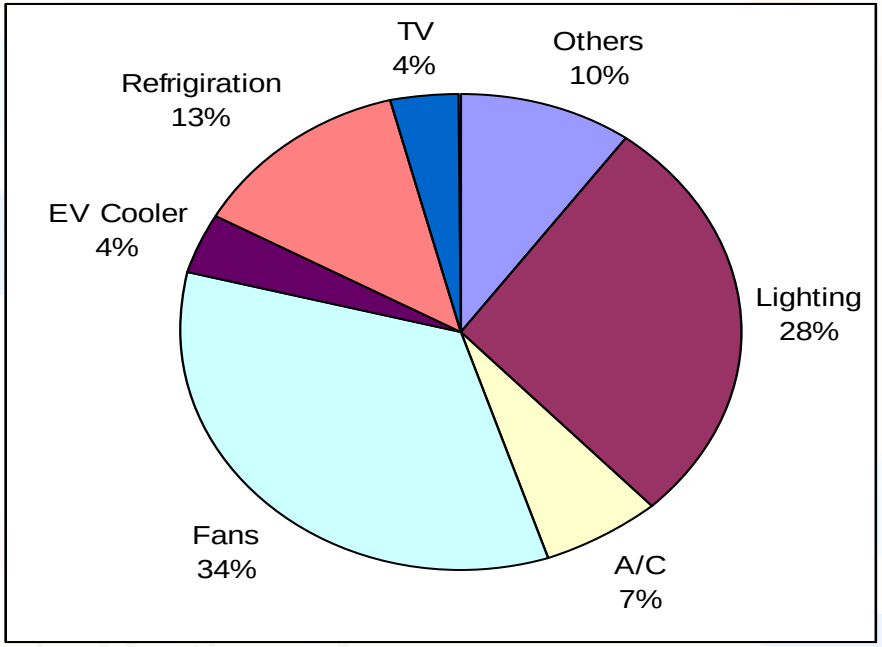
Probable Solutions to Meet Future Requirements



Energy consumption in the commercial and residential buildings

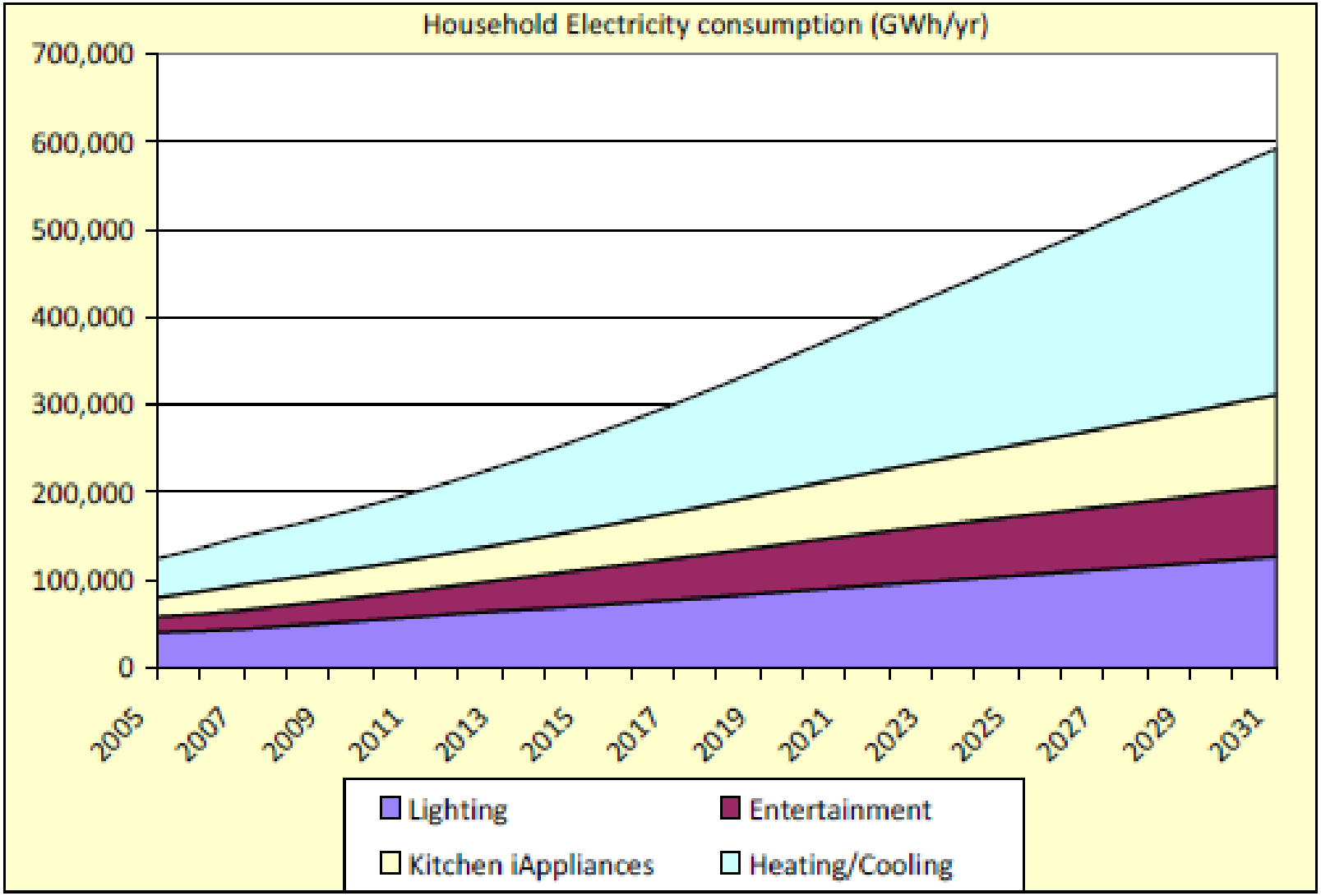


Commercial buildings 100 billion units



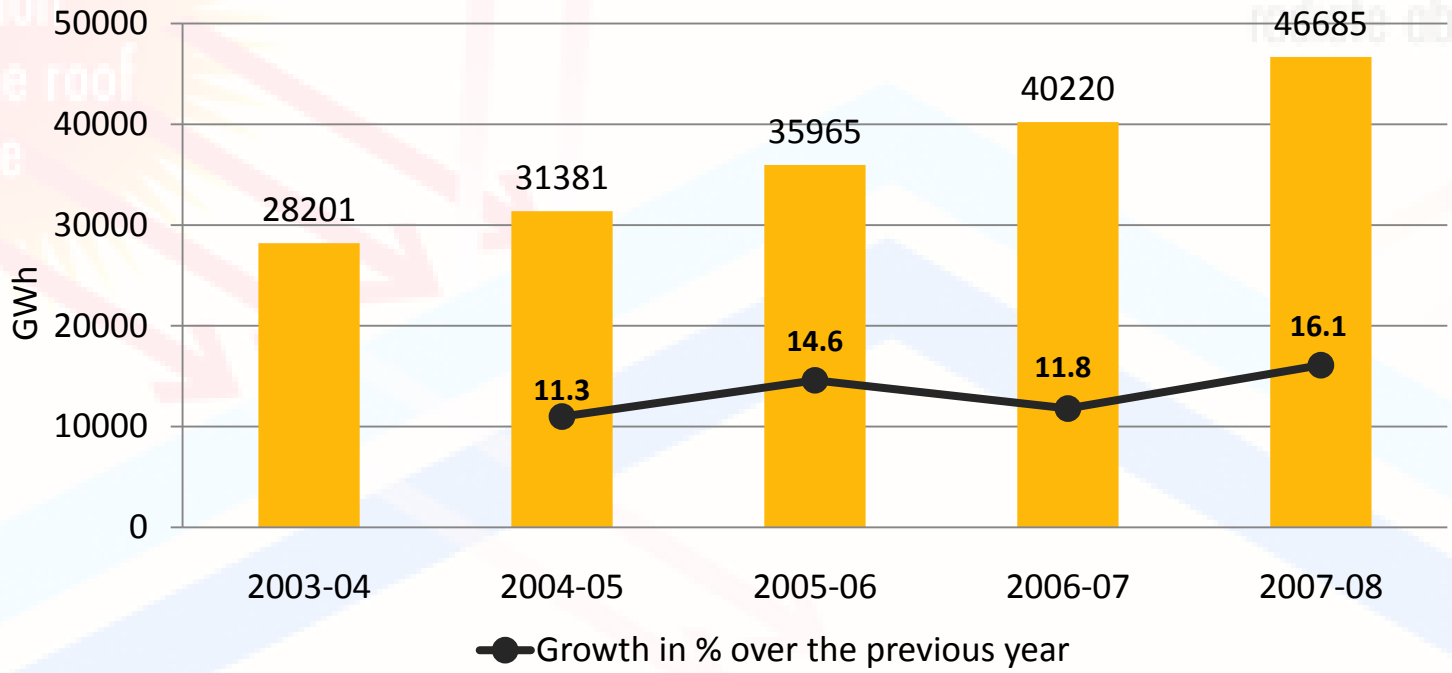
Residential buildings 200 billion units

Total Power consumed by Appliances



Source: Background paper, India: Strategies for Low Carbon Growth, July 2008, World bank

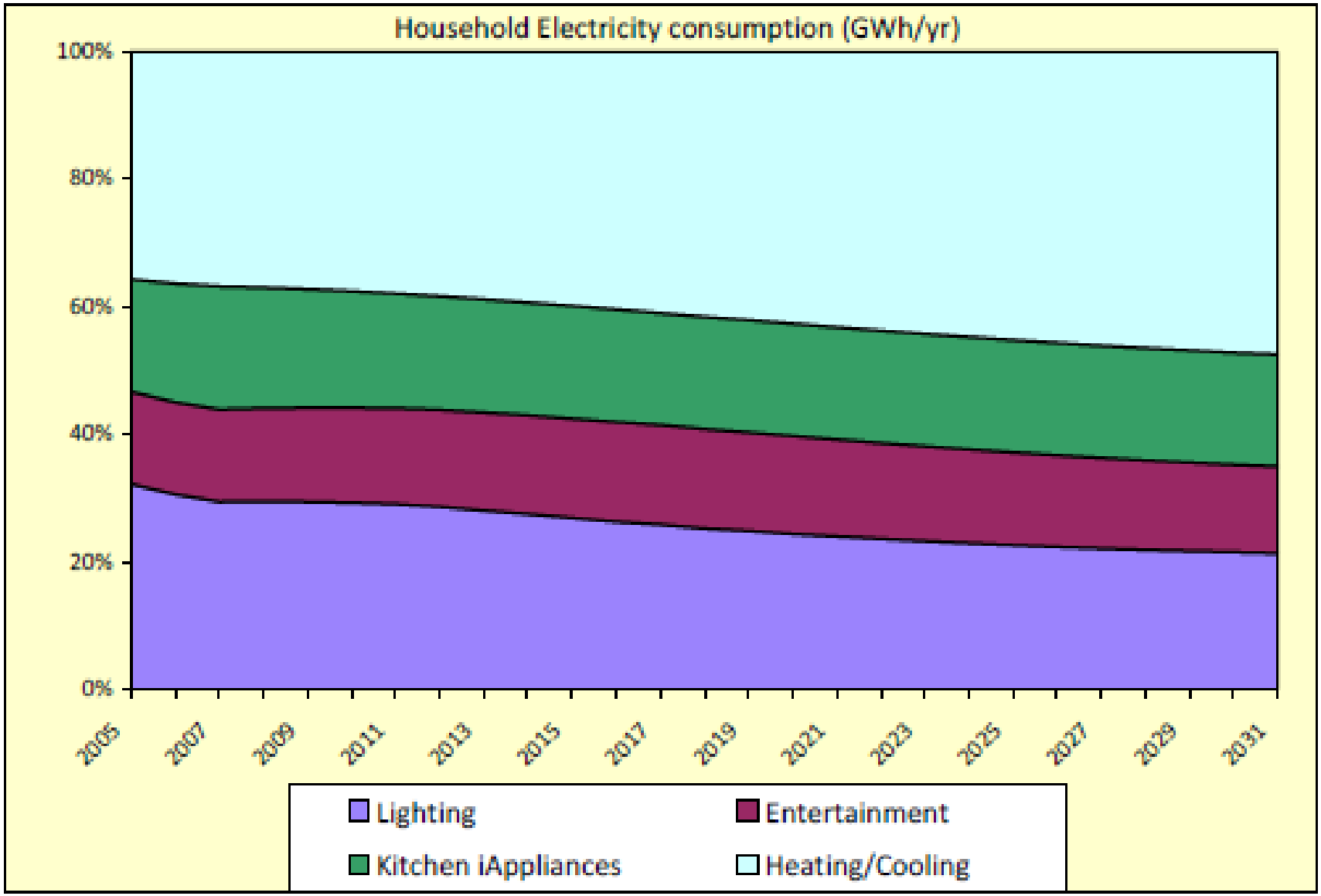
Energy Scenario in INDIA



Growth of Electricity Consumption in Commercial Sector in India (2003-08)

SOURCE: Central Electricity Authority, General Review 2009

Distribution of Power consumed by Appliances



Source: Background paper, India: Strategies for Low Carbon Growth, July 2008, World bank

ECBC Requirements: Prescriptive

(Opaque Walls)

- Maximum U-factor is prescribed for the complete wall assembly
- Minimum R-value is prescribed for insulation alone (excluding air films)

Table 4.2: Opaque Wall Assembly U-factor and Insulation R-value Requirements

Climate Zone	**Hospitals, Hotels, Call Centers (24-Hour)**		**Other Building Types (Daytime)**	
	Maximum U-factor of the overall assembly (W/m^2-°C)	Minimum R-value of insulation alone (m^2-°C/W)	Maximum U-factor of the overall assembly (W/m^2-°C)	Minimum R-value of insulation alone (m^2-°C/W)
Composite	U-0.440	R-2.10	U-0.440	R-2.10
Hot and Dry	U-0.440	R-2.10	U-0.440	R-2.10
Warm and Humid	U-0.440	R-2.10	U-0.440	R-2.10
Moderate	U-0.440	R-2.10	U-0.440	R-2.10
Cold	U-0.369	R-2.20	U-0.352	R-2.35

ECBC Requirements: Prescriptive (Roofs)

- Maximum U-factor is prescribed for the complete roof assembly
- Minimum R-value is prescribed for insulation alone (excluding air films)

Climate Zone	24-Hour use buildings Hospitals, Hotels, Call Centers etc.		Daytime use buildings Other Building Types	
	Maximum U-factor of the overall assembly (W/m^2-°C)	Minimum R-value of insulation alone (m^2-°C/W)	Maximum U-factor of the overall assembly (W/m^2-°C)	Minimum R-value of insulation alone (m^2-°C/W)
Composite	U-0.261	R-3.5	U-0.409	R-2.1
Hot and Dry	U-0.261	R-3.5	U-0.409	R-2.1
Warm and Humid	U-0.261	R-3.5	U-0.409	R-2.1
Moderate	U-0.409	R-2.1	U-0.409	R-2.1
Cold	U-0.261	R-3.5	U-0.409	R-2.1

- Recommendations made for proper placement, installation and protection of insulation

ECBC Requirements: Mandatory

- U-factors AND SHGC (Appendix C of the ECBC)
- In accordance with ISO-15099 AND labeled and certified by the manufacturer
- U-Factors and SHGC must be certified by an accredited independent testing laboratory

Table 11.1: Defaults for Unrated Vertical Fenestration (Overall Assembly including the Sash and Frame)

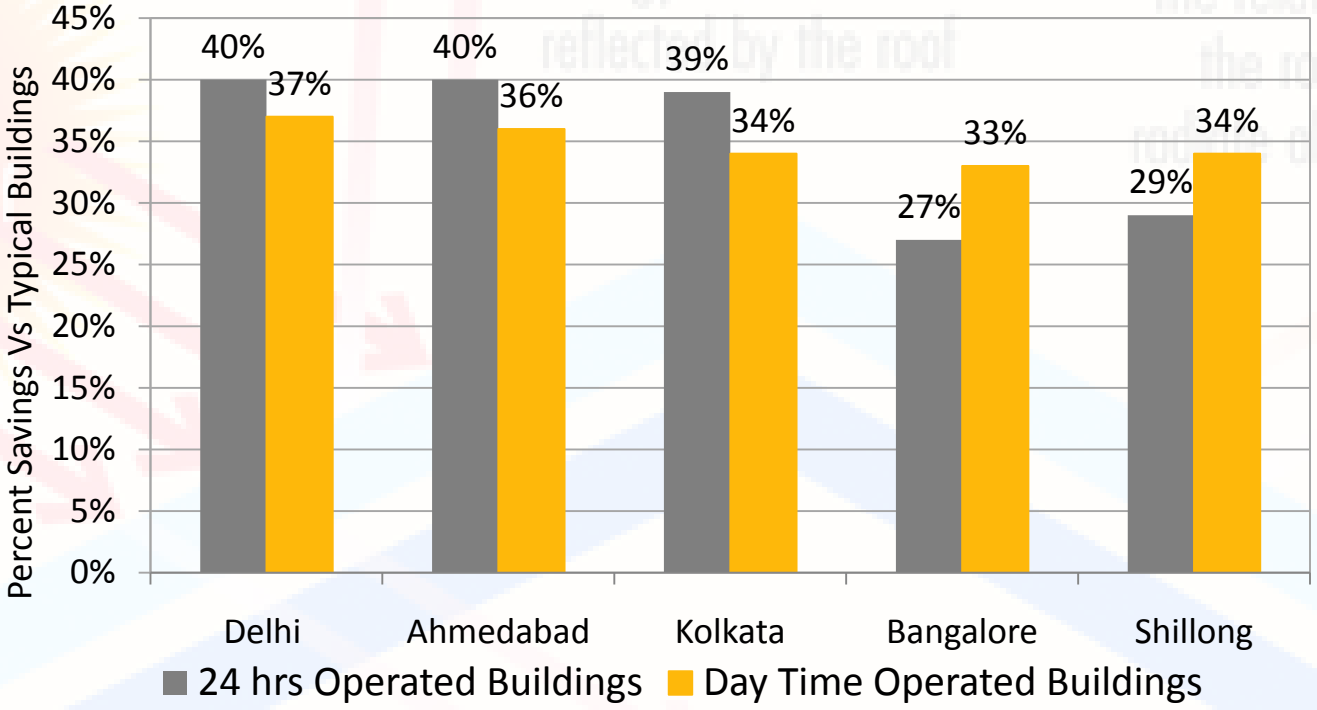
		Clear Glass			Tinted Glass		
Frame Type	**Glazing Type**	**U-Factor (W/m^2-°C)**	**SHGC**	**VLT**	**U-Factor (W/m^2-°C)**	**SHGC**	**VLT**
All frame types	Single Glazing	7.1	0.82	0.76	7.1	0.70	0.58
Wood, vinyl, or fiberglass frame	Double Glazing	3.3	0.59	0.64	3.4	0.42	0.39
Metal and other frame type	Double Glazing	5.1	0.68	0.66	5.1	0.50	0.40

ECBC Requirements: Mandatory

- Air Leakage through doors and fenestration
  - for glazed swinging entrance doors and revolving doors shall not exceed 5.0 l/s-m^2.
  - Other fenestration and doors shall not exceed 2.0 l/s-m^2.

- Building Envelope Sealing
  - The following areas of the enclosed building envelope shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:
    - Joints around fenestration and door frames
    - Openings between walls and foundations and between walls and roof and wall panels
    - Openings at penetrations of utility services through, roofs, walls, and floors
    - Site-built fenestration and doors
    - Building assemblies used as ducts or plenums
    - All other openings in the building envelope

ECBC and Energy Savings



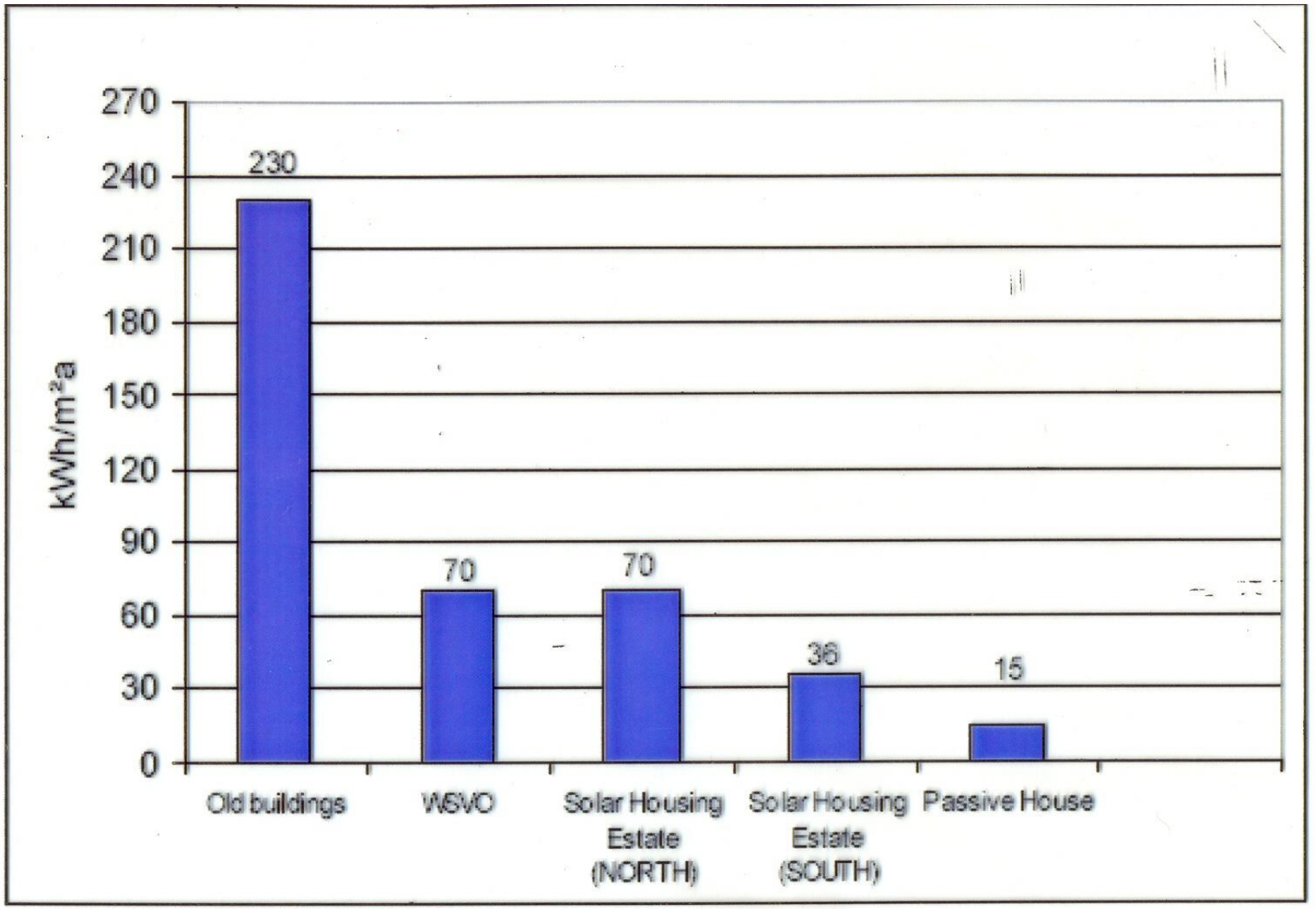
NATIONAL ENERGY SAVINGS	=	CODE STRINGENCY	X	LEVEL OF COMPLIANCE	X	ADOPTION RATE

SOURCE: ECBC Impact Analysis done by IECC under USAID ECO-III Project, New Delhi

EU Standards

- Energy-Saving House 60:The annual primary energy demand Qp may not exceed 60 kWh per square meter per energy reference area An. Furthermore, the specific heat transmission losses shall fall 30 percent below the upper limiting value, required according to the EnEV 2007.
- Energy-Saving House 40:The annual primary energy demand may not exceed 40 kWh per square meter per energy reference area. Furthermore, the specific heat transmission losses shall fall 45 percent below the upper limiting value, required according to the EnEV 2007.

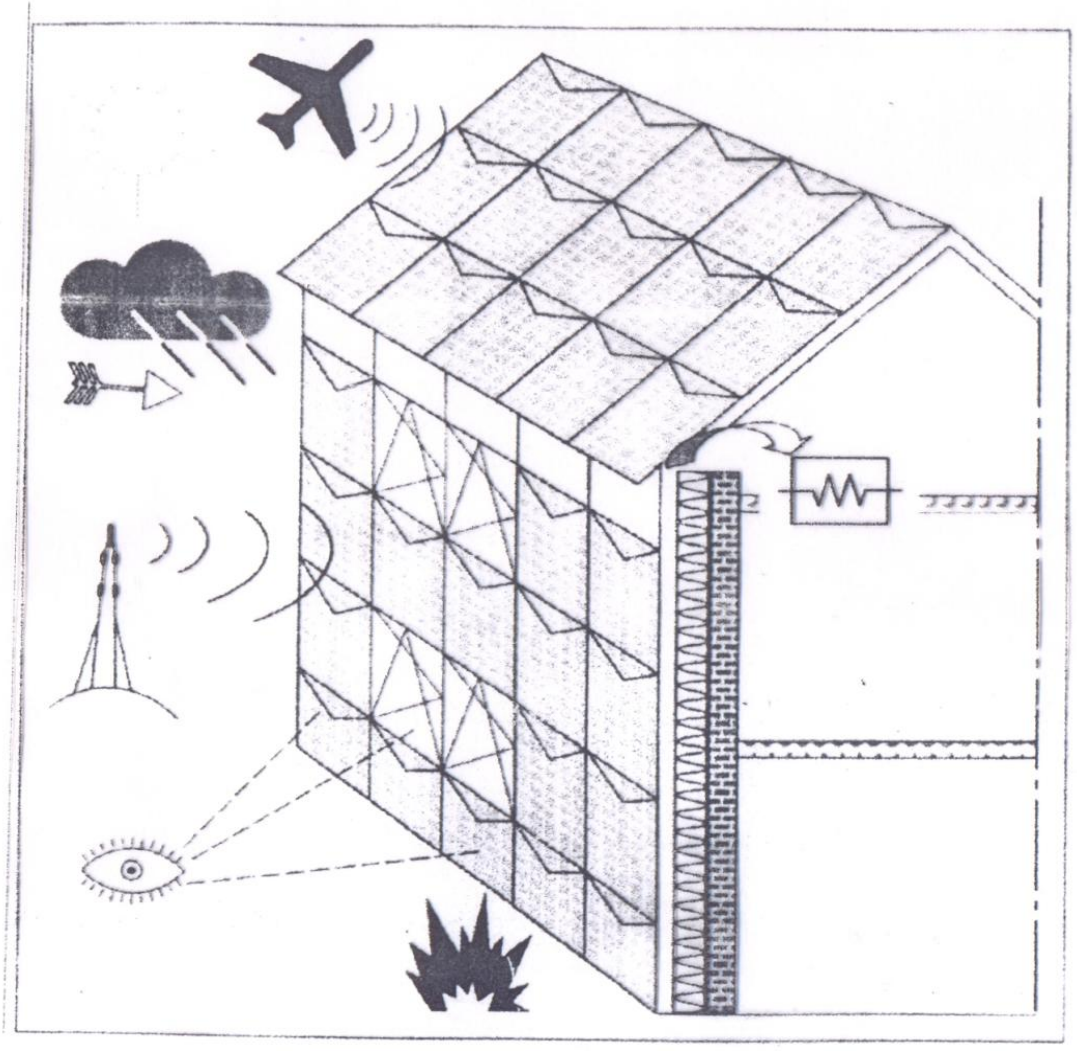
Passive House: Fulfilling all the requirements of a Energy-Saving House40, and additionally, the annual heating demand shall not exceed15 kWh per square meter of leasable area



Patterns of Energy Consumption in A Cluster of Buildings

Measures

- Thermal insulation of the roof and cellar
- Renewal of windows and doors
- Façade insulation
- Heating system and distribution board

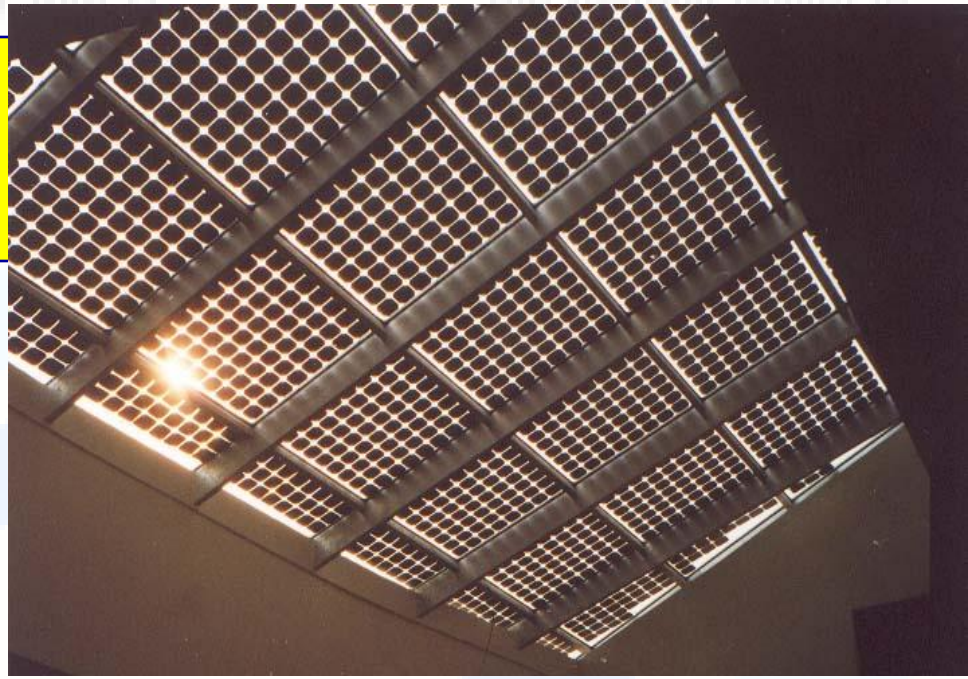


- Weather Protection
- Insulation
- Diffuse Light
- Design
- Noise Protection
- Fire Protection
- Electrical Energy Producti
- Thermal Energy Productio
- Electromagnetic Wave Protection

Renewable Energy

Photovoltaic system

- PV panels on roof top



- View of PV panels from inside lobby

Rudrapur Plant – 9.8KWp [BIPV]

Delta Rudrapur factory - BIPV

Capacity : 9.5 kWp
Module : See-thru module (44Wp, 10% Transparency),
Inverter : Delta 3.6 kW

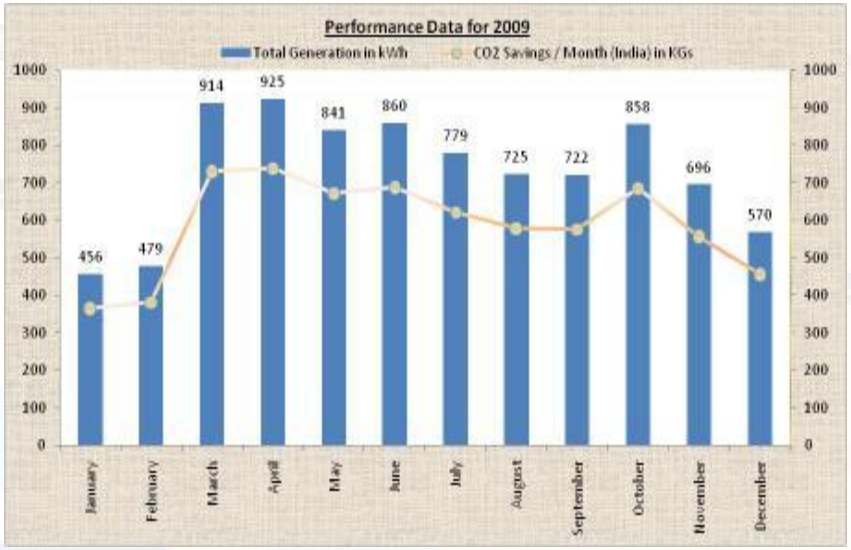
Left Façade

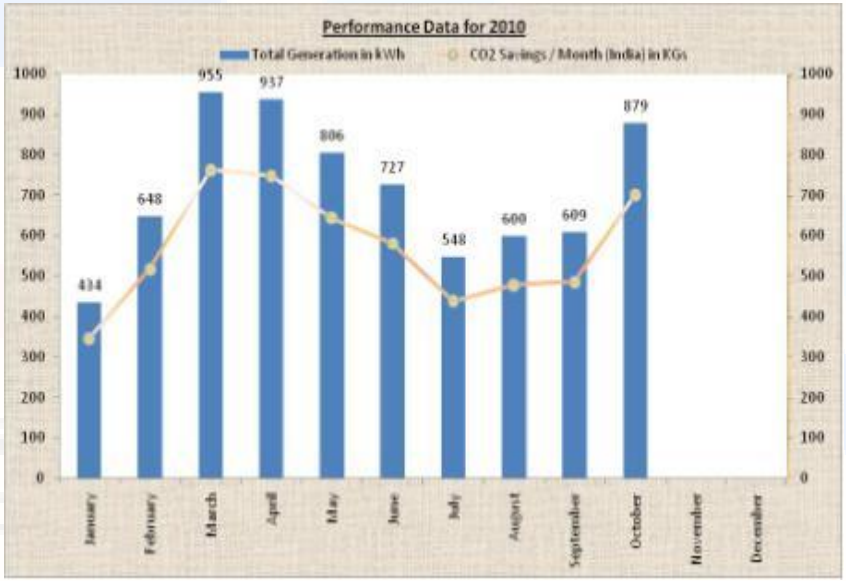
Canopy

Right Façade

Delta Rudrapur – System Performance

InsightPower Historical Data		
Month	**Total Generation in kWh**	**CO_2 Savings / Month (India) in KGs**
Year 2009		
January	456	365
February	479	383
March	914	731
April	925	740
May	841	673
June	860	688
July	779	623
August	725	580
September	722	578
October	858	686
November	696	557
December	570	456
Year 2010		
January	434	347
February	648	518
March	955	764
April	937	750
May	806	645
June	727	581
July	548	439
August	600	480
September	609	487
October	879	703
November		
December		





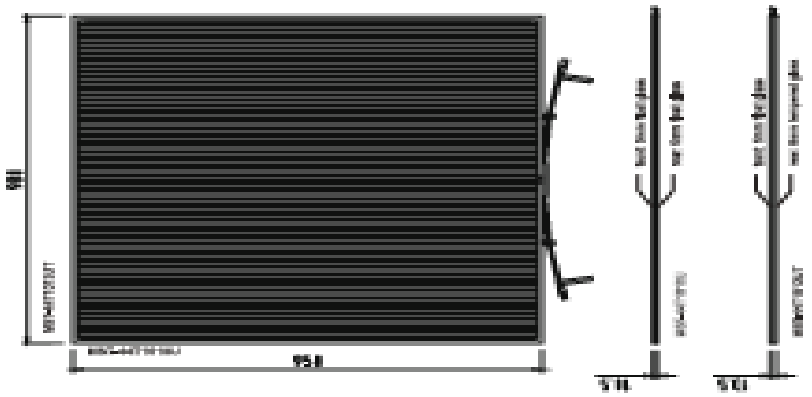
Source for CO2 Saving Calculation : CO2 Baseline Database for the Indian Power Sector User Guide Version 5

Roof Mounted Collectors

Quelle: IGS, TU-Braunschweig

PHOTOVOL GLASS
MST-44T1010U / MST-44T1013UT

Two thicknesses are available: 10.5mm (Top, Bottom: 5t annealed) and 13.5mm (Top: 5t annealed, Bottom: 8t tempered). Developed by MSK with Kaneka Corporation and the Japanese architects Taiyo Kogyo. 20 year power output guarantee. IEC and UL certified.



ELECTRICAL DATA

Transmittance	10%	5%	1%
Output power	44.0W	50.W	55.0W
Max power voltage	59.6V	64.4V	68.0V
Max power current	0.74A	0.78A	0.81A
Open circuit voltage	91.8V	91.8V	91.8V
Short circuit current	0.97A	1.09A	1.14A

Measured at standard test conditions of 1000W/m² irradiance, AM1.5 spectrum, 25°C. Values stabilise after a few months, initial values may exceed stabilised values shown by up to 15%.

OPTICAL DATA

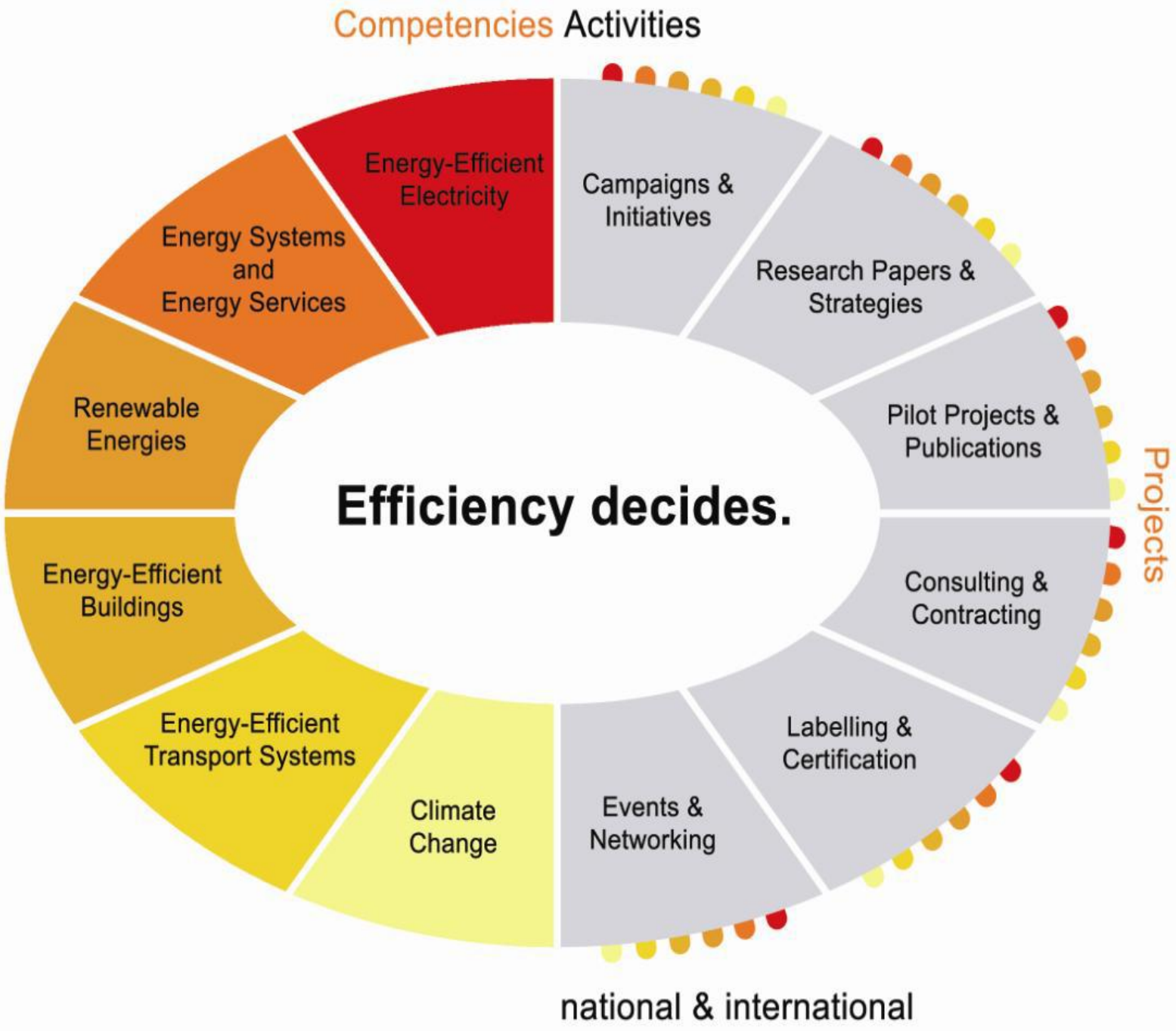
visible light	transmitted	10.6%
	reflected	9.7%
total solar energy	transmitted	10.0%
	reflected	20.0%
	absorbed	70.0%
UV	rejected	98.9%

THERMAL DATA

solar heat gain coefficient	vertical	0.24
	at 45°	0.25
	horizontal	0.25
shading coefficient	vertical	0.27
	at 45°	0.28
	horizontal	0.29
U-value (exterior to interior)	vertical	6.0 W/m²K
	at 45°	6.5 W/m²K
	horizontal	6.5 W/m²K
U-value (interior to exterior)	vertical	6.0 W/m²K
	at 45°	5.6 W/m²K
	horizontal	4.8 W/m²K

MECHANICAL DATA

Length	980mm
Width	950mm
MST-44T1010U depth	10.5mm (float glass)
MST-44T1013UT depth	13.5mm (tempered glass)
MST-44T1010U weight	23kg
MST-44T1013UT weight	30kg
Series cells	108
Parallel cells	1
Cell area	80.95cm²
Cell length	922mm
Cell width	8.78mm


Competencies Activities
Energy-Efficient Electricity
Energy Systems and Energy Services
Renewable Energies
Energy-Efficient Buildings
Energy-Efficient Transport Systems
Climate Change
Campaigns & Initiatives
Research Papers & Strategies
Pilot Projects & Publications
Consulting & Contracting
Labelling & Certification
Events & Networking
Projects
Efficiency decides.
national & international

FURTHER DISCUSSIONS AND THANK YOU