GREEN BUILDINGS RETURN ON INVESTMENT: AFRICA

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Creating Markets, Creating Opportunities

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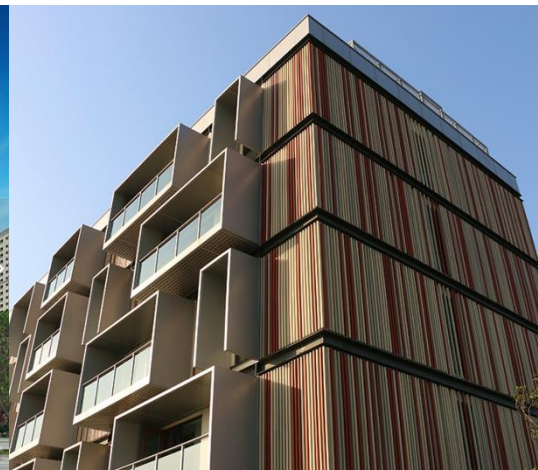

ANGOLA: GREEN BUILDINGS RETURN ON INVESTMENT

IFC International Finance Corporation
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Creating Markets, Creating Opportunities

ANGOLA – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	$245/unit	$35/unit	0.6
Hotels	$142,055	$34,745	0.3
Shopping Centers	$43,410	$29,165	0.1
Offices	$46,700	$5,145	0.8
Schools	$6,840	$1,400	0.4
Hospitals	$126,010	$33,765	0.31
Light Industry	$182,630	$10,535	1.4

HOMES – ANGOLA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m^2	2	10	50

Energy Measures – 23% Savings through:

- Energy Saving Light Bulbs
- Water Savings

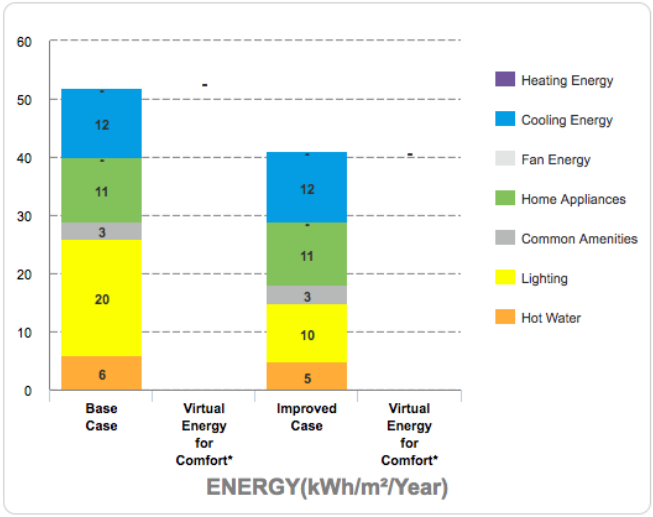
Water – 21% Savings through:

- Low-Flow Showerheads
- Low-Flow Faucets for Washbasins
- Dual Flush for Water Closets

Materials – 28% Savings through:

- In-Situ Trough Concrete Floor Slabs

23.29% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$245/unit

Utility Costs Savings

$35 / unit / month

Payback in Years

0.6

Operational CO_2 Savings

0.62 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 49% Savings through:

- Reduced Window to Wall Ratio
- Reflective paint and tiles for roof
- Energy-Saving Lighting
- Solar PV

Water – 24% Savings through:

- Low-Flow Faucets
- Water-Conserving Toilets

Materials – 45% Savings through:

- Medium-weight hollow concrete blocks for internal/external walls
- UPVC window frames

VILLA FLORA (HAITI)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

Hotels

HOTELS –ANGOLA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 21% Savings through:

- Insulation of Roof
- Preheat Water With Waste Heat from Generator
- Hot Water Heat Pump
- Energy Saving Light Bulbs
- Corridor lighting controls

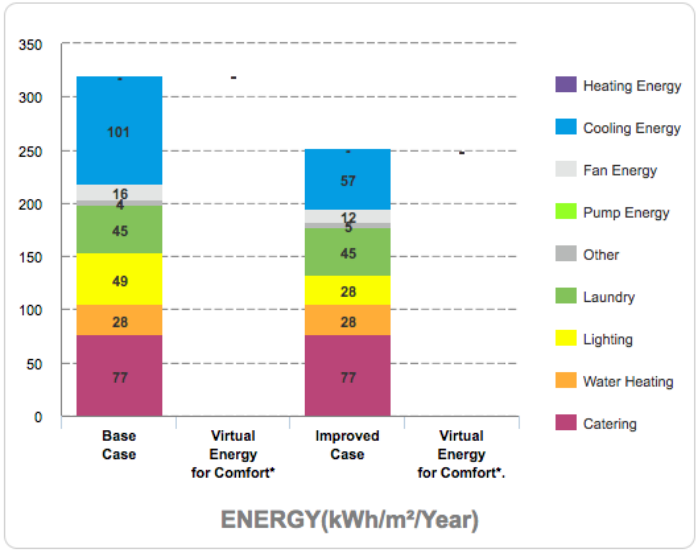
Water – 22% Savings through:

- Low Flow Showers and Faucets

Materials – 34% Savings through:

- Concrete filler slab

21.84% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$142,055

Utility Costs Savings

$34,745 / month

Payback in Years

0.3

Operational CO_2 Savings

639 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 60% Savings through:

- Reduced Window to Wall Ratio
- External shading devices
- Energy-efficient variable refrigerant volume cooling system
- Heat pump for hot water
- Energy Saving Lighting in internal/external areas
- Solar PVs

Water – 26% Savings through:

- Low-flow showerheads
- Low-flow faucets in guest rooms
- Dual flush water closets
- Water-efficient kitchen faucets

Materials – 34% Savings through:

- Cored bricks with internal and external plaster for internal/external walls
- Parquet wood flooring

ECO GREEN BOUTIQUE HOTEL (VIETNAM)

In-country certified project to replace related example once an EDGE project is certified.

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Retail

SHOPPING CENTERS – ANGOLA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 24% Savings through:

- Reflective Paint/Tiles for Roof, External Walls
- Variable Refrigerant Flow Cooling System
- Energy Saving Light Bulbs

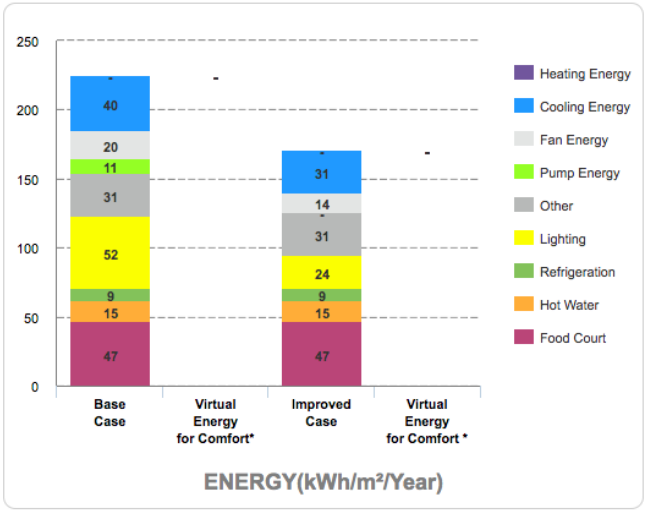
Water – 29% Savings through:

- Dual Flush for Water Closets
- Water-Efficient Urinals in all Bathrooms

Materials – 41% Savings through:

- In-situ trough concrete floor slab

23.78% **Meets EDGE energy standard**



PROJECT METRICS

Incremental Cost

$43,410

Utility Costs Savings

$29,165 / month

Payback in Years

0.1

Operational CO_2 Savings

485 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 37% Savings through:

- Reduced Window to Wall Ratio,
- Reflective paint and insulation for roof, walls
- Recovery of waste heat from generator for space heating
- Variable frequency drives in AHUs
- Variable speed drive pumps
- CO2 sensor/demand-controlled ventilation
- High-efficiency condensing boiler for space heating
- High efficiency refrigerated cases
- Energy-efficient lighting system

Water – 53% Savings through:

- Dual-flush water closets
- Water-efficient urinals
- Aerators and auto shut-off faucets

Materials – 30% Savings through:

- Corrugated zinc sheets for roof construction
- Steel profile cladding for external walls
- Solid dense concrete blocks for internal walls.

KAUFLAND (BULGARIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

LIGHT INDUSTRY– ANGOLA CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 25% Savings through:

- Reflective Paint/Tiles for Roof, External Areas
- Energy-Saving Lightbulbs
- Skylights
- Solar Hot Water Collectors
- Solar Photovoltaics

Water – 24% Savings through:

- Dual Flush for Water Closets
- Water-Efficient Urinals in all Bathrooms

Materials – 26% Savings through:

- In-Situ Trough Concrete Slab

PROJECTED PROJECT METRICS

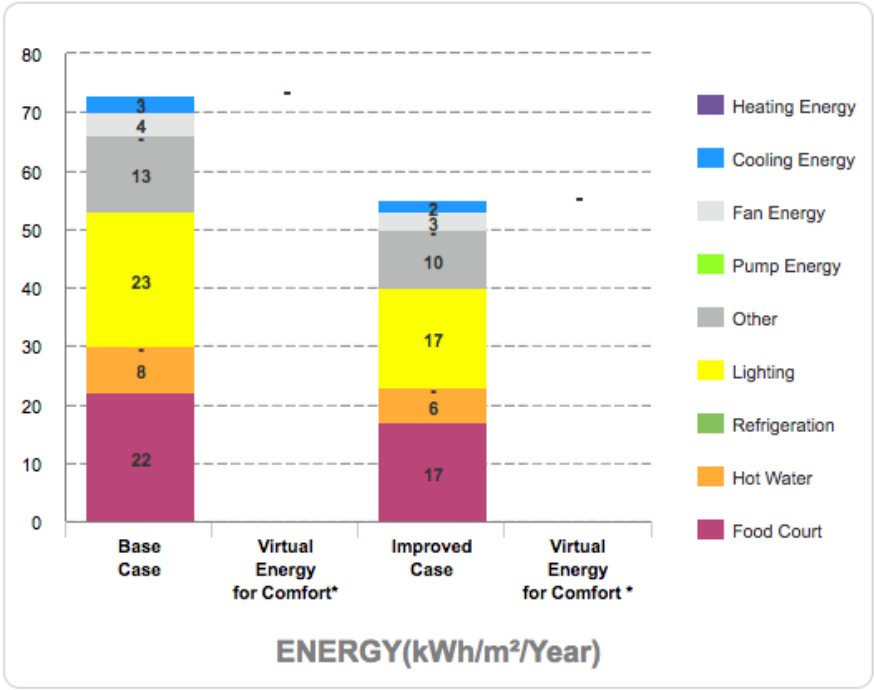
Incremental Cost
$182,630

Utility Costs Savings
$10,535 / month

Payback in Years
1.4

Operational CO2 Savings
169 tCO_2/Year

25.07% **Meets EDGE energy standard**



Light Industry is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

OFFICES – ANGOLA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 23% Savings through:

- External Shading Devices
- Insulation of Roof
- Occupancy Sensors in Open Offices
- Daylight Photoelectric Sensors

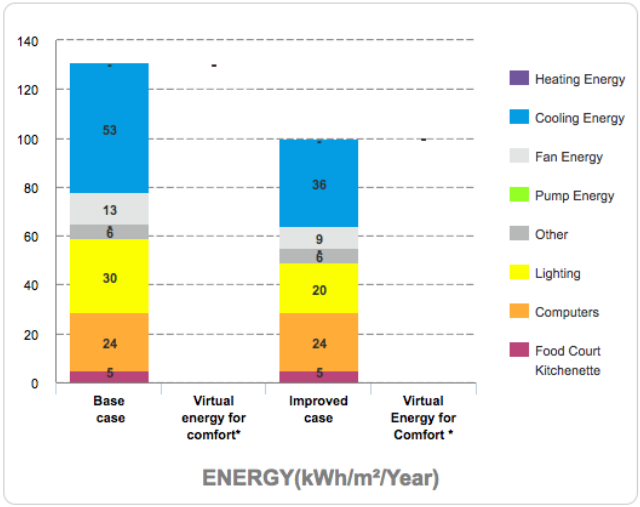
Water – 23% Savings through:

- Dual flush for water closets in Bathrooms
- Low-Flow Faucets in Bathrooms
- Water-Efficient Urinals in All Bathrooms

Materials – 27% Savings through:

- Concrete filler slab

23.29% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$46,700

Utility Costs Savings

$5,145 / month

Payback in Years

0.75

Operational CO_2 Savings

93 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 41% Savings through:

- Reduced window to wall ratio
- External Shading
- Air conditioning with air-cooled chiller and high COP
- Variable speed drives pumps
- Energy-efficient lighting system

Water – 29% Savings through:

- Low-Flow Faucets
- Dual-flush water closets

Materials – 34% Savings through:

- Concrete filler slabs for floors
- Solid dense concrete blocks for walls

TOHME RIZK (LEBANON)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SCHOOLS – ANGOLA CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 25% Savings through:

- Energy-Efficient Ceiling Fans
- Solar Hot Water Collectors

Water – 20% Savings through:

- Low-flow Showerheads and Faucets
- Dual-Flush for Water Closets

Materials – 24% Savings through:

- In-situ trough concrete slab

PROJECTED PROJECT METRICS

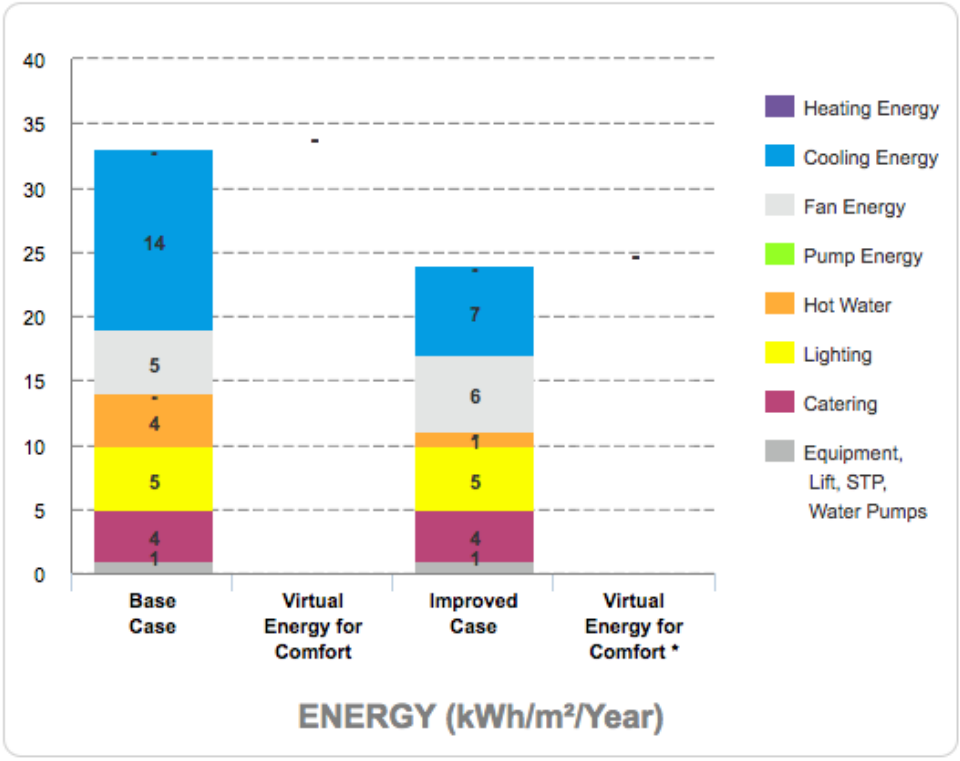
Incremental Cost
$6,840

Utility Costs Savings
$1,400 / month

Payback in Years
0.4 Years

Operational CO2 Savings
26 tCO_2/Year

24.8% **Meets EDGE Energy Standard**



Education is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

HOSPITALS – ANGOLA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m^2	70%	7	100

Energy Measures – 28% Savings through:

- Air Economizers Except for Critical Areas
- Energy Saving Light Bulbs

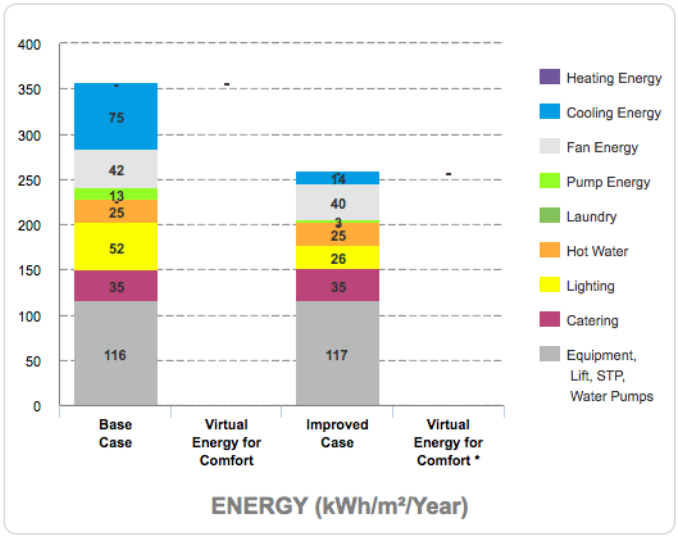
Water – 45% Savings through:

- Low-Flow Faucets in Bathrooms
- Dual-Flush for Water Closets in All Bathrooms

Materials – 27% Savings through:

- In-situ trough concrete slab

27.73% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$126,010

Utility Costs Savings

$33,765 / month

Payback in Years

0.3

Operational CO_2 Savings

610 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 56% Savings through:

- Reduced Window To Wall Ratio
- Insulation Of Roof And External Walls
- Low E-coated Glass
- Air Conditioning With Air Cooled Chiller
- Energy-saving Lighting Systems For Internal And External Spaces
- Solar Hot Water Collectors
- Solar Photovoltaics

Water – 33% Savings through:

- Low-flow Faucets In Bathrooms And Dual-flush Water Closets

Materials – 42% Savings through:

- Aluminum Sheets On Steel Rafters For Roof Construction
- 3-D Wire Panel With “Shot-crete” On Both Sides For External And Internal Walls
- Ceramic Tile Flooring

KOMFO ANOKYE HOSPITAL (GHANA)

In-country certified project to replace related example once an EDGE project is certified.

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COTE D'IVOIRE: GREEN BUILDINGS RETURN ON INVESTMENT

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Creating Markets, Creating Opportunities

COTE D'IVOIRE – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	$100/unit	$10/unit	0.9
Hotels	$67,900	$6,900	0.8
Shopping Centers	$17,150	$6,470	0.2
Offices	$26,400	$1,170	1.9
Schools	$10,425	$295	3
Hospitals	$83,320	$6,090	1.1
Light Industry	$58,620	$2,220	2.2

HOMES – COTE D'IVOIRE CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

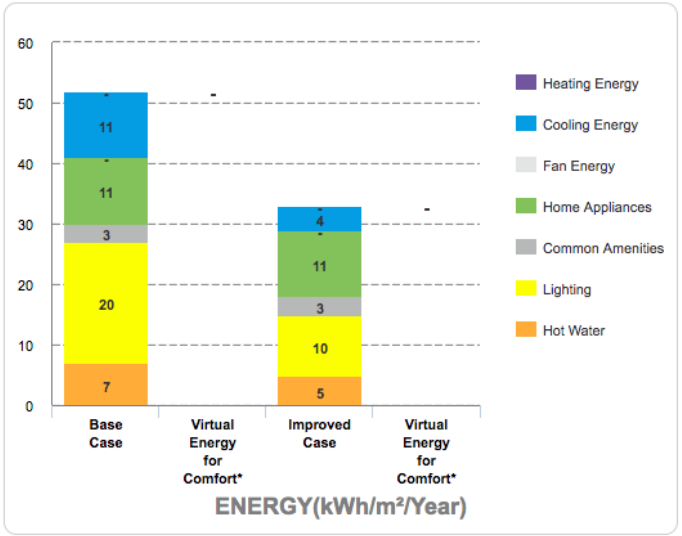
Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m^2	2	10	50

Energy Measures – 36% Savings through:
- Low-E coated glass
- Natural ventilation
- Energy Saving Light Bulbs
- High-efficiency boiler for hot water

Water – 21% Savings through:
- Low-Flow Faucets for Washbasins & Kitchen Sinks
- Dual Flush for Water Closets

Materials – 24% Savings through:
- Composite In-Situ Concrete Floor Slabs

36.46% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$100/unit

Utility Costs Savings

$10 / unit / month

Payback in Years

0.9

Operational CO_2 Savings

0.74 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 23% Savings through:
- Reduced window to wall ratio
- Reflective paint for roof and walls
- External shading
- Energy efficient ceiling fans and lighting systems

Water – 24% Savings through:
- Low-flow faucets
- Recycled black water for flushing

Materials – 71% Savings through:
- In-situ concrete with greater than 30% PFA
- Internal walls made of FALG blocks

KESAR CITY (INDIA)

In-country certified project to replace related example once an EDGE project is certified.

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HOTELS – COTE D'IVOIRE CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

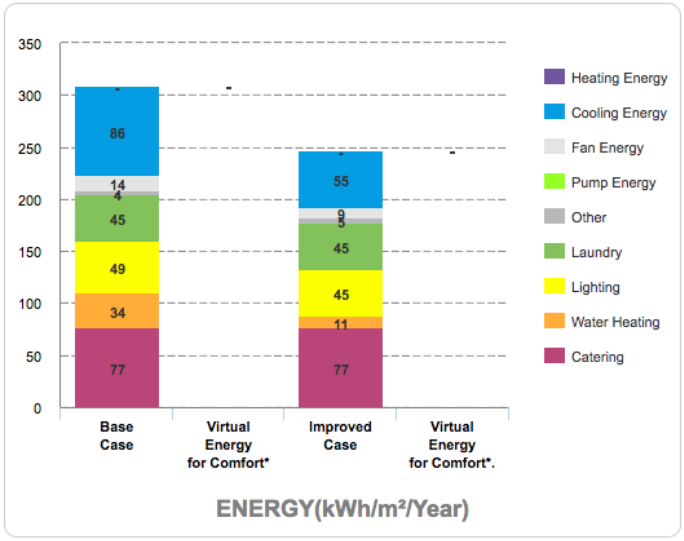
Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 20% Savings through:
- External Shading Devices
- Low-E Coated Glass
- Natural Ventilation-Corridors
- Heat Pump for Hot Water
- Occupancy Sensors in Bathrooms

Water – 22% Savings through:
- Low Flow Showers and Faucets

Materials – 33.83% Savings through:
- Concrete Filler Slab

20.07% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$67,900

Utility Costs Savings

$6,900 / month

Payback in Years

0.8

Operational CO_2 Savings

450 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 46% Savings through:
- Reduced Window to Wall Ratio
- External shading devices
- Low-E coated glass
- Variable refrigerant volume cooling system,
- Heat pump for hot water
- Energy Saving Lighting for internal/external spaces

Water – 25% Savings through:
- Low-flow faucets in kitchens/bathrooms
- Dual Flush water closets
- Water-efficient urinals, dishwashers, and landscaping
- Aerators and auto shut-off faucets in bathrooms

Materials – 41% Savings through:
- Autoclaved aerated concrete blocks for internal/external walls
- UPVC window frames

THE 101 BOGOR SURYAKANCANA (INDONESIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SHOPPING CENTERS – COTE D'IVOIRE CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

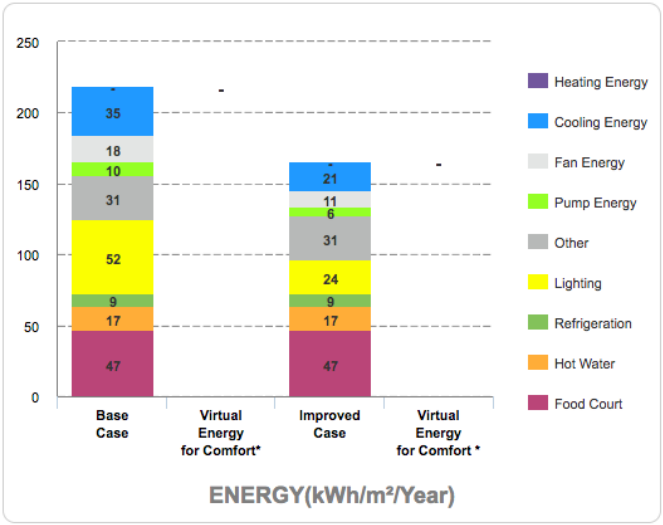
Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 24% Savings through:
- Reflective Paint/Tiles for Roof
- Natural Ventilation w/Operable Windows
- Energy Saving Light Bulbs

Water – 25% Savings through:
- Dual Flush for Water Closets
- Water-Efficient Urinals

Materials – 21% Savings through:
- Light Gauge Steel Floor Cassette

23.78% **Meets EDGE energy standard**



PROJECT METRICS

Incremental Cost

$17,150

Utility Costs Savings

$6,470 / month

Payback in Years

0.2

Operational CO_2 Savings

360 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 29% Savings through:
- Reduced Window to Wall Ratio,
- Reflective Paint for Roof
- Variable Refrigerant Volume (VRV) Cooling System
- Energy Saving Lighting, Solar Photovoltaics

Water – 49% Savings through:
- Low-Flow Plumbing Fixtures
- Aerators and Auto Shut-off Faucet in All Washrooms
- Rainwater Harvesting System

Materials – 36% Savings through:
- In-Situ Reinforced Concrete Floor Slabs, Steel Sheets on Steel Rafters Roof
- Steel Profile Cladding for External Walls
- Autoclaved Aerated Concrete for Internal and External Walls

SAVEMAX SUPER GROSIR CIBUBUR (INDONESIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

LIGHT INDUSTRY– COTE D'IVOIRE CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 21% Savings through:
- Reflective Paint/Tiles for Roof, External Areas
- Natural Ventilation
- Variable Frequency Drives in AHUs
- Energy-Saving Lightbulbs
- Solar Hot Water Collectors
- Skylights

Water – 24% Savings through:
- Dual Flush for Water Closets
- Water-Efficient Urinals

Materials – 22% Savings through:
- In-situ waffle concrete slab

PROJECTED PROJECT METRICS

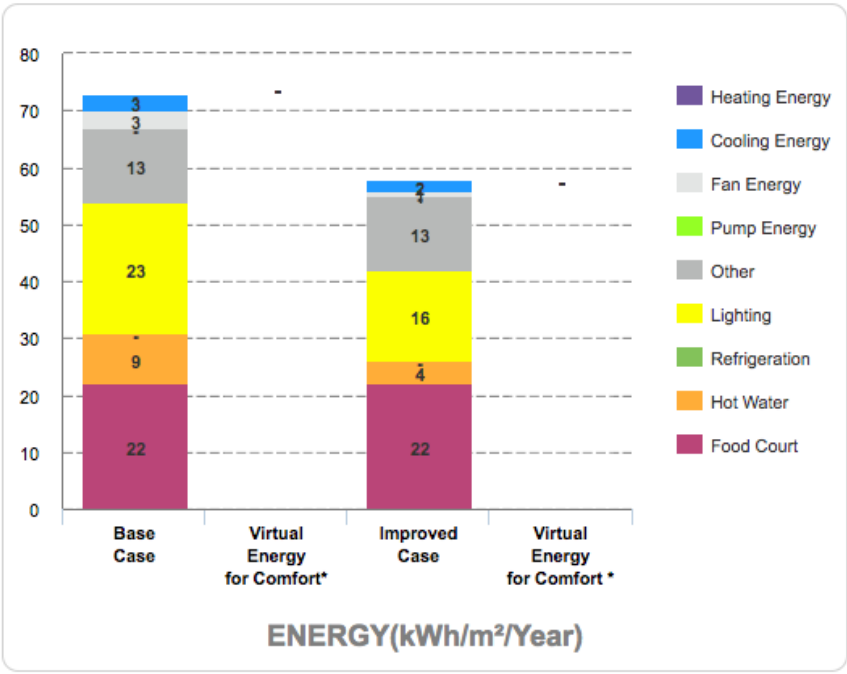
Incremental Cost
$58,620

Utility Costs Savings
$2,220 / month

Payback in Years
2.2

Operational CO2 Savings
109 tCO_2/Year

21.23% Meets EDGE energy standard



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OFFICES – COTE D'IVOIRE CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 25% Savings through:

- Reflective Paint/Tiles for Roof
- Variable Refrigerant Flow System
- Occupancy Sensors in Open Offices
- Daylight Photoelectric Sensors

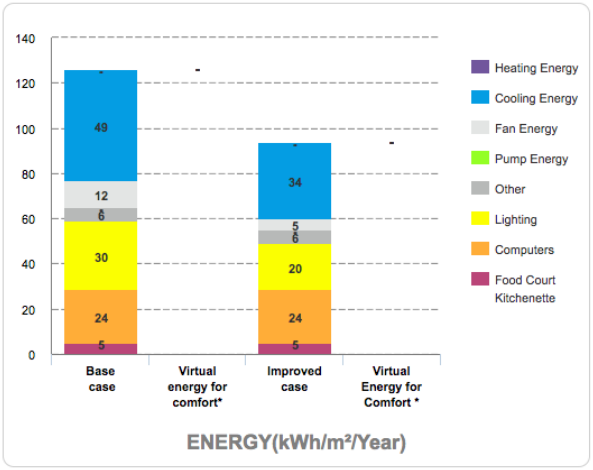
Water – 23% Savings through:

- Dual flush for water closets in Bathrooms
- Low Flow Faucets
- Water-Efficient Urinals in All Bathrooms

Materials – 27% Savings through:

- Concrete filler slab

25.17% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$26,400

Utility Costs Savings

$1,170 / month

Payback in Years

1.88

Operational CO_2 Savings

74 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 32% Savings through:

- External Shading
- Roof insulation
- Variable Refrigerant Volume Cooling System
- Energy-saving lighting system
- Solar PVs

Water – 54% Savings through:

- Low-Flow Faucets
- Dual flush water closets
- Water-efficient urinals

Materials – 38% Savings through:

- Concrete filler slabs for floors
- Solid dense concrete blocks for external walls

DIPOA (COSTA RICA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SCHOOLS – COTE D'IVOIRE CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 32% Savings through:
- Natural Ventilation for Classrooms
- Photoelectric Sensors to Harvest Daylight

Water – 25% Savings through:
- Low-flow Faucets
- Dual-Flush Water Closets
- Water-Efficient Urinals

Materials – 23% Savings through:
- Concrete Filler Floor Slabs

PROJECTED PROJECT METRICS

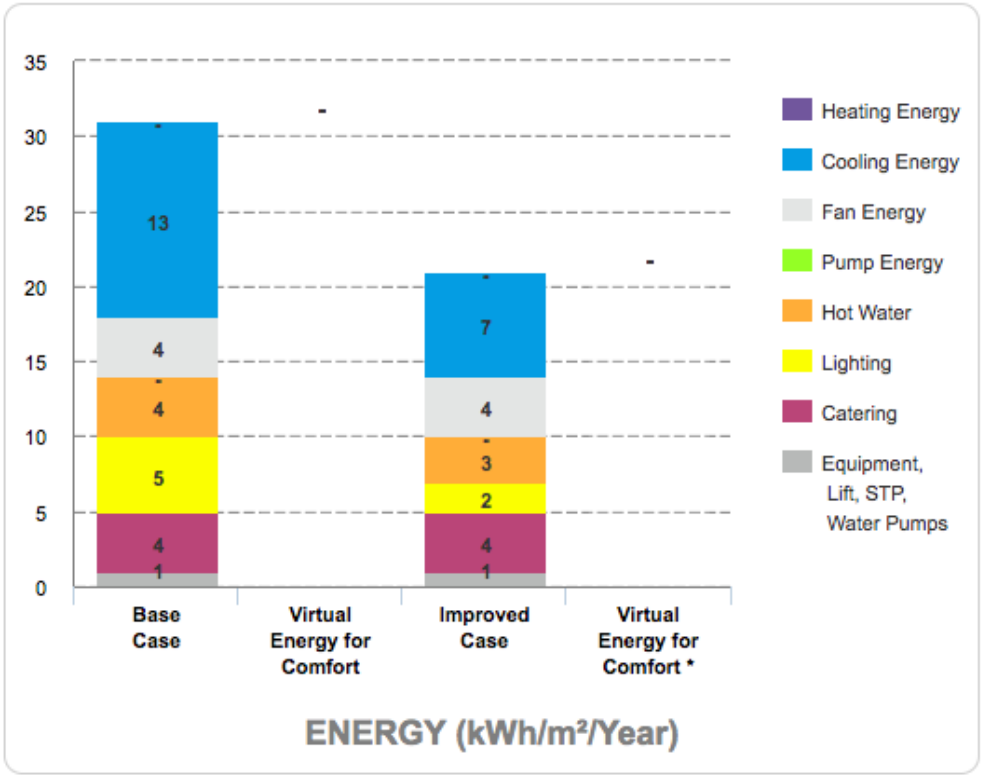
Incremental Cost
$10,425

Utility Costs Savings
$295 / month

Payback in Years
3 Years

Operational CO2 Savings
24.4 tCO_2/Year

31.6% Meets EDGE Energy Standard



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HOSPITALS – COTE D'IVOIRE CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m^2	70%	7	100

Energy Measures – 29% Savings through:

- Air Economizers Except for Critical Areas
- Energy Saving Light Bulbs

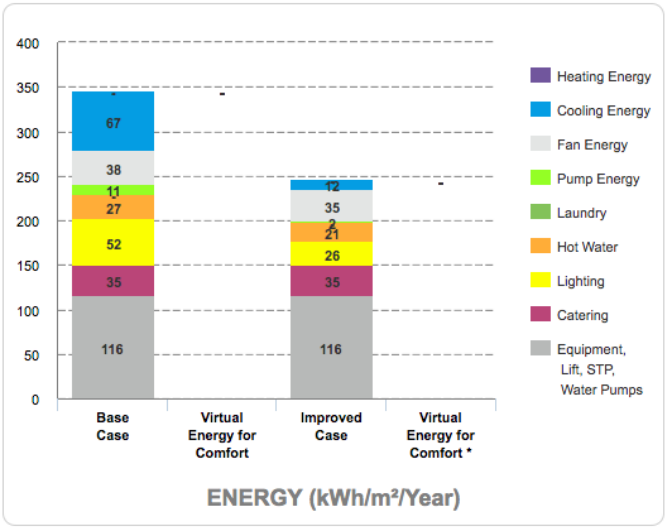
Water – 31% Savings through:

- Low-Flow Faucets in All Bathrooms

Materials – 25% Savings through:

- Concrete Filler Floor Slabs

28.83% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$83,320

Utility Costs Savings

$6,090 / month

Payback in Years

1.1

Operational CO_2 Savings

467 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 37% Savings through:

- Reduced Window To Wall Ratio
- Reflective paint for external walls
- Insulation of roof and external walls
- Natural ventilation for corridors
- Variable Refrigerant Volume (VRV) cooling system
- Energy-saving lighting systems
- Occupancy sensors in bathrooms
- Solar PVs

Water – 39% Savings through:

- Low-flow faucets In bathrooms
- Single-flush and flush valves for water closets and Water-efficient urinals
- Water-efficient landscaping
- Rainwater Harvesting System

Materials – 39% Savings through:

- Steel sheets on steel rafters for roof construction
- Medium-weight hollow concrete blocks for internal, external walls
- Finished concrete flooring

SEDE DE EBAIS DE LA RIBERA DE BELEN (COSTA RICA)

In-country certified project to replace related example once an EDGE project is certified.

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GHANA: GREEN BUILDINGS RETURN ON INVESTMENT

IFC | International Finance Corporation
WORLD BANK GROUP

Creating Markets, Creating Opportunities

GHANA – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	$250/unit	$20/unit	1
Hotels	$132,590	$43,290	0.3
Shopping Centers	$140,900	$27,900	0.4
Offices	$40,815	$5,620	0.7
Schools	$19,000	$3,710	0.4
Hospitals	$83,420	$31,620	0.2
Light Industry	$173,580	$14,870	1

HOMES – GHANA CASE STUDY & CERTIFIED PROJECT

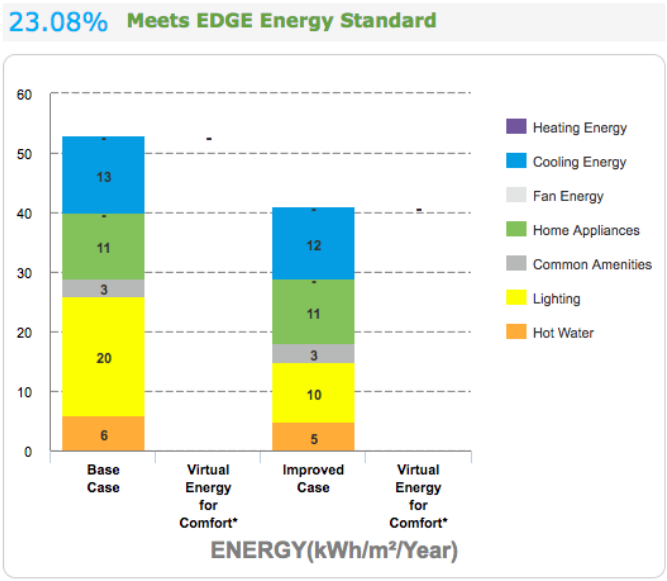
BUILDING DETAILS

Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m²	2	10	50

Energy Measures – 23% Savings through:
- Energy Saving Light Bulbs
- Energy savings from water interventions

Water – 21% Savings through:
- Low-Flow showerheads
- Low-Flow Faucets for washbasins
- Dual-Flush for water closets

Materials – 22% Savings through:
- Concrete filler slab



PROJECT METRICS

Incremental Cost

$250/unit

Utility Costs Savings

$20 / unit / month

Payback in Years

1

Operational CO_2 Savings

0.39 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 30% Savings through:
- Insulation of roof
- Low-E coated class
- Air conditioning system with high COP
- Energy saving light bulbs for internal/external spaces and common areas

Water – 25% Savings through:
- Low-Flow plumbing fixtures
- Dual flush water closets

Materials – 28% Savings through:
- Medium weight hollow concrete blocks for internal/external walls
- Solid dense concrete blocks for external walls

EXCHANGE COMPLEX (GHANA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOTELS – GHANA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

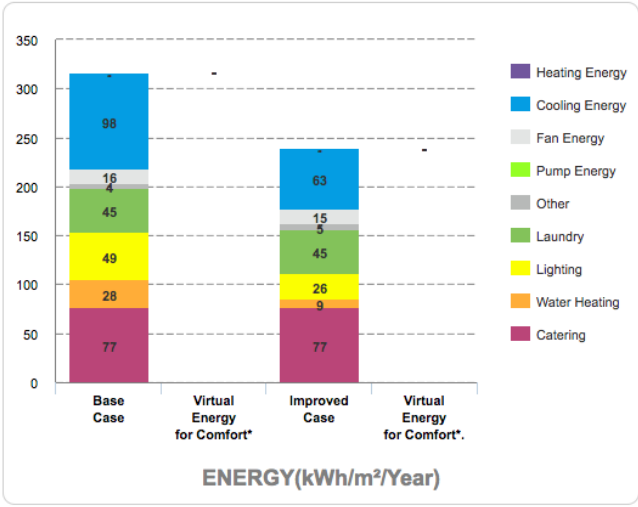
Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 24% Savings through:
- Natural Ventilation-Corridors
- Variable Refrigerant Flow Cooling System
- Heat Pump for Hot Water
- Energy-Saving Lightbulbs in Internal, External Spaces

Water – 22% Savings through:
- Low Flow Showers and Faucets

Materials – 33.83% Savings through:
- Concrete Filler Slab

24.44% Meets EDGE Energy Standard



PROJECT METRICS

Incremental Cost

$132,590

Utility Costs Savings

$43,290 / month

Payback in Years

0.3

Operational CO_2 Savings

463 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 22% Savings through:
- Reduced Window to Wall Ratio
- Insulated roof
- Low-E coated glass
- High-efficiency boiler for hot water
- Energy Saving Lighting for internal spaces with corridor lighting controls
- Air conditioning with air cooled screw chiller
- Variable speed drive pumps
- Sensible heat recovery from exhaust air and variable speed hoods with automated fan controls
- Preheating water using waste heat from the generator

Water – 24% Savings through:
- Low-flow plumbing fixtures
- Rainwater harvesting system
- Dual-flush water closets
- Water-efficient landscaping
- Condensate water recovery
- Black water treatment and recycling

Materials – 22% Savings through:
- Medium-weight hollow concrete blocks for internal/external walls
- Terrazzo tile flooring

RADISSON BLU HOTEL-EXCHANGE (GHANA)

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SHOPPING CENTERS – GHANA CASE STUDY & CERTIFIED PROJECT

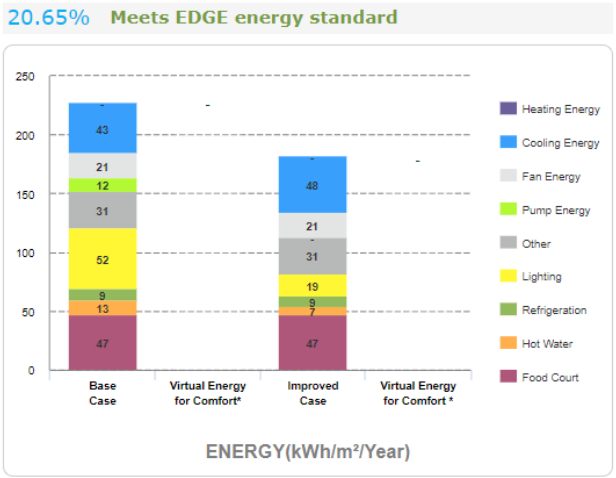
BUILDING DETAILS

Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 34% Savings through:
- Reflective Paint/Tiles for Roof
- Skylights to top floor
- Solar Photovoltaics

Water – 28% Savings through:
- Dual Flush for Water Closets
- Water-Efficient Kitchen Faucets

Materials – 23% Savings through:
- Composite Slim Floor Slabs with Steel I-Beams



PROJECT METRICS

Incremental Cost

$140,900

Utility Costs Savings

$27,900 / month

Payback in Years

0.4

Operational CO_2 Savings

268 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 29% Savings through:
- Reduced Window to Wall Ratio,
- Insulated roofs and external walls
- Occupancy sensors in bathrooms
- Energy saving lighting in sales, corridors, common and external areas

Water – 24% Savings through:
- Single flush for water closets
- Water-efficient urinals
- Aerators and auto-shut-off faucets in all bathrooms

Materials – 23% Savings through:
- Steel sheets on steel rafters roof construction
- Cement fibre boards on metal studs for all external walls

RETAIL AT SANTA VERDE (COSTA RICA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

LIGHT INDUSTRY– GHANA CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 35% Savings through:
- Solar Hot Water Collectors
- Solar Photovoltaics
- Skylights

Water – 21% Savings through:
- Water-Efficient Kitchen Faucets
- Grey Water Treatment and Recycling System

Materials – 27% Savings through:
- In-situ trough concrete slab

PROJECTED PROJECT METRICS

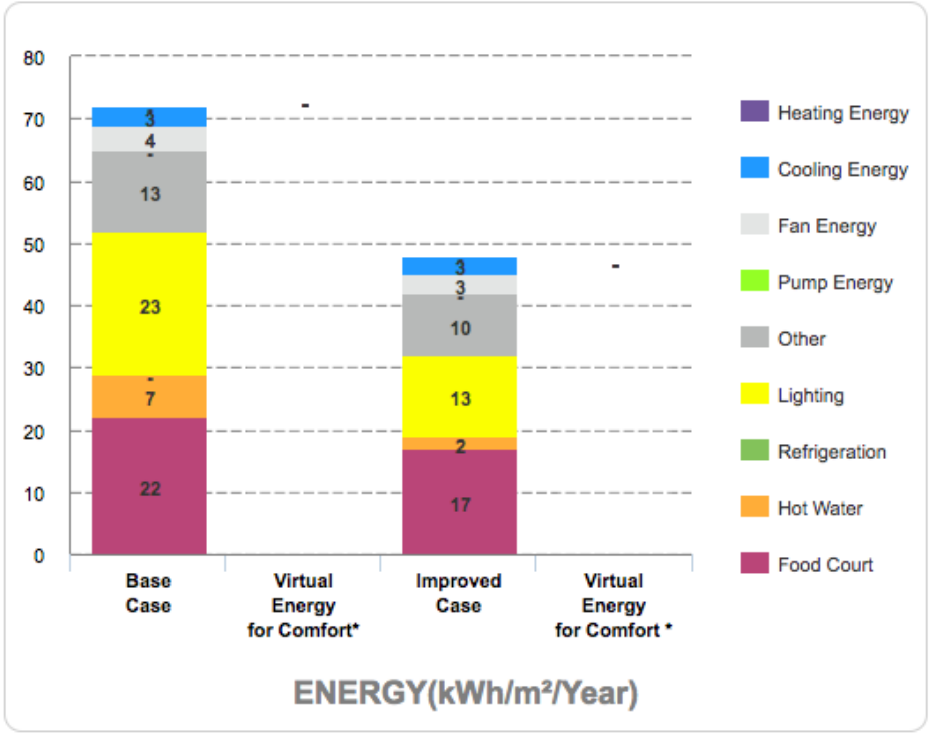
Incremental Cost
$173,580

Utility Costs Savings
$14,870 / month

Payback in Years
0.97

Operational CO2 Savings
148 tCO_2/Year

35.35% **Meets EDGE energy standard**



Light Industry is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

OFFICES – GHANA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

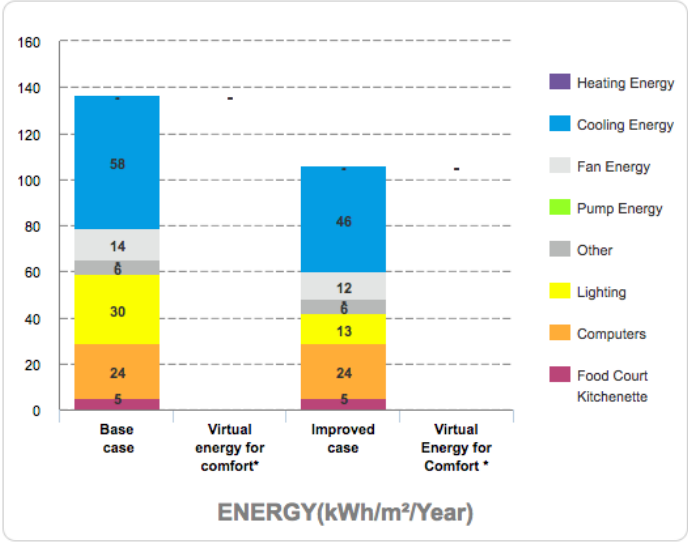
Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 23% Savings through:
- Insulation of Roof
- Energy-Saving Lightbulbs
- Daylight Photoelectric Sensors

Water – 20% Savings through:
- Dual flush for Water Closets in Bathrooms
- Water-Efficient Urinals in All Bathrooms

Materials – 26% Savings through:
- Thin precast concrete deck and composite in-situ slab

22.66% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$40,815

Utility Costs Savings

$5,620 / month

Payback in Years

0.7

Operational CO_2 Savings

59 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 32% Savings through:
- Reduced window to wall ratio
- Reflective paint and tiles for roof
- Reflective paint for external walls
- External shading devices
- Insulation of roof
- Energy-saving lighting system for internal spaces

Water – 24% Savings through:
- Low-Flow faucets in kitchens and bathrooms
- Dual-flush water closets

Materials – 43% Savings through:
- Aluminum-clad sandwich panel for roof construction
- In-situ reinforced wall and honeycomb clay blocks with internal + external plaster for external walls
- Honeycomb clay blocks with plaster on both sides + plasterboard on metal studs for internal walls
- Ceramic tile flooring
- Aluminum window frames

ALTURIA (COLOMBIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

Education

SCHOOLS – GHANA CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 36% Savings through:
- External Shading Devices
- Insulation of Roof, External Walls
- Natural Corridor Ventilation
- Sensible Heat Recovery from Exhaust Air

Water – 25% Savings through:
- Low-flow Faucets
- Dual-Flush Water Closets
- Water-Efficient Urinals

Materials – 23% Savings through:
- Concrete filler slab

PROJECTED PROJECT METRICS

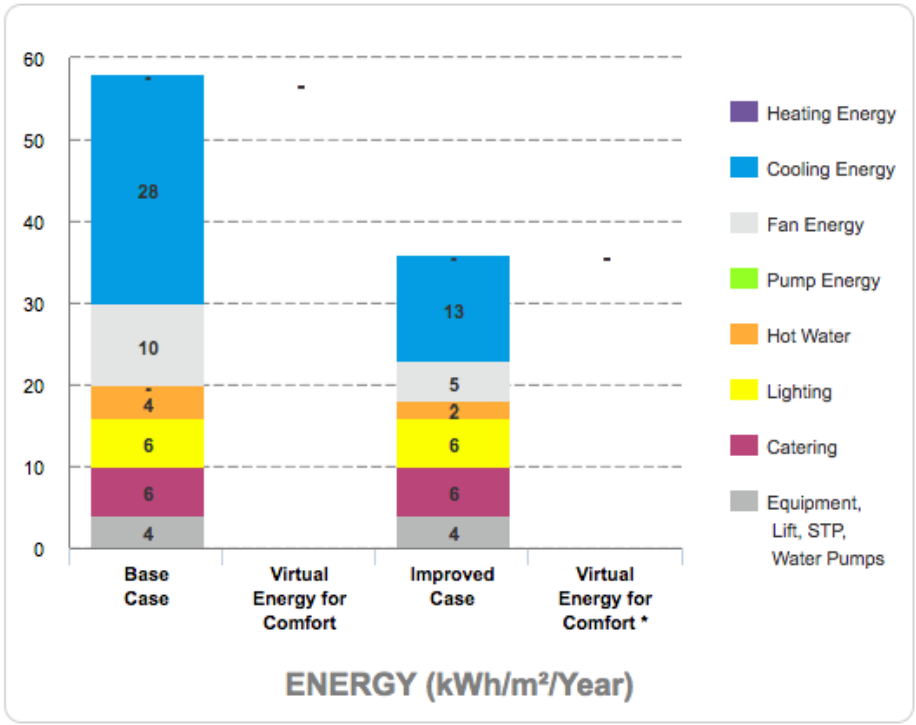
Incremental Cost
$19,000

Utility Costs Savings
$3,710 / month

Payback in Years
0.4 Years

Operational CO2 Savings
41 tCO_2/Year

36.4% Meets EDGE Energy Standard



Education is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOSPITALS – GHANA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m^2	70%	7	100

Energy Measures – 24% Savings through:

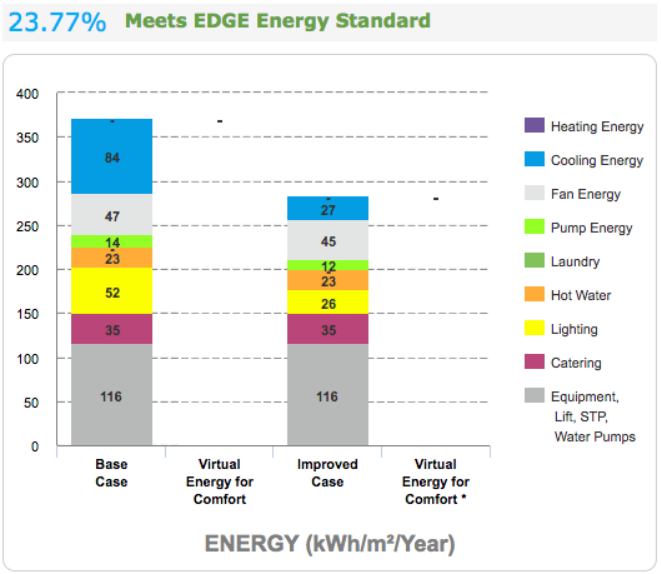
- Air Economizers Except for Critical Areas
- Energy Saving Light Bulbs

Water – 26% Savings through:

- Dual-Flush for Water Closets in All Bathrooms

Materials – 27% Savings through:

- In-Situ Trough Concrete Floor Slabs



PROJECT METRICS

Incremental Cost

$83,420

Utility Costs Savings

$31,620 / month

Payback in Years

0.22

Operational CO_2 Savings

340 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 56% Savings through:

- Reduced Window To Wall Ratio
- Insulation Of Roof And External Walls
- Low E-coated Glass
- Air Conditioning With Air Cooled Chiller
- Energy-saving Lighting Systems For Internal And External Spaces
- Solar Hot Water Collectors
- Solar Photovoltaics

Water – 33% Savings through:

- Low-flow Faucets In Bathrooms And Dual-flush Water Closets

Materials – 42% Savings through:

- Aluminum Sheets On Steel Rafters For Roof Construction
- 3-D Wire Panel With “Shot-crete” On Both Sides For External And Internal Walls
- Ceramic Tile Flooring

KOMFO ANOKYE HOSPITAL (GHANA)

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

KENYA: GREEN BUILDINGS RETURN ON INVESTMENT

IFC International Finance Corporation
WORLD BANK GROUP

Creating Markets, Creating Opportunities

KENYA – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	$100/unit	$15/unit	0.6
Hotels	$89,720	$13,750	0.5
Shopping Centers	$137,800	$16,565	0.7
Offices	$18,820	$1,860	0.8
Schools	$2,110	$780	0.2
Hospitals	$60,570	$9,870	0.5
Light Industry	$38,100	$3,810	0.8

HOMES – KENYA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

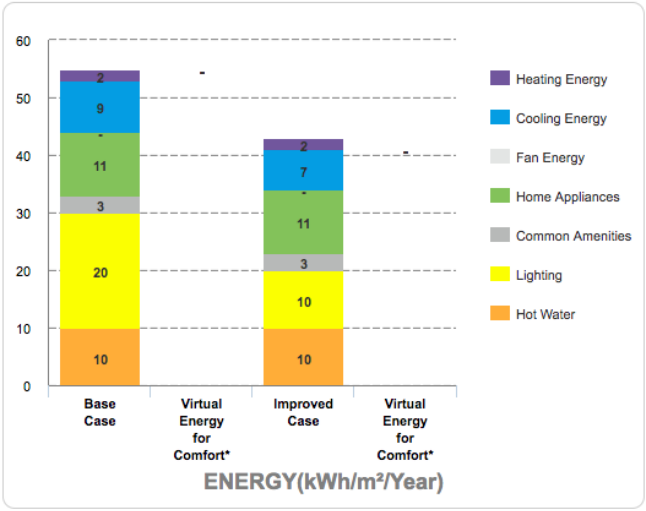
Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m^2	2	10	50

Energy Measures – 25% Savings through:
- Low E-Coated Glass
- Energy Saving Light Bulbs
- Savings from Water interventions

Water – 24% Savings through:
- Dual Flush for Water Closets
- Low Flow Showers
- Low Flow Faucets

Materials – 23% Savings through:
- In-Situ Trough Concrete Floor Slabs

25.06% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$100/unit

Utility Costs Savings

$15 / unit / month

Payback in Years

0.6

Operational CO_2 Savings

0.50 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 32% Savings through:
- Reduced Window to Wall Ratio
- Roof insulation
- Heat pump for hot water

Water – 25% Savings through:
- Low-flow faucets in bathrooms
- Dual-flush water closets

Materials – 35% Savings through:
- Clay roofing tiles on timber rafters for roof constrution
- Cored bricks with plater on both sides for internal/external walls
- Cellulose roof insulation

FOURLEAF ESTATE (SOUTH AFRICA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOTELS – KENYA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

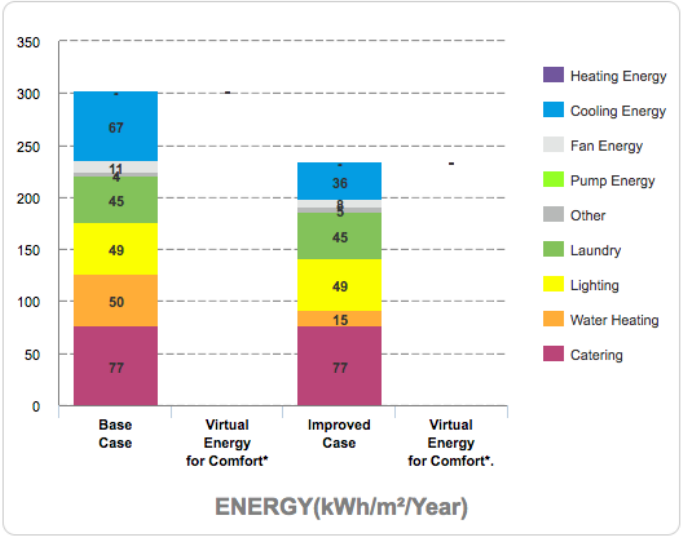
Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 23% Savings through:
- External Shading Devices
- Insulation of Roof
- Variable Refrigerant Flow Cooling System
- Heat Pump for Hot Water

Water – 27% Savings through:
- Aerators and Auto-Shutoff Faucets
- Low Flow Showers and Faucets

Materials – 30% Savings through:
- Light-Gauge Steel Floor Cassette

22.28% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$89,720

Utility Costs Savings

$13,750 / month

Payback in Years

0.5

Operational CO_2 Savings

460 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 23% Savings through:
- Reduced Window to Wall Ratio
- Insulation of external walls
- Low-E coated glass
- Air conditioning with air cooled screw chiller
- Energy-saving lighting systems for back-of-house, internal, external spaces

Water – 28% Savings through:
- Low-flow faucets in kitchens, bathrooms
- Single and valve flush for water closets
- Water-efficient urinals
- Aerators and auto shut-off faucets

Materials – 51% Savings through:
- Facing brick and hollow concrete blocks for external walls

AC HOTEL BY MARIOTT VERACRUZ (MEXICO)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SHOPPING CENTERS – KENYA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

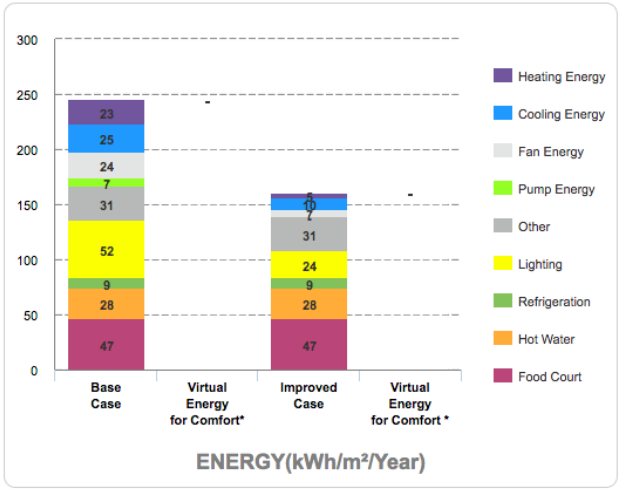
Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 34% Savings through:
- Insulation of Roof
- Variable Refrigerant Flow Cooling System
- Variable Frequency Drives in AHUs
- Energy Saving Light Bulbs

Water – 22% Savings through:
- Dual Flush for Water Closets in all Bathrooms

Materials – 27% Savings through:
- Composite in-situ concrete and steel deck

34.05% **Meets EDGE energy standard**



PROJECT METRICS

Incremental Cost

$137,800

Utility Costs Savings

$16,565 / month

Payback in Years

0.69

Operational CO_2 Savings

546 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 29% Savings through:
- Reduced Window to Wall Ratio,
- Insulated roofs and external walls
- Occupancy sensors in bathrooms
- Energy saving lighting in sales, corridors, common and external areas

Water – 24% Savings through:
- Single flush for water closets
- Water-efficient urinals
- Aerators and auto-shut-off faucets in all bathrooms

Materials – 23% Savings through:
- Steel sheets on steel rafters roof construction
- Cement fibre boards on metal studs for all external walls

RETAIL AT SANTA VERDE (COSTA RICA)

In-country certified project to replace related example once an EDGE project is certified.

LIGHT INDUSTRY– KENYA CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 23% Savings through:
- Solar Hot Water Collectors
- Skylights

Water – 38% Savings through:
- Dual Flush for Water Closets
- Aerators & Auto Shut-off Faucets
- Water-Efficient Kitchen Faucets

Materials – 27% Savings through:
- In-situ trough concrete slab

PROJECTED PROJECT METRICS

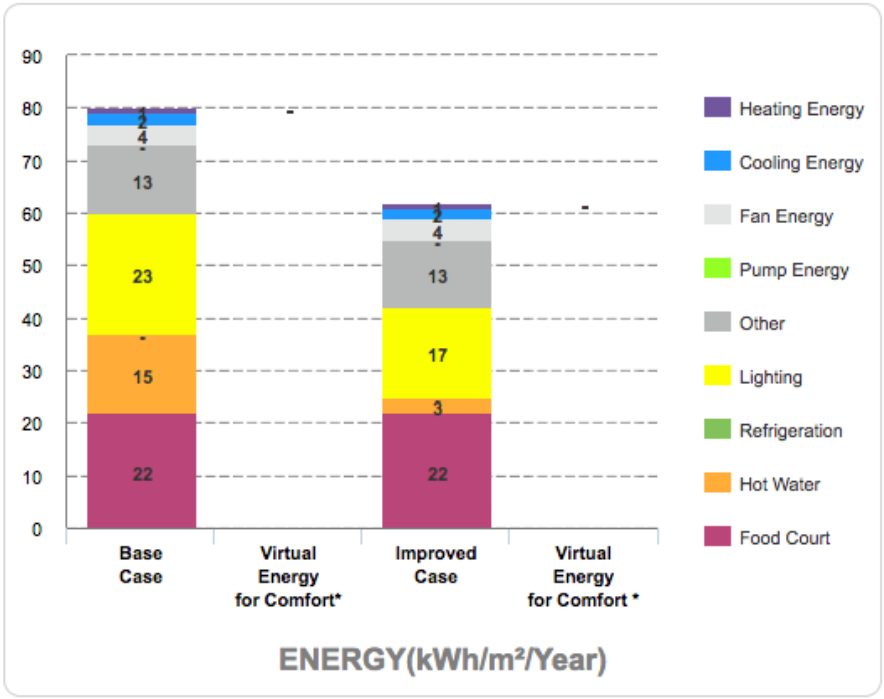
Incremental Cost
$38,100

Utility Costs Savings
$3,810 / month

Payback in Years
0.8

Operational CO2 Savings
115 tCO_2/Year

22.26% **Meets EDGE energy standard**



Light Industry is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

OFFICES – KENYA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

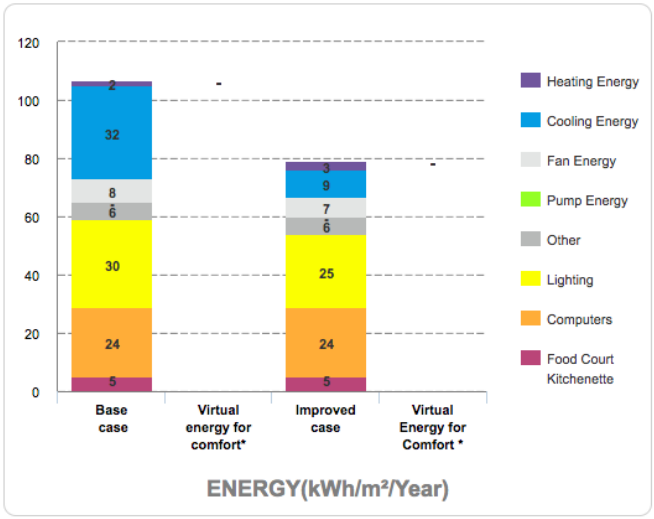
Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 26% Savings through:
- Reflective Paint/Tiles for Roof
- Air Economizers During Favorable Weather
- Daylight Photoelectric Sensors

Water – 23% Savings through:
- Dual flush for water closets in Bathrooms
- Low Flow Faucets
- Water-Efficient Urinals in All Bathrooms

Materials – 23% Savings through:
- In-situ waffle concrete slab

26.35% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$18,820

Utility Costs Savings

$1,860 / month

Payback in Years

0.8

Operational CO_2 Savings

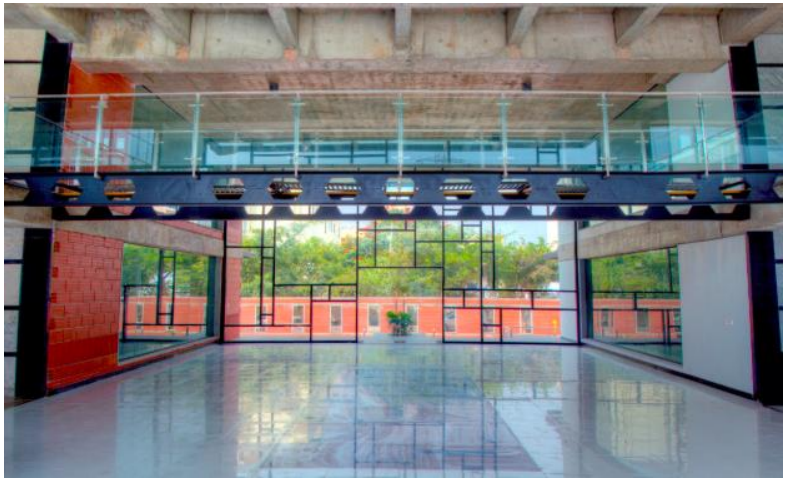
62 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 33% Savings through:
- Reduced window to wall ratio
- Higher thermal performance glass
- Variable Refrigerant Volume cooling system
- Sensible heat recovery from exhaust air
- Energy-saving light bulbs for internal and external spaces

Water – 68% Savings through:
- Low-flow plumbing fixtures
- Dual flush water closets
- Black Water Treatment and Recycling System

Materials – 32% Savings through:
- Honeycomb clay blocks for external walls
- uPVC window frames



QUASITUM INTELISOFT INDIA (INDIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

Education

SCHOOLS – KENYA CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 33% Savings through:
- Reflective Paint/Tiles for Roof
- Energy Efficient Ceiling Fans

Water – 25% Savings through:
- Low-flow Faucets
- Dual-Flush for Water Closets
- Water-Efficient Faucets for Kitchen Sinks

Materials – 22% Savings through:
- Concrete filler slab

PROJECTED PROJECT METRICS

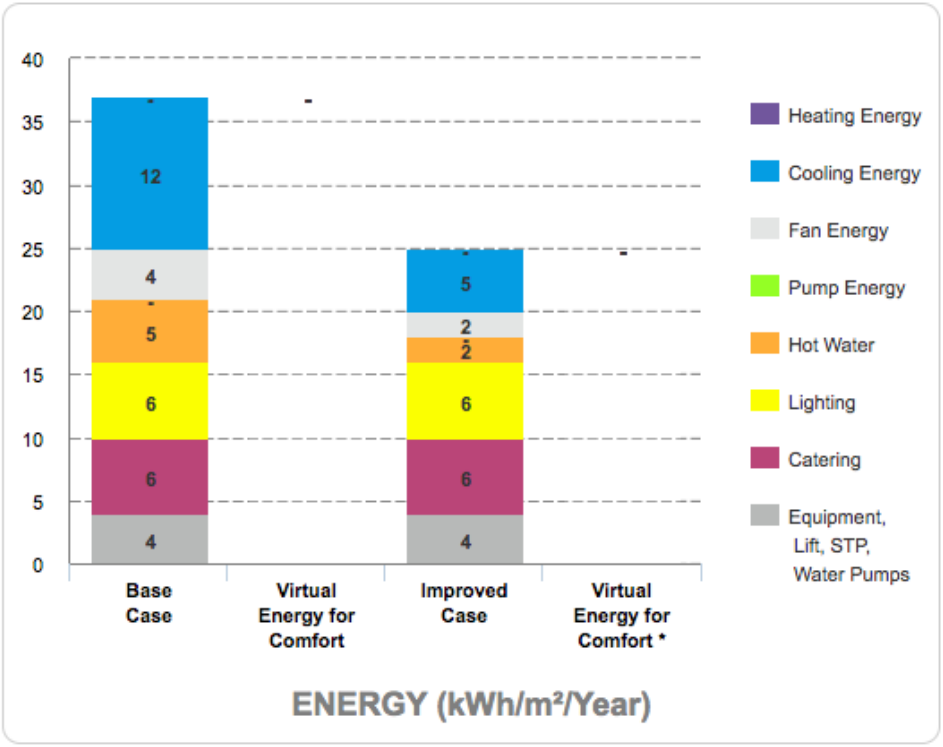
Incremental Cost
$2,110

Utility Costs Savings
$780 / month

Payback in Years
0.2 Years

Operational CO2 Savings
28 tCO_2/Year

33.4% Meets EDGE Energy Standard



Education is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOSPITALS – KENYA CASE STUDY & CERTIFIED PROJECT

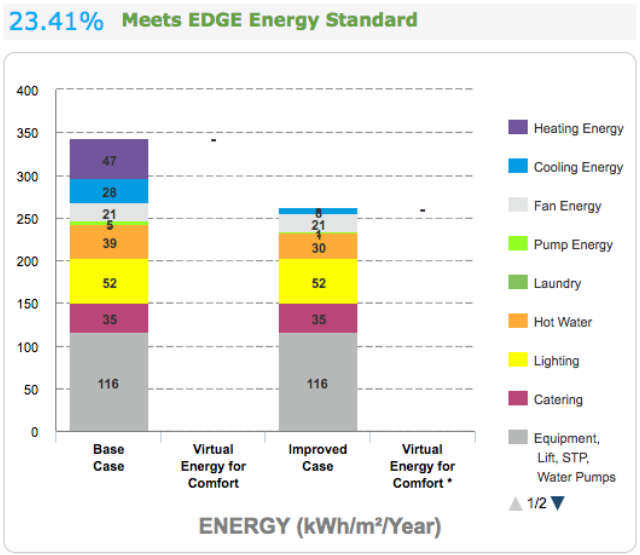
BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m^2	70%	7	100

Energy Measures – 23% Savings through:
- Air Economizers Except for Critical Areas
- Variable Refrigerant Flow Cooling System
- Recovery of Waste Heat from Generator for Space Heating

Water – 25% Savings through:
- Low-Flow Faucets in All Bathrooms

Materials – 22% Savings through:
- In-situ waffle concrete slab



PROJECT METRICS

Incremental Cost

$60,570

Utility Costs Savings

$9,870 / month

Payback in Years

0.5

Operational CO_2 Savings

354 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 32% Savings through:
- Reduced window to wall ratio
- Reflective paint for external walls
- Insulation of roof and external walls
- Natural ventilation for corridors
- Energy-saving lighting systems
- Occupancy sensors in bathrooms
- Solar Photovoltaics

Water – 35% Savings through:
- Low-flow faucets in kitchens and bathrooms
- Single-flush and flush valve for water closets
- Water-efficient urinals, faucets, landscaping
- Rainwater harvesting system

Materials – 43% Savings through:
- Steel sheets on steel rafters for roof construction
- Medium weight hollow concrete blocks for internal, external walls
- Finished concrete flooring

SEDE DE EBAIS DE ESCOBAL DE BELEN (COSTA RICA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

NIGERIA: GREEN BUILDINGS RETURN ON INVESTMENT

IFC International Finance Corporation
WORLD BANK GROUP

Creating Markets, Creating Opportunities

NIGERIA – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	$20/unit	$10/unit	0.3
Hotels	$27,320	$5,635	0.4
Shopping Centers	$44,740	$4,900	0.8
Offices	$26,550	$830	2.7
Schools	$2,100	$325	0.5
Hospitals	$55,680	$3,790	1.2
Light Industry	$24,430	$2,260	0.9

HOMES – NIGERIA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

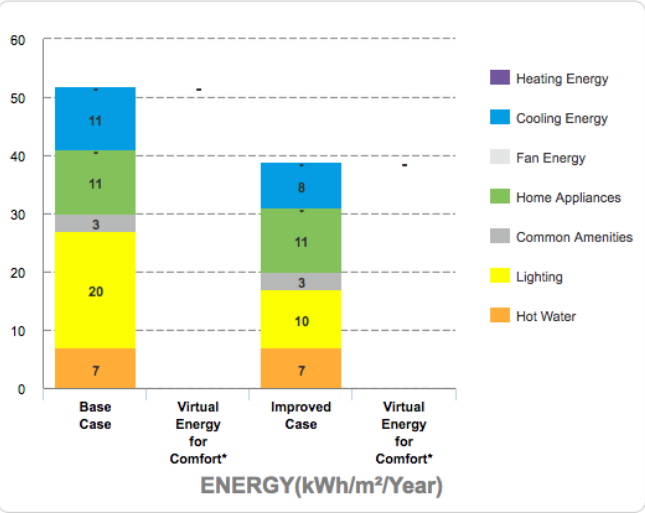
Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m^2	2	10	50

Energy Measures – 26% Savings through:
- Low-E coated glass
- High-efficiency boiler for hot water
- Energy Saving Light Bulbs for Internal Spaces

Water – 24% Savings through:
- Low Flow Showers
- Low Flow Faucets

Materials – 22% Savings through:
- Concrete Filler Floor Slab

26.37% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$20/unit

Utility Costs Savings

$6 / unit / month

Payback in Years

0.3

Operational CO_2 Savings

0.45 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 21% Savings through:
- Roof insulation
- Low-E coated glass
- Natural ventilation
- Energy-Saving Lighting for internal/external spaces
- Lighting controls for common areas/outdoors
- Solar hot water collectors
- Smart meters

Water – 27% Savings through:
- Low-flow faucets in Kitchens and Bathrooms
- Dual-flush water closets

Materials – 49% Savings through:
- Precast RC planks and joist system
- Clay roofing tiles on timber rafters
- Solid dense concrete blocks for internal/external walls

WATERFALL PARK (SOUTH AFRICA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOTELS – NIGERIA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

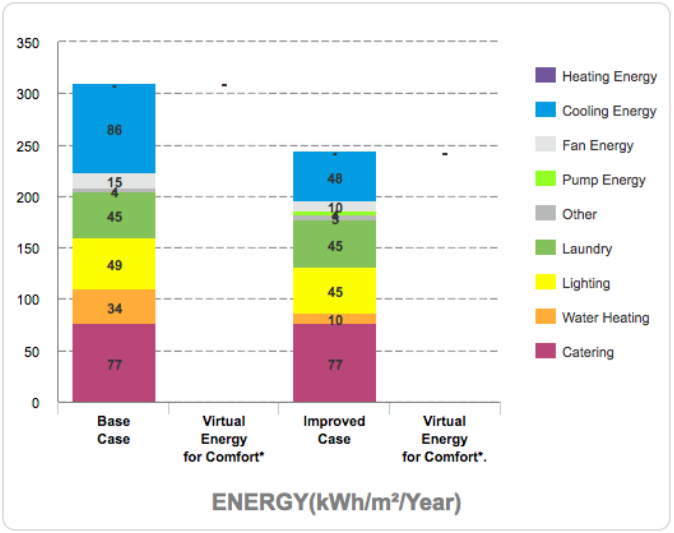
Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 21% Savings through:
- Higher Thermal Performance Glass
- Natural Ventilation for Corridors
- Air Conditioning with Air Cooled Screw Chiller
- Heat Pump for Hot Water
- Occupancy Sensors in Bathrooms

Water – 27% Savings through:
- Aerators & Auto Shut-Off Faucets
- Low Flow Showers and Faucets

Materials – 28% Savings through:
- Concrete filler slabs with polystyrene blocks

21.08% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$27,320

Utility Costs Savings

$5,635 / month

Payback in Years

0.4

Operational CO_2 Savings

399 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 21% Savings through:
- Reduced Window to Wall Ratio
- External shading devices
- Insulation of roof, external walls
- Natural ventilation in corridors
- Air conditioning with air-cooled screw chiller
- Energy-saving lighting for internal/external spaces
- Solar PVs

Water – 21% Savings through:
- Low-flow fixtures for washbasins and showerheads
- Dual-flush water closets
- Water-efficient urinals, kitchen faucets
- Water-efficient landscaping

Materials – 37% Savings through:
- Micro concrete tiles on steel rafters for roof construction
- Stone profile cladding and autoclaved aerated concrete blocks for internal/external walls
- Wood block finishes for flooring
- Timber window frames

SPRINGHILL CONDOTEL AT JIMBARAN HIJAU (INDONESIA)

In-country certified project to replace related example once an EDGE project is certified.

SHOPPING CENTERS – NIGERIA CASE STUDY & CERTIFIED PROJECT

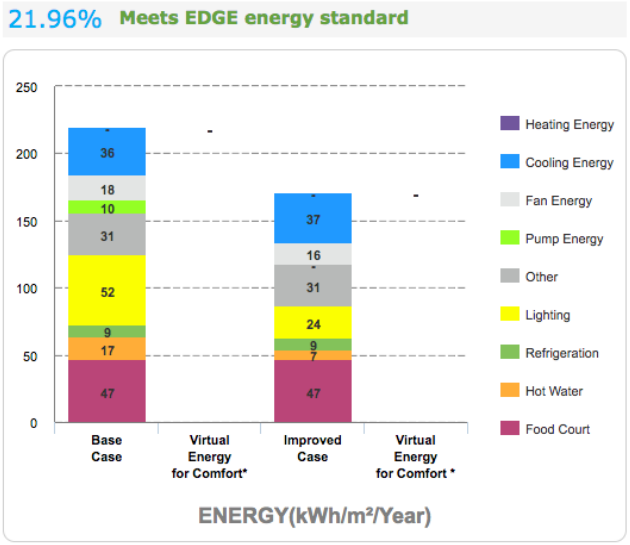
BUILDING DETAILS

Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 22% Savings through:
- Variable Refrigerant Flow Cooling System
- Energy Saving Light Bulbs, Sales Area

Water – 29% Savings through:
- Aerators & Auto Shut-off Faucets in Bathrooms
- Water-Efficient Kitchen Faucets
- Rainwater Harvesting System

Materials – 41% Savings through:
- Composite in-situ concrete and steel deck



PROJECT METRICS

Incremental Cost

$44,740

Utility Costs Savings

$4,900 / month

Payback in Years

0.76

Operational CO_2 Savings

282 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 29% Savings through:
- Reduced Window to Wall Ratio,
- Reflective paint and tiles for roof
- Insulation of roof, external walls
- Variable Refrigerant Volume (VRV) cooling system
- Energy saving lighting system in external, corridors, sales & common areas
- Skylights

Water – 27% Savings through:
- Low-Flow faucets in kitchens, bathrooms
- Dual-flush water closets and water-efficient urinals
- Aerators and auto shut-off faucets in all bathrooms

Materials – 36% Savings through:
- Steel sheets on steel rafters for roof construction
- Medium weight hollow concrete blocks, steel profile cladding for external walls
- Medium weight hollow concrete blocks for internal walls
- Finished concrete floor

BMB 001 CAMBUCI - OBRAMAX (BRAZIL)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

LIGHT INDUSTRY– NIGERIA CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 22% Savings through:
- Variable Frequency Drives in AHUs
- Energy-Saving Light Bulbs in Food Court
- Solar Hot Water Collectors
- Skylights

Water – 47% Savings through:
- Dual Flush for Water Closets
- Water-Efficient Urinals in all Bathrooms
- Aerators and Auto Shut-Off Faucets
- Water-Efficient Kitchen Faucets
- Grey Water Treatment & Recycling System

Materials – 25% Savings through:
- Concrete filler slab

PROJECTED PROJECT METRICS

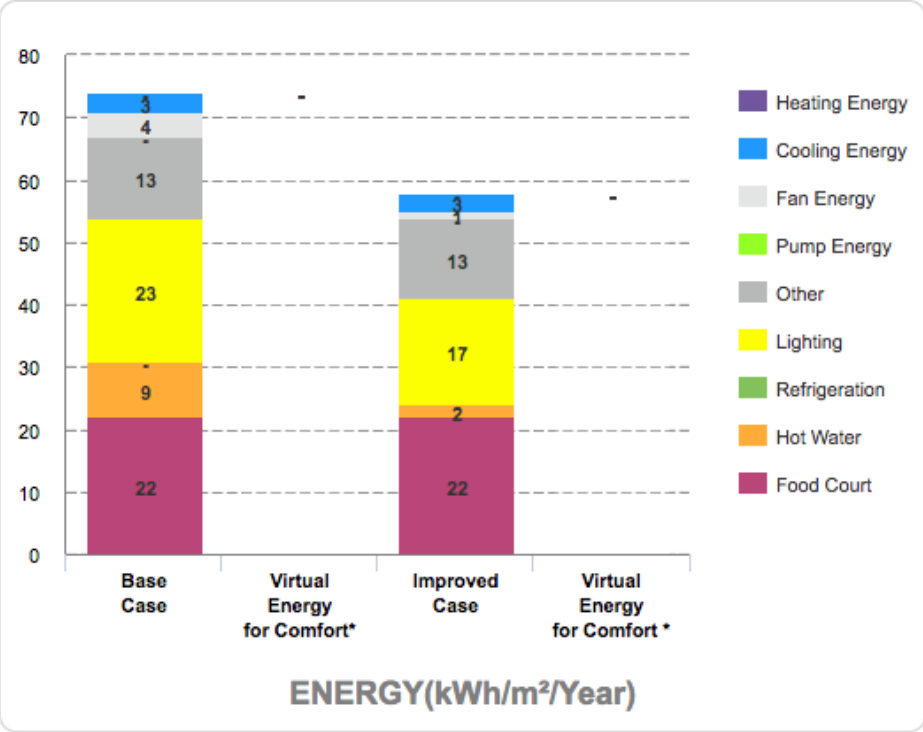
Incremental Cost
$24,430

Utility Costs Savings
$2,260 / month

Payback in Years
0.9

Operational CO2 Savings
94 tCO_2/Year

21.77% **Meets EDGE energy standard**



Light Industry is a new sector in the EDGE application.
Relevant certified project to be included as soon as case study is published.

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OFFICES – NIGERIA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

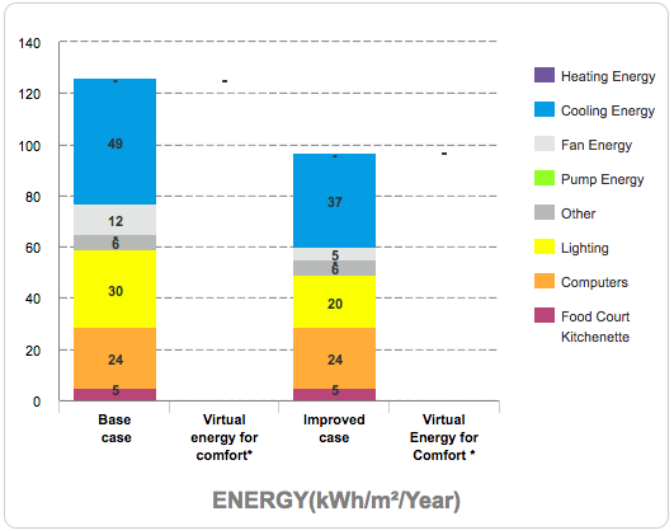
Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 22% Savings through:
- Variable Refrigerant Flow System
- Occupancy Sensors in Open Offices
- Daylight Photoelectric Sensors

Water – 29% Savings through:
- Dual flush for water closets in Bathrooms
- Water-Efficient Faucets for Kitchen Sinks
- Water-Efficient Urinals in All Bathrooms

Materials – 23% Savings through:
- In-situ waffle concrete slab

22.46% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$26,550

Utility Costs Savings

$830 / month

Payback in Years

2.7

Operational CO_2 Savings

55 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 38% Savings through:
- Reduced widow to wall ratio
- Reflective paint for roof and walls
- Roof and wall insulation
- Energy-saving lighting for internal, external spaces

Water – 23% Savings through:
- Rainwater harvesting system
- Low-Flow plumbing fixtures for kitchen sinks, washbasins, water closets, and showerheads

Materials – 63% Savings through:
- Reuse of existing floor slabs
- External walls with steel profile cladding
- Plasterboards on metal studs for internal walls
- Steel sheets on steel rafters for the roof
- Ceramic tile

CENTRO DE DESARROLLO EMPRENDEDOR Y LABORAL (ARGENTINA)

In-country certified project to replace related example once an EDGE project is certified.

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SCHOOLS – NIGERIA CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 26% Savings through:
- Reflective Paint/Tile for Roof
- Natural Ventilation for Corridors, Classrooms
- Sensible Heat Recovery from Exhaust Air
- Occupancy Sensors in Classrooms

Water – 25% Savings through:
- Low-flow Faucets
- Dual-Flush for Water Closets
- Water-Efficient Urinals

Materials – 20% Savings through:
- Light gauge steel cassette

PROJECTED PROJECT METRICS

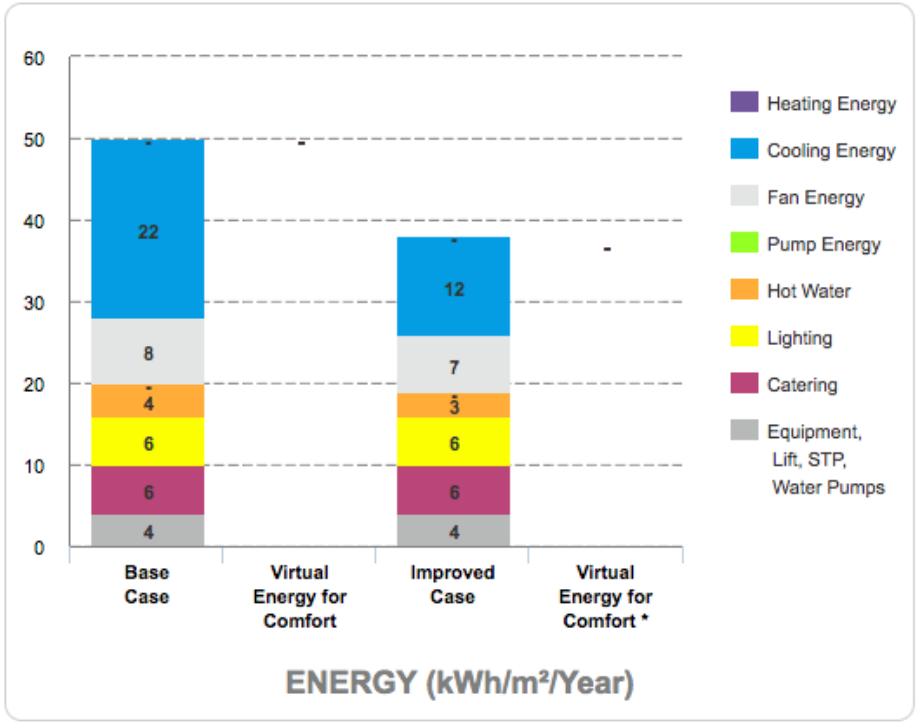
Incremental Cost
$2,100

Utility Costs Savings
$325 / month

Payback in Years
0.5 Years

Operational CO2 Savings
26 tCO_2/Year

25.8% **Meets EDGE Energy Standard**



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HOSPITALS – NIGERIA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m²	70%	7	100

Energy Measures – 20% Savings through:

- Air Economizers Except for Critical Areas

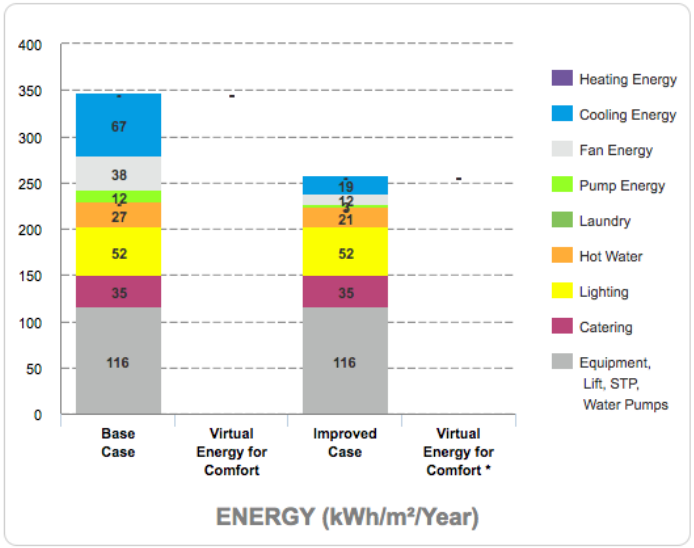
Water – 31% Savings through:

- Low-Flow Faucets in Bathrooms

Materials – 22% Savings through:

- Precast concrete double tee units

25.65% **Meets EDGE Energy Standard**



PROJECT METRICS

Incremental Cost

$55,680

Utility Costs Savings

$3,790 / month

Payback in Years

1.2

Operational CO_2 Savings

350 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 56% Savings through:

- Reduced Window To Wall Ratio
- Insulation Of Roof And External Walls
- Low E-coated Glass
- Air Conditioning With Air Cooled Chiller
- Energy-saving Lighting Systems For Internal And External Spaces
- Solar Hot Water Collectors
- Solar Photovoltaics

Water – 33% Savings through:

- Low-flow Faucets In Bathrooms And Dual-flush Water Closets

Materials – 42% Savings through:

- Aluminum Sheets On Steel Rafters For Roof Construction
- 3-D Wire Panel With “Shot-crete” On Both Sides For External And Internal Walls
- Ceramic Tile Flooring

KOMFO ANOKYE HOSPITAL (GHANA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SOUTH AFRICA: GREEN BUILDINGS RETURN ON INVESTMENT

IFC | International Finance Corporation
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Creating Markets, Creating Opportunities

SOUTH AFRICA – ROI ON MEASURES NEEDED TO ACHIEVE THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Homes	ZAR 570/unit	ZAR 90/unit	0.5
Hotels	ZAR 2,442,250	ZAR 203,100	1
Shopping Centers	ZAR 3,948,600	ZAR 138,650	2.3
Offices	ZAR 213,600	ZAR 13,930	1.2
Schools	ZAR 112,280	ZAR 4,670	2
Hospitals	ZAR 64,925	ZAR 142,000	0
Light Industry	ZAR 658,940	ZAR 46,540	1.2

HOMES – SOUTH AFRICA CASE STUDY & CERTIFIED PROJECT

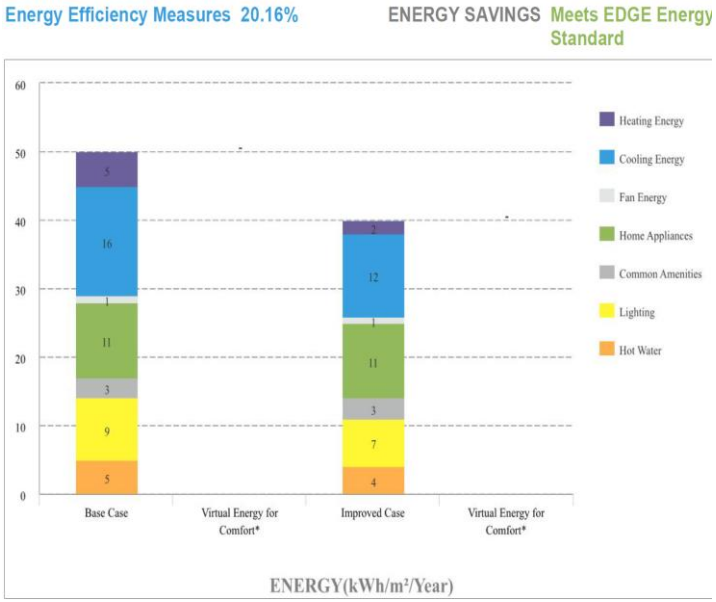
BUILDING DETAILS

Type of Unit	Average Unit Area	Bedrooms / Unit	Floors	Units
Low Income	80m^2	2	10	50

Energy Measures – 20% Savings through:
- Reflective Paint for External Walls
- Efficient Air Conditioning System
- Energy-Saving Light Bulbs
- Savings from Water interventions

Water – 21% Savings through:
- Low-Flow Showerheads - 8 lt./min
- Dual Flush for Water Closets

Materials – 24% Savings through:
- Composite In-Situ Concrete and Steel Deck



PROJECT METRICS

Incremental Cost
ZAR 570

Utility Costs Savings
ZAR 90 / unit / month

Payback in Years
0.5

Operational CO_2 Savings
0.8 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 25% Savings through:
- Reduced window to wall ratio.
- Natural ventilation
- Energy-efficient heat pump for hot water
- Energy-saving lighting systems
- Lighting controls for common areas and outdoors

Water – 24% Savings through:
- Low-flow plumbing fixtures and dual-flush water closets.

Materials – 54% Savings through:
- Solid dense concrete blocks for internal and external walls.

THE VILLAGE CLUBVIEW (SOUTH AFRICA)

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOTELS – SOUTH AFRICA CASE STUDY & CERTIFIED PROJECT

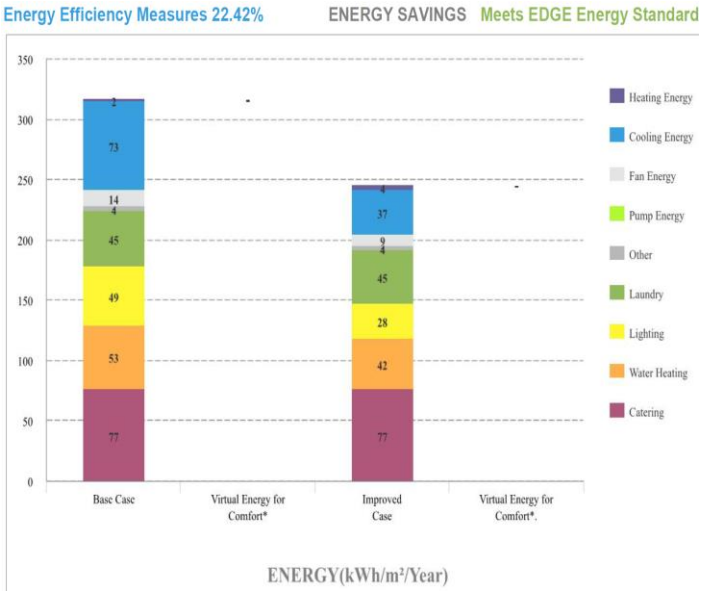
BUILDING DETAILS

Type of Hotel	Floors Above Ground	Total Guest Units	Internal Area
4 Star Hotel	8	200	15,600 m^2

Energy Measures – 22% Savings through:
- External Shading Devices
- Energy-Saving Light Bulbs

Water – 22% Savings through:
- Low-Flow Showerheads and Faucets Guestrooms
- Dual Flush for Water Closets in Guest Rooms
- Water-Efficient Front Loading Washing Machine
- Water-Efficient Urinals in all Other Bathrooms

Materials – 37% Savings through:
- Composite In-Situ Concrete and Steel Deck



PROJECT METRICS

Incremental Cost
ZAR 2,442,250

Utility Costs Savings
ZAR 203,100 / month

Payback in Years
1

Operational CO_2 Savings
1,023 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 51% Savings through:
- Reduced window-to-wall ratio
- External shading devices
- Air conditioning with water-cooled chiller
- Low-E coated glass
- Insulation of roof and external walls, and energy-efficient lighting.

Water – 32% Savings through:
- Low-flow showerheads
- Dual flush water closets
- Water-efficient urinals

Materials – 44% Savings through:
- Concrete filler slab for floors and roof
- Medium weight hollow concrete blocks for internal walls
- Finished concrete flooring

CITY EXPRESS HOTEL (MEXICO)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SHOPPING CENTERS – SOUTH AFRICA CASE STUDY & CERTIFIED PROJECT

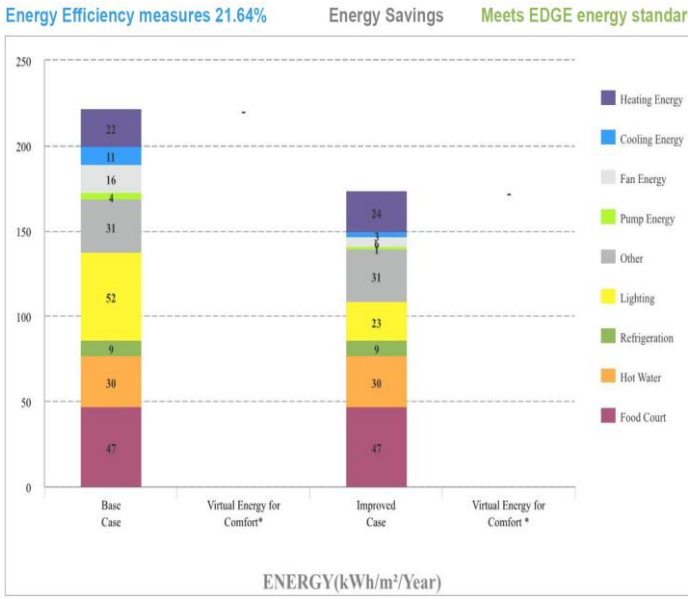
BUILDING DETAILS

Site Area	Floor to floor height	Landscaped Area	Amenities
15,000 m^2	4m	1,000,000 m^2	Supermarket, Food Court

Energy Measures – 22% Savings through:
- Reflective Paint/Tiles for Roof
- Insulation of Roof and External Walls
- Air Economizers During Favorable Outdoor Conditions
- Variable Frequency Drives in AHUs
- Energy-Saving Light Bulbs

Water – 25% Savings through:
- Dual Flush for Water Closets
- Water-Efficient Urinals in all Bathrooms

Materials – 27% Savings through:
- Composite In-Situ Concrete and Steel Deck



PROJECT METRICS

Incremental Cost

ZAR 3,948,600

Utility Costs Savings

ZAR 138,650 / month

Payback in Years

2.3

Operational CO_2 Savings

664 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 29% Savings through:
- Reduced Window to Wall Ratio, Reflective Paint for Roof
- Variable Refrigerant Volume (VRV) Cooling System
- Energy Saving Lighting, Solar Photovoltaics

Water – 27% Savings through:
- Low-flow faucets in kitchens and bathrooms
- Dual-flush water closets
- Water-efficient urinals
- Aerators and auto shut-off faucets in all bathrooms

Materials – 36% Savings through:
- Steel sheets on steel rafters for roof construction
- Medium-weight hollow concrete blocks and steel profile cladding for external walls

BMB001 CAMBUCI OBRAMAX (BRAZIL)

In-country certified project to replace related example once an EDGE project is certified.

LIGHT INDUSTRY– SOUTH AFRICA CASE STUDY

BUILDING DETAILS

Floors Above Ground	Shifts	Gross Internal Area
1	1 (8hrs, 6 d/wk)	15,000 m^2

Energy Measures – 22% Savings through:
- Energy Saving interior Light Bulbs
- Solar Hot Water Collectors for 50% of Hot Water
- Skylight(s) to Provide Daylight

Water – 24% Savings through:
- Dual Flush for Water Closets
- Single Flush/Flush Valve
- Water-Efficient Urinals in all Bathrooms

Materials – 28% Savings through:
- Composite In-Situ Concrete and Steel Deck

PROJECTED PROJECT METRICS

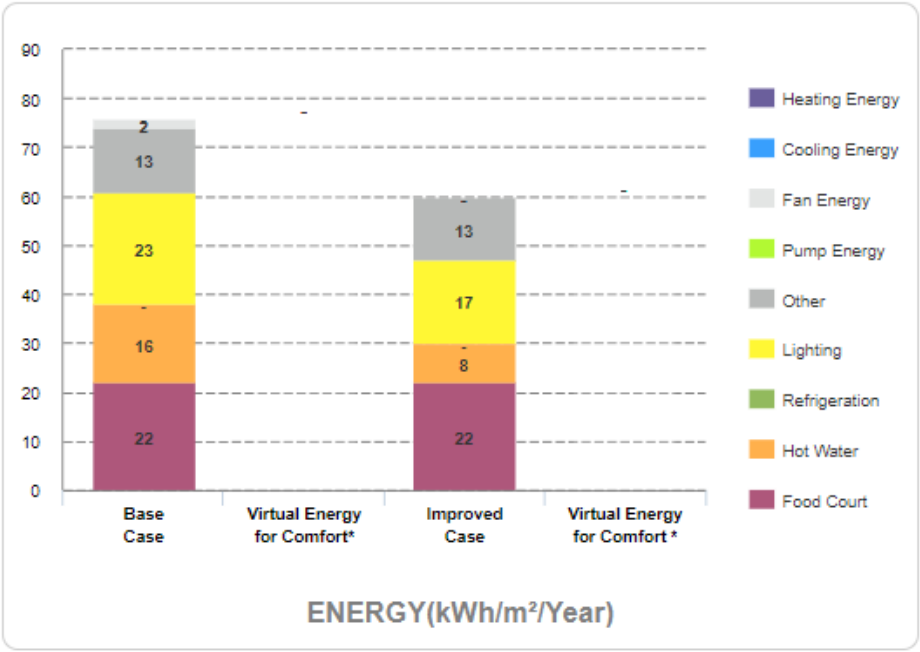
Incremental Cost
ZAR 658,940

Utility Cost Savings
ZAR 46,540 / month

Payback in Years
1.2

Operational CO2 Savings
230 tCO_2/Year

20.04% **Meets EDGE energy standard**



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OFFICES – SOUTH AFRICA CASE STUDY & CERTIFIED PROJECT

BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m^2	3	2	3.5m

Energy Measures – 25% Savings through:

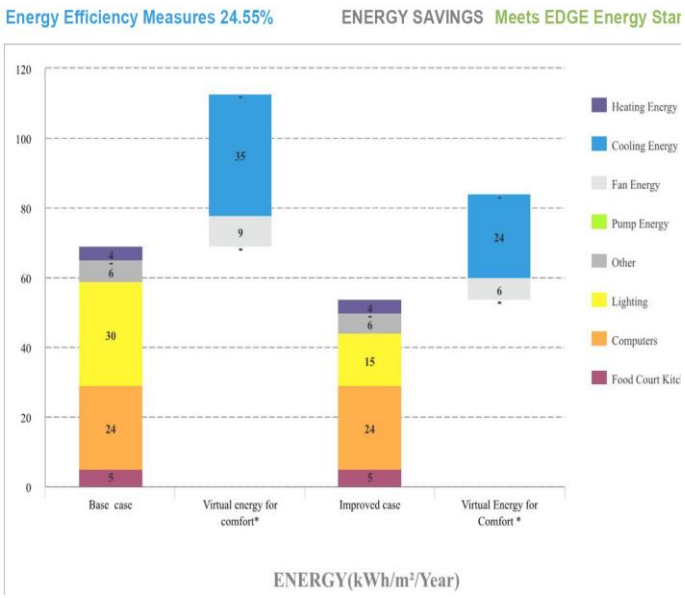
- Natural ventilation with operable windows and no A/C
- Energy-Saving Light Bulbs

Water – 23% Savings through:

- Dual Flush for Water Closets in Bathrooms
- Single Flush/Flush Valve
- Low-Flow Faucets in Bathrooms

Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck



PROJECT METRICS

Incremental Cost

ZAR 213,600

Utility Costs Savings

ZAR 13,930 / month

Payback in Years

1.2

Operational CO_2 Savings

68 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 68% Savings through:

- Reflective Paint, Tiles, and Insulation for Roof
- Low E-Coated Glass
- Higher thermal performance glass
- Variable refrigerant volume (VRV) cooling system; sensible exhaust air

Water – 83% Savings through:

- Low-flow plumbing fixtures for washbasins and kitchens
- Rainwater harvesting system
- Black water treatment and recycling system

Materials – 28% Savings through:

- Autoclaved aerated concrete blocks for external walls
- Stone and ceramic tiles for floors
- UPVC window frames; polystyrene roof insulation

ABHIKALPAN OFFICE (INDIA)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

HOSPITALS – SOUTH AFRICA CASE STUDY & CERTIFIED PROJECT

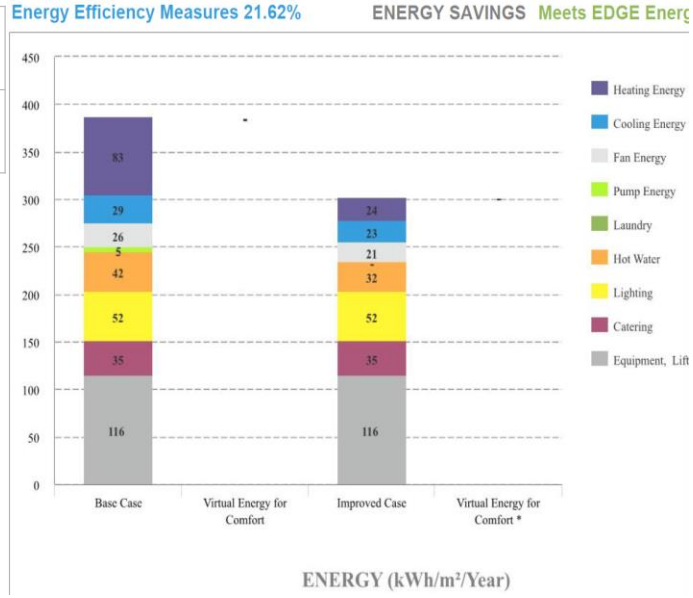
BUILDING DETAILS

Type of Unit	Gross Internal Area	Occupancy Rate	Floors	Beds
Multi Specialty	9,700m^2	70%	7	100

Energy Measures – 22% Savings through:
- Higher Thermal Performance Glass
- Variable Refrigerant Flow (VRF) Cooling System

Water – 25% Savings through:
- Low-Flow Faucets in all Bathrooms

Materials – 24% Savings through:
- Composite In-Situ Concrete and Steel Deck



PROJECT METRICS

Incremental Cost

ZAR 64,925

Utility Costs Savings

ZAR 142,000 / month

Payback in Years

0

Operational CO_2 Savings

785 tCO_2/Year

RELEVANT CERTIFIED PROJECT

Energy Measures – 21% Savings through:
- Reduced Window To Wall Ratio
- Insulation Of Roof And External Walls
- Higher thermal performance glass
- Air economizers
- Energy-efficient air conditioning with air-cooled chiller

Water – 25% Savings through:
- Low-flow Faucets In Bathrooms
- Dual-flush Water Closets
- Water-efficient faucets for kitchen sinks.

Materials – 26% Savings through:
- Aluminum Sheets On Steel Rafters For Roof Construction
- 3-D Wire Panel With “Shot-crete” On Both Sides For External And Internal Walls
- Ceramic Tile Flooring

KESERWAN MEDICAL CENTER (LEBANON)

In-country certified project to replace related example once an EDGE project is certified.

Case study for illustration purposes only, access more projects at https://www.edgebuildings.com/projects/

SCHOOLS – SOUTH AFRICA CASE STUDY

BUILDING DETAILS

Occupancy Density	Operational Hours	Working Days	Holidays / Year
3	6	5	60

Energy Measures – 20% Savings through:

- Reflective Paint/Tiles for Roof- Solar Reflectivity
- Insulation of External Walls: U-Value
- Natural Ventilation for Corridors
- Natural Ventilation for Classrooms

Water – 20% Savings through:

- Low-Flow Showerheads
- Low-Flow Faucets
- Dual Flush for Water Closets

Materials – 25% Savings through:

- Composite In-Situ Concrete and Steel Deck

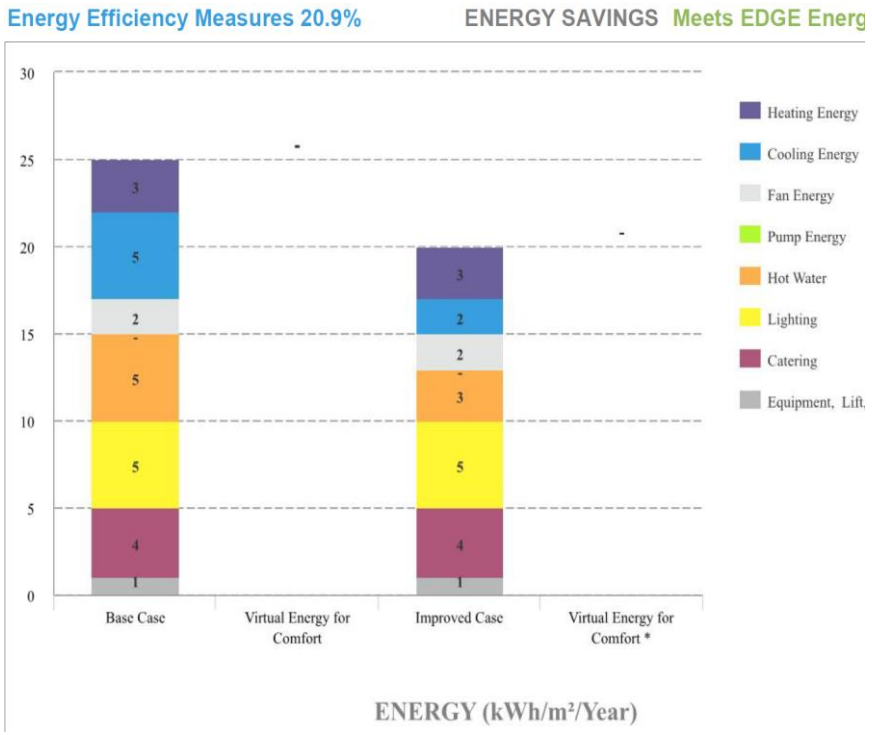
PROJECTED PROJECT METRICS

Incremental Cost
ZAR 112,280

Utility Costs Savings
ZAR 4,670 / month

Payback in Years
2 Years

Operational CO2 Savings
26 tCO_2/Year



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METHODOLOGY, NOTES, ACKNOWLEDGMENTS

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Creating Markets, Creating Opportunities

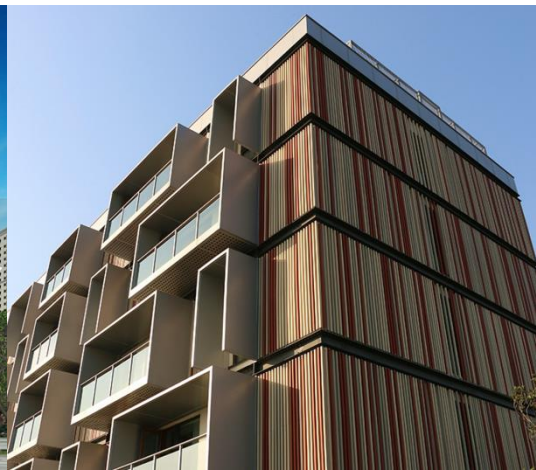
RESEARCH OBJECTIVE: MOST EFFECTIVE INTERVENTIONS TO REACH THE EDGE STANDARD

Reach 20% savings across the Energy, Water, and Materials categories in the most cost effective manner.

Analyzed focus countries in order to understand the environment and geographic impact on interventions.

Analyzed six sectors in each country – Homes, Hospitals, Hotels, Schools, Offices, and Retail – for best interventions unique to the sector and country in question in order to obtain EDGE certification.

By utilizing EDGE, we sought the most effective interventions in the passive building design phase that would in turn lead to the lowest possible payback and lowest cost for investors and builders.



OVERVIEW OF EDGE: A SOFTWARE, STANDARD, AND GREEN BUILDING CERTIFICATION SYSTEM

The EDGE application helps to determine the most cost-effective options for designing green within a local climate context. Free on-line application is available from www.edgebuildings.com.

A building has reached the EDGE standard when it achieves 20% reduction in each of the 3 categories: energy, water, and embedded energy in materials.

Third party certification verifies the resource efficiency savings so they can be credibly communicated between investors, developers, and buyers.

RESEARCH METHODOLOGY

The most cost effective interventions were determined through an iterative process using the EDGE application.

1

Determine top water measures that allow to pass the 20% minimum at the lowest Cost & Payback. Water was chosen first because it is tied to energy savings.

2

Once determined, proceed with next measure (energy) and repeat the process. Note: Water and energy measures may directly impact multiple categories.

3

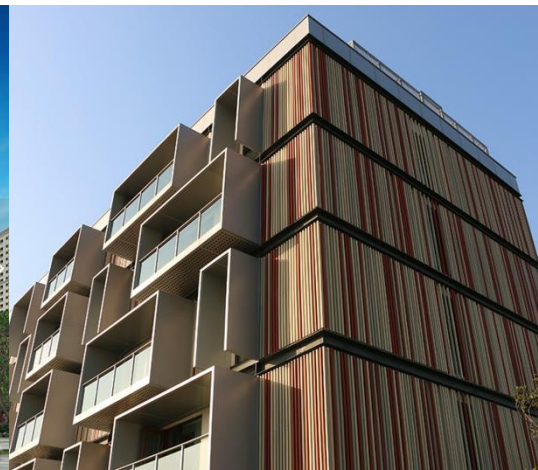
Proceed to test materials measures and review the final Incremental Cost & Payback in Years.

4 Repeat.

NOTES

- Case studies and certified projects are given for **illustrative purposes** only.
- Case studies included several assumptions in the building design, as per EDGE default values.
- Since case studies were chosen for the capital city only, the key takeaways for a country may be different in countries with varying climactic conditions across geographic regions.
- Education and Light Industrial are **new sectors** added to the EDGE application, have few certified buildings.
- Investors and developers of buildings should **use the dynamic EDGE software** with inputs specific to their respective building and climactic conditions, and then choose green interventions that **best address their specific needs**.
- IFC is **collecting additional data**, including operational savings of certified buildings – the operational data will be forthcoming, as will the ROI analysis for other regions.
- This research is part of ongoing series provided by IFC – in-depth country studies are available from: https://www.edgebuildings.com/marketing/research/





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