



## GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES



# TABLE OF CONTENTS

Regional summaries	Pages 3 – 8
East Asia	Pages 9 – 16
South Asia	Pages 17 – 21
Africa	Pages 22 – 28
Latin America	Pages 29 – 35
Middle East and North Africa (MENA)	Pages 36 – 40
Eastern Europe	Pages 41 – 47
Methodology, Notes, Acknowledgements	Pages 48 – 53





# OFFICES IN EAST ASIA



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Bill Savings / Month	Payback Period in Years
Cambodia	\$19,000	\$2,000	0.8
China	90,000 ¥ \$13,000	10,000 ¥ \$1,400	0.8
Fiji	\$45,000	\$5,300	0.7
Indonesia	190,000 Thousand Rp \$12,500	31,000 Thsnd Rp \$2,000	0.5
Philippines	450,000 PhP \$8,400	150,000 PhP \$2,800	0.3
Thailand	\$32,000	\$760	3.5
Vietnam	220 MVnd \$9,400	73 MVnd \$3,000	0.3



## ENERGY

The most cost effective measures include:

- Reduced Window To Wall Ratio
- External Shading Device
- Natural Ventilation
- Insulation of Roof and External Walls
- Air Conditioning with Water Cooled Chiller
- Variable Refrigerant Flow System



## WATER

Effective measures include:

- Water-Efficient Urinals and Faucets for Kitchen Sinks
- Grey Water Treatment and Recycling System



## MATERIALS

- Floor slabs are biggest efficiency drive, ranging from 35% - 40% of material costs out of 7 total interventions





# OFFICES IN SOUTH ASIA



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Bangladesh	\$20,810	\$1,040	1.7
India (Delhi)	Rs1,659,560	Rs195,830	1.7
India (Mumbai)	Rs1,043,415	Rs208,300	1.9
Sri Lanka	\$25,250	\$1,890	0.8



## ENERGY

Potential strategies may include:

- Reflective paint for roof and external wall
- Insulation of roof
- Occupancy sensors for bathroom and open offices
- Energy efficient lighting for internal and external spaces
- Reflective paint for roof and external walls
- Controlled Natural Ventilation

Humid climates may require efficient Air Conditioners and DE-Humidifiers



<https://www.edgebuildings.com/projects/centro-nacional-de-congresos-y-convenciones>



## WATER

The EDGE standard can be reached through:

- Gray water treatment and recycling system
- Dual flush for water closets in bathrooms
- Water efficient urinals in all bathrooms



## MATERIALS

Green measures may include:

- Ceramic tiles
- In-Situ Concrete >30% PFA for roof.
- Common brick wall for internal and external walls.
- Aluminum window frames.



# OFFICES IN AFRICA



## ROI ON MEASURES NEEDED TO REACH THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Angola	\$46,700	\$5,145	0.8
Cote D'Ivoire	\$26,400	\$1,170	1.9
Ghana	\$40,815	\$5,620	0.7
Kenya	\$18,820	\$1,860	0.8
Nigeria	\$26,550	\$830	2.7
South Africa	ZAR 213,600 \$14,840	ZAR 13,930 \$1,000	1.2



## ENERGY

The most cost effective interventions include:

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



## WATER

The best ROI is from these green measures:

- Dual Flush for Water Closets in Bathrooms
- Water Efficient Urinals and Faucets
- Low-Flow Faucets



## MATERIALS

- Floor slabs are the biggest efficiency drivers, ranging from 30% - 46% of material costs out of 7 total interventions.



Image sourced from: <https://www.edgebuildings.com/projects/centro-nacional-de-congresos-y-convenciones/>



# OFFICES IN LATIN AMERICA



## ROI ON MEASURES NEEDED TO REACH THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Argentina	\$57,100	\$1,330	3.6
Brazil	\$50,900	\$1,870	2.3
Colombia	\$29,880	\$830	3
Costa Rica	15,500,000 CRC	1,125,000 CRC	1.2
Mexico	\$52,420	\$1,250	3.5
Peru	68,200 S \$20,600	6,670 S \$2,000	1



## ENERGY

The best ROI is available through these measures:

- Reduced Window To Wall Ratio
- External Shading Device
- Energy Saving Light Bulbs
- Occupancy Sensors
- Air Conditioning with Water Cooled Chiller
- Variable Refrigerant Flow Cooling System



## WATER

The most effective measures include:

- Dual Flush for Water Closet
- Water-Efficient Urinals and Faucets for Kitchen Sinks
- Aerator and Auto Shut-off Faucets



## MATERIALS

- Floor slabs are biggest efficiency drive, ranging from 35% - 40% of material options out of 7 total interventions.

External Shading



Image sourced from: [www.pinterest.com.au/pin/321725967116931350/](http://www.pinterest.com.au/pin/321725967116931350/)



# OFFICES IN MENA



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Egypt	\$211,000	\$26,500	0.6
Jordan	\$44,000	\$8,000	0.5
Morocco	\$34,000	\$1,400	2
Pakistan	\$39,000	\$750	4



## ENERGY

The most effective strategies include:

- Reduced Window To Wall Ratio
- External Shading Devices
- Natural Ventilation with Operable Windows
- Low-E Coated Glass - U-Value of 3 W/m2 K and SHGC
- Energy-Saving Light Bulbs
- Reflective Paint for External Walls -Solar Reflectivity



## WATER

Best ROI can be reached through:

- Low-Flow Faucets in Bathrooms
- Dual flush for water closets in bathrooms
- Single Flush/Flush Valve



## MATERIALS

- Floor slabs are biggest efficiency drivers averaging 30% of material costs out of 7 total interventions
- Using materials other than the base case usually saves over 20%

## Natural Ventilation Diagram



Image sourced from: <http://2030palette.org/shading-devices/>



# OFFICES IN EASTERN EUROPE



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Armenia	\$27,840	\$1,630	1.4
Poland	\$25,730	\$3,800	0.6
Russian Federation	\$25,100	\$2,480	0.8
Serbia	\$5,330	\$555	0.8
Ukraine	\$7,460	\$560	1.2
Turkey	\$12,180	\$560	0.5



## ENERGY

The EDGE standard can typically be reached through:

- Reduced Window To Wall Ratio
- Energy Saving Light Bulbs
- Air Conditioning with Water Cooled Chiller
- Variable Refrigerant Flow System
- Ground Source Heat Pump



## WATER

Effective measures include:

- Water-efficient bathroom urinals
- Efficient faucets for kitchen sinks
- Dual flush for water closets in bathrooms



## MATERIALS

- Floor slabs are biggest efficiency drive, ranging from 20%-35% of material costs out of 6 total interventions
- Using other materials usually saves over 30%





# GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN EAST ASIA



*Creating Markets, Creating Opportunities*

# OFFICES – CAMBODIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 20% Savings through:

- Natural ventilation with operable windows and no A/C
- Variable refrigerant flow system



### Water – 56% Savings through:

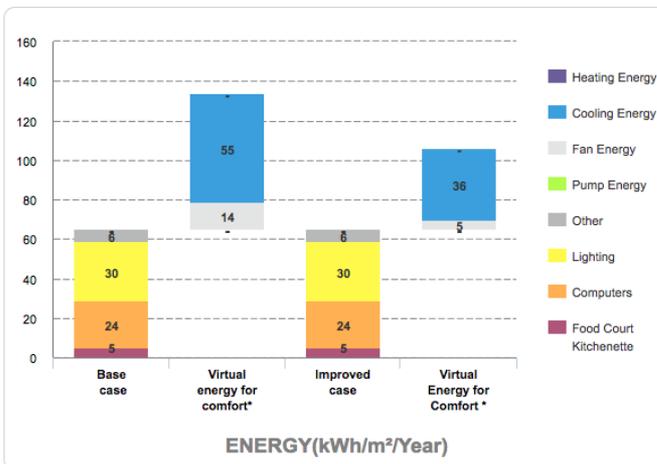
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



### Materials – 35% Savings through:

- Timber Floor Construction Floor Slabs

## 20.50% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$19,000

Utility Bill Savings  
\$2,000 / month

Payback in Years  
0.8

Operational CO<sub>2</sub>  
Savings  
10 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 30% Savings through:

- Reflective Paint, Tiles, and Insulation for Roof
- Low E-Coated Glass
- Variable Refrigerant Volume Cooling System
- Sensible Heat Recovery from Exhaust Air
- Energy-Saving Light Bulbs for Internal and External Spaces



### Water – 70% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets
- Grey Water Treatment and Recycling System



### Materials – 45% Savings through:

- Curtain Walling for External Walls



## DAAN MOGOT BARU OFFICE PARK (INDONESIA)

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

# OFFICES – CHINA CASE STUDY & CERTIFIED PROJECT



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 24% Savings through:

- External Shading Devices
- Recovery Waste Heat from the Generator for Space Heating
- Air conditioning with air air cooled screw chiller



Water – 49% Savings through:

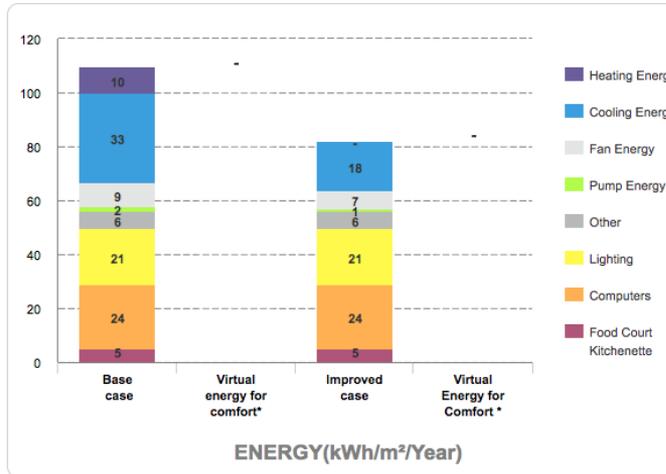
- Black water treatment and recycling system



Materials – 34% Savings through:

- Timber Floor Construction Floor Slabs

24.44% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
90,000 ¥

Utility Bill Savings  
10,000 ¥ / month

Payback in Years  
0.8

Operational CO<sub>2</sub>  
Savings  
105 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 45% Savings through:

- Reduced Window to Wall Ratio
- Insulation of Roof and External Walls
- Higher Thermal Performance Glass
- Energy-Efficient Air Conditioning with Water-Cooled Chiller
- Sensible Heat Recovery from Exhaust Air



Water – 42% Savings through:

- Low-Flow Plumbing Fixtures and Dual-Flush Water Closets
- Grey Water Treatment and Recycling System



Materials – 21% Savings through:

- In-situ Concrete with Pulverized Fly Ash for Floor Slabs and Roof Construction



JOHNSON CONTROLS HQ (SHANGHAI)



# OFFICES – FIJI CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 27% Savings through:

- Variable Refrigerant Flow System
- Energy Saving Light Bulbs for Internal Spaces



Water – 21% Savings through:

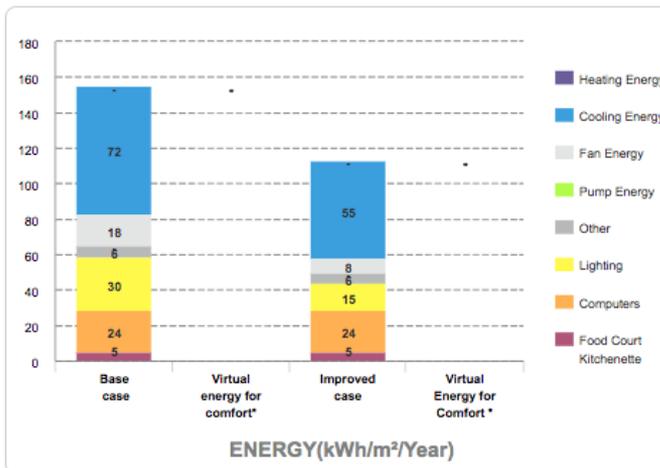
- Low-Flow Faucets in Bathrooms and Kitchen Sinks
- Water-Efficient Urinals in all Bathrooms



Materials – 35% Savings through:

- Timber Floor Construction Floor Slabs

27.10% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$45,000

Utility Bills Savings  
\$5,300 / month

Payback in Years  
0.70

Operational CO<sub>2</sub>  
Savings  
110 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 38% Savings through:

- Reduced Window To Wall Ratio
- Reflective Paint for Roof and Walls
- Roof and Wall Insulation
- Energy-Saving Lightning for Internal and External Spaces



Water – 23% Savings through:

- Rainwater Harvesting System
- Low-Flow Plumbing Fixtures for Kitchen Sinks, Washbasins, Water Closets and Shower Heads



Materials – 63% Savings through:

- Reuse of Existing Floor Slabs and External Walls With Steel Profile Cladding, Plasterboards on Metal Studs for Internal Walls, Steel Sheets on Steel Rafters for the Roof and Ceramic Tile



CeDEL (ARGENTINA)

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

# OFFICES – INDONESIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 29% Savings through:

- External Shading Devices
- Insulation of Roof and External Walls
- Energy-Saving Light Bulbs



Water – 50% Savings through:

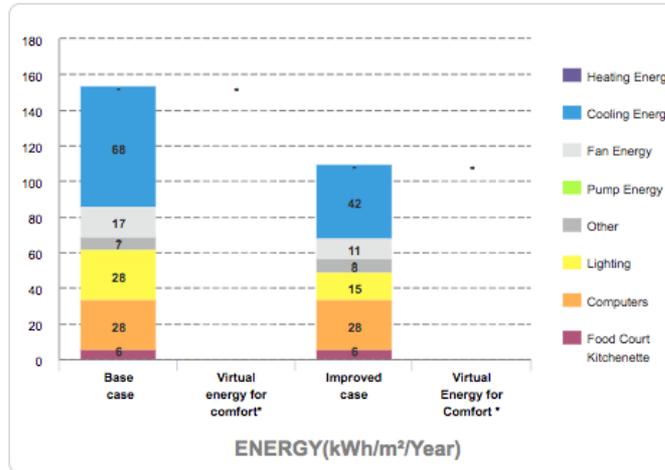
- Black Water Treatment and Recycling System



Materials – 35% Savings through:

- Timber Floor Construction Floor Slabs

28.64% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
190,000  
Thousand Rp

Utility Bills Savings  
31,000 Thousand Rp /  
month

Payback in Years  
0.5

Operational CO<sub>2</sub> Savings  
150 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 27% Savings through:

- High Performance Glass
- Reduced Window To Wall Ratio
- Energy-Saving Lighting
- Efficient Cooling Systems



Water – 65% Savings through:

- Low-Flow Faucets For Washbasins
- Dual Flush For Water Closets
- Water-efficient Urinals



Materials – 37% Savings through:

- Gypsum Walls And Stone Tile Floors For The Retail Space
- Steel Profile Cladding and Finished Concrete Floors



**CITRA TOWERS KEMAYORAN (JAKARTA)**

# OFFICES – PHILIPPINES CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 24% Savings through:

- Air conditioning with water cooled chiller
- Air economizer during favorable outdoor conditions



### Water – 50% Savings through:

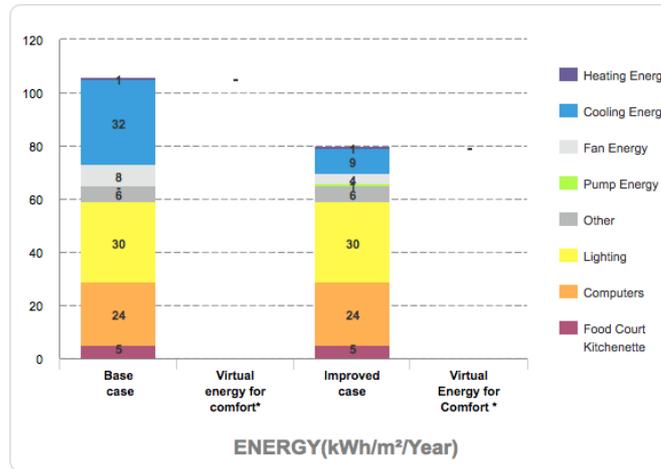
- Black water treatment and recycling system



### Materials – 35% Savings through:

- Timber Floor Construction Floor Slabs

24.30% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
450,000 PhP

Utility Bills Savings  
150,000 / month

Payback in Years  
0.3

Operational CO<sub>2</sub>  
Savings  
60 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 68% Savings through:

- Reduced Window To Wall Ratio
- Reflective Paint and Insulation
- Higher Thermal Performance Glass;
- Variable Refrigerant Volume (VRV) Cooling System
- Sensible Heat Recovery From Exhaust Air
- Energy-Saving Light Bulbs For Internal Spaces
- Lighting Controls For Corridors And Staircases
- Solar Photovoltaics



### 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:

- Stone And Ceramic Tiles For Floors; UPVC Window Frames; Polystyrene Roof Insulation; And Autoclaved Aerated Concrete Blocks For External Walls



## ABHIKALPAN OFFICE (INDIA)

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



# OFFICES – THAILAND CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 32% Savings through:

- Air conditioning with water cooled chiller



Water – 20% Savings through:

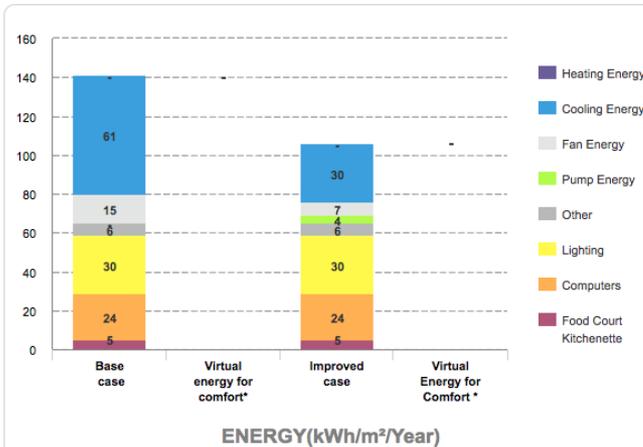
- Black water treatment and recycling system



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

23.78% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$32,000

Utility Bills Savings  
\$760 / month

Payback in Years  
3.5

Operational CO<sub>2</sub>  
Savings  
84 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 33% Savings through:

- Reduced Window To Wall Ratio
- Higher Thermal Performance Glass
- Variable Refrigerant Volume (VRV) Cooling System
- Sensible Heat Recovery From Exhaust Air
- Energy Saving Light-Bulbs In 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 And UPVC Window Frames



## QUASITUM INTELISOFT (INDIA)

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



# OFFICES – VIETNAM CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 23% Savings through:

- Energy Saving Light Bulbs – Internal & External
- Reflective Paint/Tiles for Roof and Walls
- Insulation of Roof and External Walls



### Water – 43% Savings through:

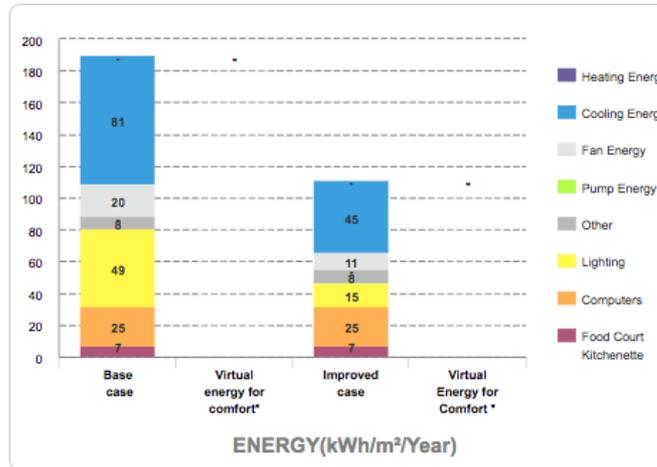
- Black water treatment and recycling system



### Materials – 35% Savings through:

- Timber Floor Construction Floor Slabs

41.31% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
220 mVND

Utility Bills Savings  
73 mVND / month

Payback in Years  
0.3

Operational CO<sub>2</sub>  
Savings  
160 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 32% Savings through:

- External Shading
- Roof Insulation
- Variable Refrigerant Volume Cooling System
- Energy-saving Lighting System
- Solar Photovoltaics



### Water – 54% Savings through:

- Low-flow Faucets, Dual Flush Water Closets And 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.



## GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN SOUTH ASIA



*Creating Markets, Creating Opportunities*



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m

### Energy Measures – 21% Savings through:



- Reflective paint for roof and external wall.
- Low E-Coated Glass.
- Variant Refrigerant Flow (VRF) System..



### Water – 21% Savings through:

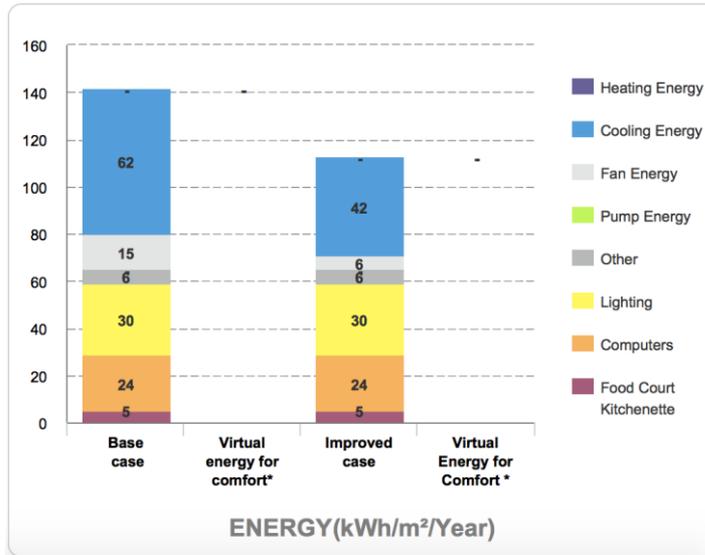
- Water efficient urinals in all bathroom
- Water efficient faucets for all kitchen sink
- Gray water treatment and recycling system



### Materials – 22% Savings through:

- Ceramic tiles
- In-Situ Concrete >30% PFA for roof.
- Common brick wall for internal and external walls.
- Aluminum window frames.

20.50% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$20,860

Payback in Years  
1.7

Utility cost saving  
\$1,040/Month

Operational CO<sub>2</sub>  
Savings  
91 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 30% Savings through:

- Occupancy sensors in bathrooms
- Low E-Coated glass
- Variable refrigerant volume (VRV) cooling system.
- Sensible heat recovery from exhaust air
- Energy saving lighting
- Daylight photoelectric sensors for internal space



### Water – 70% Savings through:

- Low-flow faucets in kitchen and bathroom.
- Dual-flush water closets.
- Gray water treatment and recycling system.
- Water efficient urinals and rain water harvesting



### Materials – 45% Savings through:

- Autoclaved Aerated Concrete blocks for internal walls
- Curtain walling for external walls



## DAAN MOGOT BARU OFFICE PARK (INDONESIA)

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

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m

### Energy Measures – 20% Savings through:

- Insulation on roof.
- Low E-Coating glass.
- Energy efficient light bulbs for internal space.

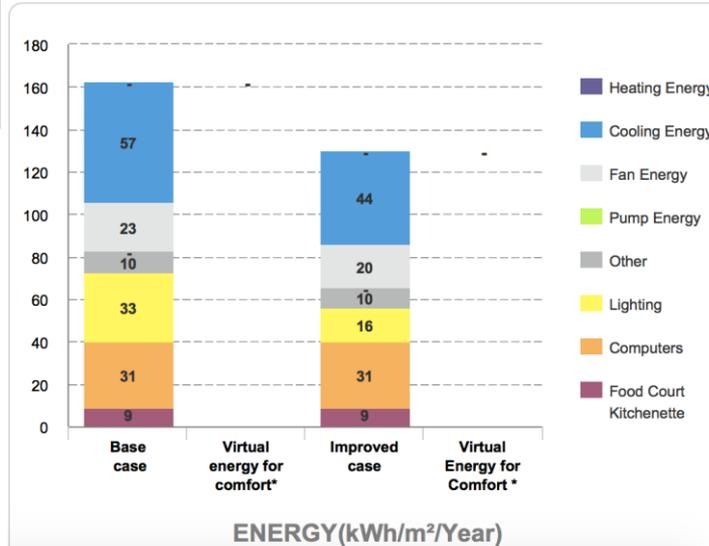
### Water – 28% Savings through:

- Low-Flow Faucets in Bathrooms - 2 lt./min
- Dual flush for water closets in bathrooms

### Materials – 26% Savings through:

- Ceramic tiles.
- In-Site Concrete<30% PFA for roof.
- Common brick wall
- Aluminum window frames.

20.17% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
Rs 1,659,550

Payback in Years  
0.7

Utility cost saving  
Rs 195,830/Month

Operational CO<sub>2</sub>  
Savings  
119 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT

### Energy Measures – 68% Savings through:

- Reduced window to wall ratio.
- Higher thermal performance glass
- Reflective paint and insulation of the roof.
- Variable refrigerant volume (VRV) cooling system.
- Sensible heat recovery from exhaust air
- Energy saving lighting and solar photovoltaic

### Water – 83% Savings through:

- Low-flow plumbing fixtures.
- Rain water harvesting.
- Black water treatment and recycling system.

### Materials – 28% Savings through:

- Stone and ceramic tiles for floors
- UPVC window frames.
- Polystyrene roof insulation and AAC blocks for external walls



## ABHIKALPAN OFFICE (INDIA)

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



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 21% Savings through:

- Reflective paint for roof and external wall.
- Insulation of roof.
- Energy saving lights for internal and external spaces.



### Water – 29% Savings through:

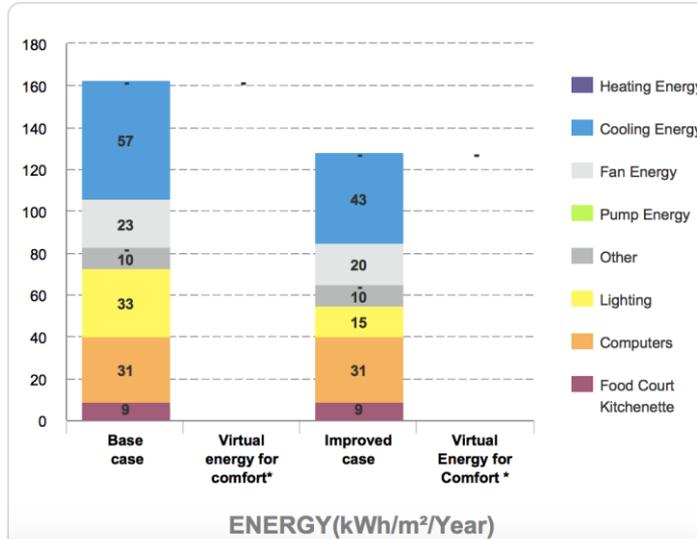
- Gray water treatment and recycling system
- Dual flush for water closets in bathrooms



### Materials – 21% Savings through:

- Ceramic tiles.
- In-Site concrete <30% PFA, for roof.
- Aerated Autoclaved Concrete blocks
- Aluminum window frames

21.48% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
Rs 1,043,415

Payback in Years  
0.4

Utility cost saving  
Rs 208,310/Month

Operational CO<sub>2</sub>  
Savings  
126 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 27% Savings through:

- Reduced window to wall ratio.
- Higher thermal performance glass..
- Energy saving lighting
- Efficient cooling system



### Water – 65% Savings through:

- Low-flow faucet wash basin.
- Dual-flush water closets.
- Water efficient urinals.



### Materials – 37% Savings through:

- Gypsum walls and stone tiled floor for retail space
- Steel profile cladding
- Finish concrete floor for office towers.



## CITRA TOWERS KEMAYORAN

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

# OFFICES – SRI LANKA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m

### Energy Measures – 29% Savings through:

- Occupancy Sensors in Bathrooms, Conference Rooms.
- Variable refrigerant flow system.
- Occupancy Sensors in Open Offices.
- Air Conditioning with Air Cooled Screw Chiller.

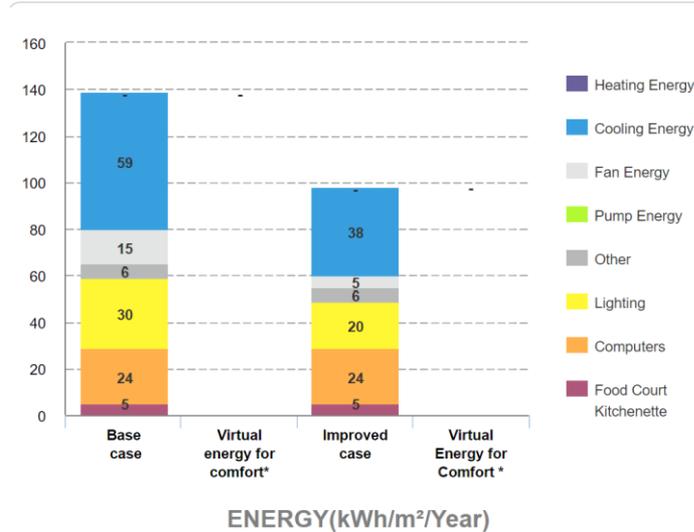
### Water – 23% Savings through:

- Low-Flow Faucets in Bathrooms - 2 Lt./min
- Dual flush for water closets in bathrooms

### Materials – 75% Savings through:

- Timber Floor Construction.
- Concrete Filler Slab with Polystyrene Blocks.
- Stone Blocks – Hand Cut.
- Cork Tiles Flooring and Timber Window Frames.

28.80% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$25,250

Payback in Years  
0.8

Utility Costs Savings  
\$1,890/ month

Operational CO<sub>2</sub>  
Savings  
143 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT

### Energy Measures – 33% Savings through:

- Reduced window to wall ratio.
- Higher thermal performance glass.
- Variable refrigerant volume (VRV) cooling system.
- Sensible heat recovery from exhaust air and energy saving light-bulbs.

### 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 Pvt. Ltd.

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



# GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN AFRICA



*Creating Markets, Creating Opportunities*

# OFFICES – ANGOLA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	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:

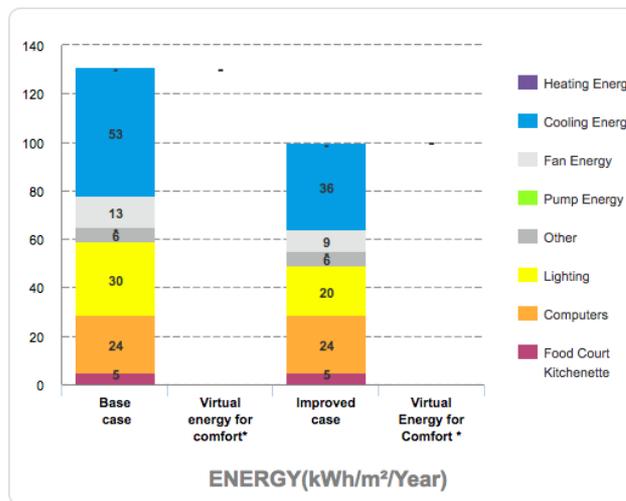
- Dual flush for water closets in Bathrooms
- Low-Flow Faucets in Bathrooms
- Water-Efficient Urinals in All Bathrooms



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<sub>2</sub>  
Savings  
93 tCO<sub>2</sub>/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.

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	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:

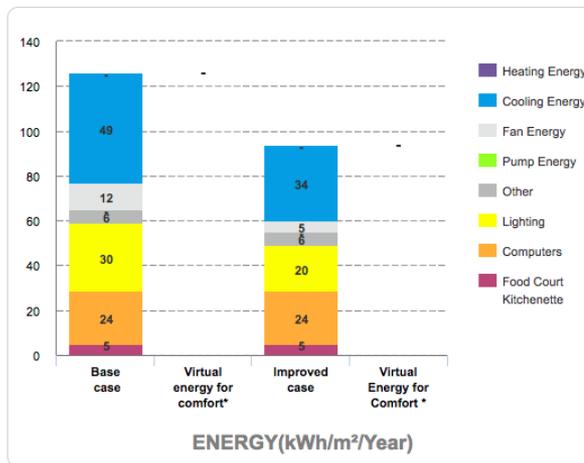
- Dual flush for water closets in Bathrooms
- Low Flow Faucets
- Water-Efficient Urinals in All Bathrooms



### 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<sub>2</sub>  
Savings  
74 tCO<sub>2</sub>/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.



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 23% Savings through:

- Insulation of Roof
- Energy-Saving Lightbulbs
- Daylight Photoelectric Sensors



### Water – 20% Savings through:

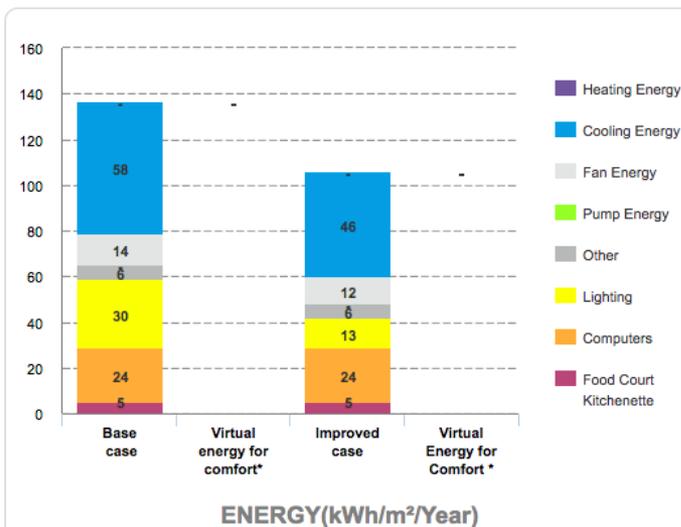
- Dual flush for Water Closets in Bathrooms
- Water-Efficient Urinals in All Bathrooms



### 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<sub>2</sub> Savings

59 tCO<sub>2</sub>/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.

# OFFICES – KENYA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	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:

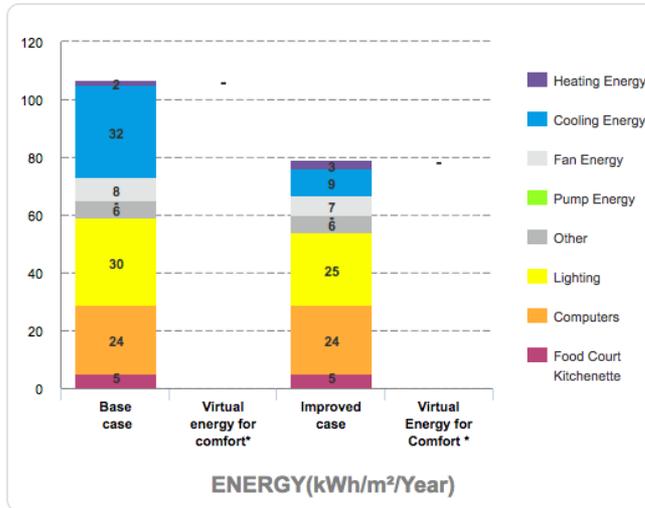
- Dual flush for water closets in Bathrooms
- Low Flow Faucets
- Water-Efficient Urinals in All Bathrooms



### 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<sub>2</sub>  
Savings  
62 tCO<sub>2</sub>/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.

# OFFICES – NIGERIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	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:

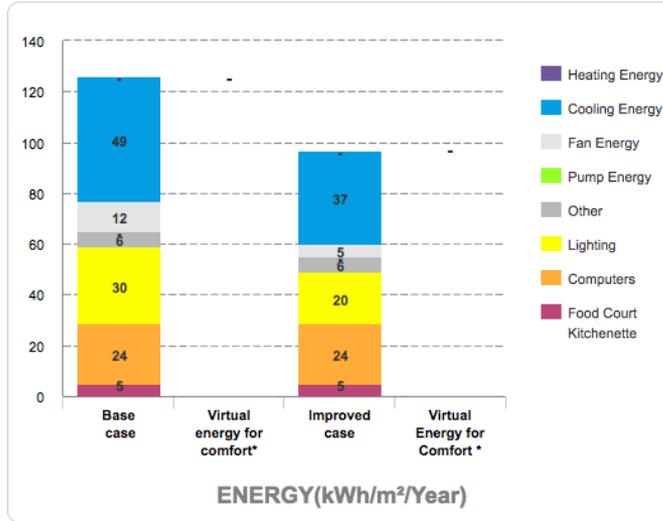
- Dual flush for water closets in Bathrooms
- Water-Efficient Faucets for Kitchen Sinks
- Water-Efficient Urinals in All Bathrooms



### 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<sub>2</sub>  
Savings  
55 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 38% Savings through:

- Reduced window 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.



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	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

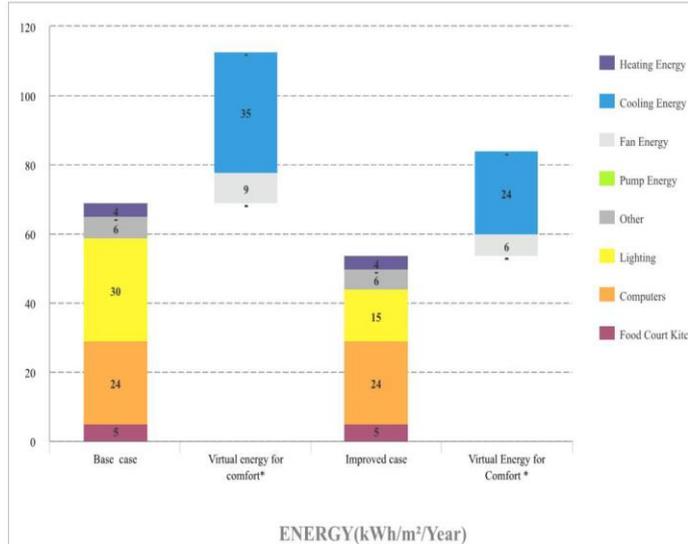


### Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck

Energy Efficiency Measures 24.55%

ENERGY SAVINGS Meets EDGE Energy Star



## PROJECT METRICS

Incremental Cost  
ZAR 213,600

Utility Costs Savings  
ZAR 13,930 / month

Payback in Years  
1.2

Operational CO<sub>2</sub>  
Savings  
68 tCO<sub>2</sub>/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



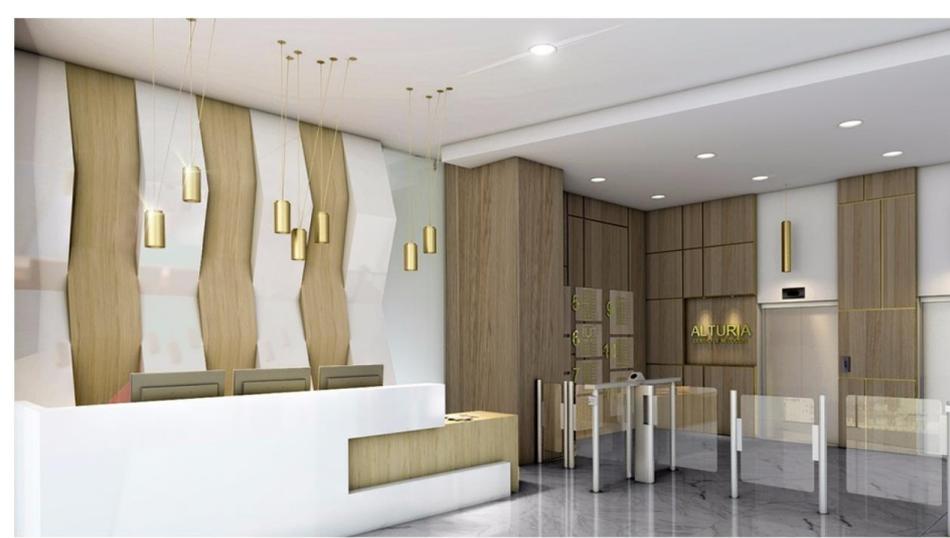
### Materials – 28% Savings through:

- 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.



## GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN LATIN AMERICA



*Creating Markets, Creating Opportunities*

# OFFICES – ARGENTINA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 33% Savings through:

- Variable Refrigerant Flow System
- Air Conditioning with Water Screwed Chiller
- Energy Saving Lightbulb



Water – 20% Savings through:

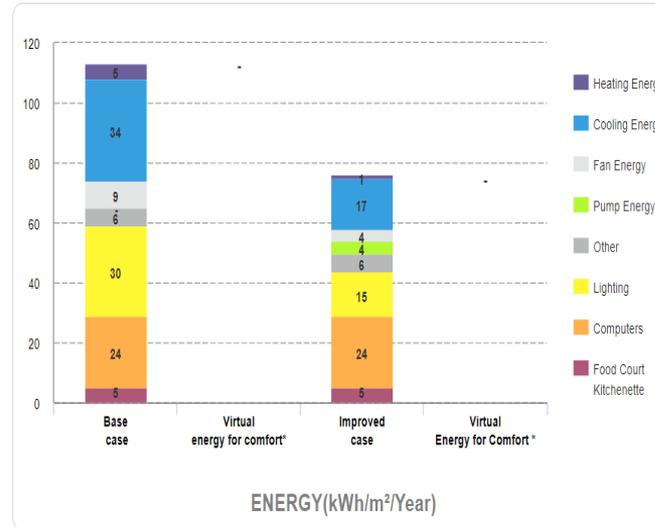
- Water-efficient bathroom urinals
- Dual flush for water closets in bathrooms
- Low Flow Faucet in bathroom
- Water Efficient Faucet in Kitchen



Materials – 27% Savings through:

- Concrete Filler Floor Slabs

33.39% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost

\$57,100

Utility Cost Savings

\$1,330/month

Payback in Years

3.6

Operational CO<sub>2</sub> Savings

180 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 38% Savings through:

- Reduced Window to Wall Ratio
- Reflective paint for roof and walls
- Roof and wall insulation
- Energy-Saving Light Bulbs for Internal and External Spaces



Water – 23% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets
- Rainwater Harvesting System



Materials – 63% Savings through:

- Reuse of existing floor slabs and external walls with steel profile cladding
- Plasterboards on metal studs for internal walls,
- Steel sheets on steel rafters for the roof, and ceramic tile.



**Centro de Desarrollo Emprendedor y Laboral (CeDEL)**

# OFFICES – BRAZIL CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



- Energy Measures – 24% Savings through:
- Air Conditioning With Water Cooled Chiller
  - Variable Refrigerant Flow Cooling System

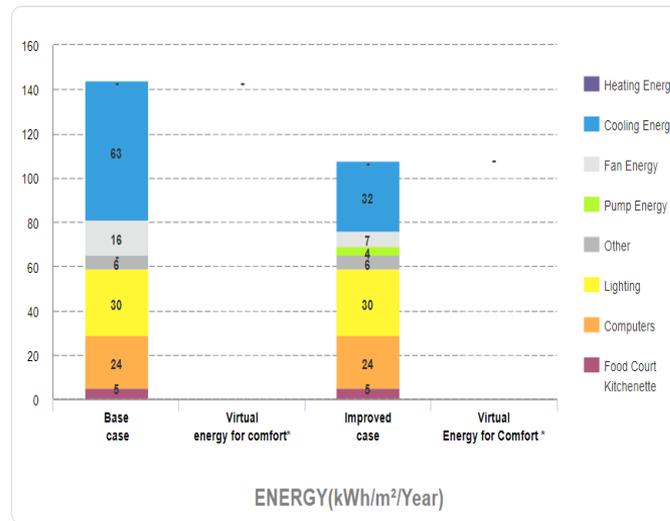


- Water – 22% Savings through:
- Grey Water Treatment and Recycle System
  - Rainwater Harvesting System on 50% of Roof Area
  - Water-Efficient Bathroom Urinals and Faucets for Kitchen Sinks
  - Dual Flush for Water Closets in Bathrooms
  - Low Flow Water Faucet in Bathroom



- Materials – 35% Savings through:
- In-Situ Concrete with >25% GGBS Floor Slabs

24.38% Meets EDGE Energy Standard



## PROJECT METRICS

- Incremental Cost  
\$50,900
- Utility Cost Savings  
\$1,870/month
- Payback in Years  
2.3
- Operational CO<sub>2</sub> Savings  
230 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



- Energy Measures – 32% Savings through:
- Reduced window to wall ratio
  - reflective paint and tiles for roof and 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 and external plaster for external walls
  - honeycomb clay blocks with plaster on both sides and plasterboards on metal studs for internal walls
  - ceramic tile flooring
  - aluminium window frames.



## ALTURIA (COLOMBIA)

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

# OFFICES – COLOMBIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 21% Savings through:

- Air Conditioning with Water Chiller
- Variable Refrigerant Flow Cooling System
- Occupancy Sensor



### Water – 35% Savings through:

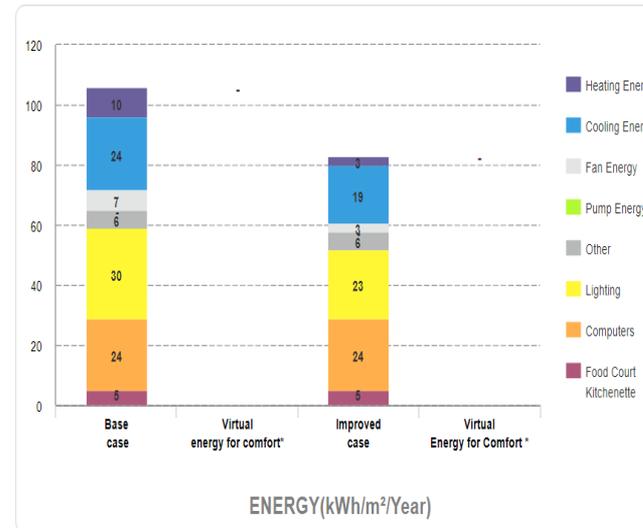
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms
- Low Flow Bathroom Faucet



### Materials – 22% Savings through:

- In-Situ Concrete with > 25% GGBS Floor Slabs

21.28% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost

\$29,880

Utility Cost Savings

\$830/month

Payback in Years

3

Operational CO<sub>2</sub> Savings

88.5 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 32% Savings through:

- Reduced window to wall ratio
- reflective paint and tiles for roof and 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 and external plaster for external walls
- honeycomb clay blocks with plaster on both sides and plasterboards on metal studs for internal walls
- ceramic tile flooring
- aluminium window frames.



**ALTURIA (COLOMBIA)**

# OFFICES – COSTA RICA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 25% Savings through:

- Energy Saving Light Bulbs for Internal Space
- Natural Ventilation with Operable Window
- Air Conditioning: COP of 3.5\*



### Water – 47% Savings through:

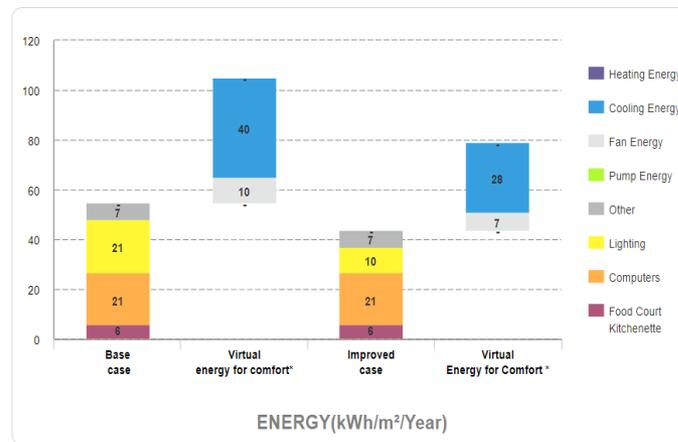
- Grey Water Treatment and Recycling System
- Rainwater Harvesting System 50% of Roof Area
- Water-efficient Urinals and Kitchen Faucet
- Dual flush for water closets in bathrooms
- Low Flow Faucet in Bathroom



### Materials – 20% Savings through:

- Hollow Core Precast Floor Slabs
- Finished Concrete Flooring

25.07% Meets EDGE Energy Standard



\*NOT PART OF ENERGY SAVING  
Assumed Air Conditioning Installation in the Future

## PROJECT METRICS

Incremental Cost  
15,500,000 CRC

Utility Cost Savings  
1,125,000 CRC/month

Payback in Years  
1.2

Operational CO<sub>2</sub>  
Savings  
70 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 22% Savings through:

- Reduced Window To Wall Ratio
- Energy-saving Lighting Systems In Internal And External Areas
- Occupancy Sensors In Bathrooms, Conference Rooms And Offices



### Water – 27% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets



### Materials – 27% Savings through:

- Steel Sheets On Steel Rafters For Roof Construction
- Cement Fiber Boards On Metal Studs For External Walls
- Finished Concrete Flooring



Offices At Santa Verde (Costa Rica)

# OFFICES – MEXICO CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 31% Savings through:

- Air Conditioning with Air Cooled Screw
- Energy Saving Light Bulbs
- Variable Refrigerant Flow Cooling System



### Water – 21% Savings through:

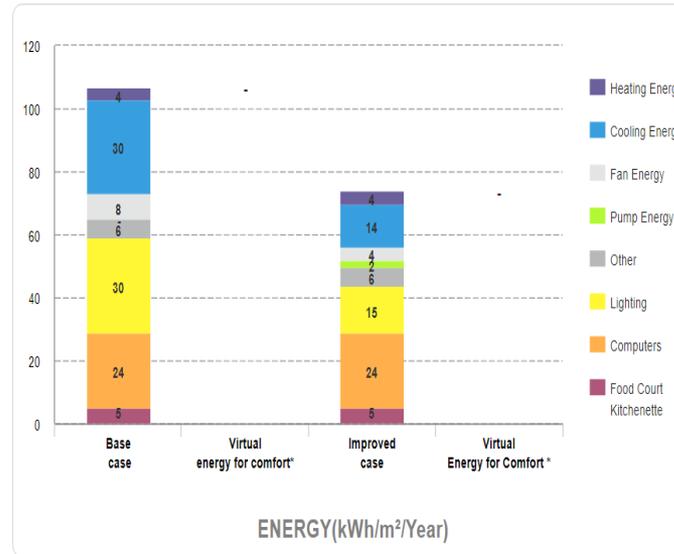
- Dual flush for water closets in bathrooms
- Low Flow Faucet
- Water-efficient urinals and faucets for kitchen sinks



### Materials – 22% Savings through:

- In-Situ Concrete with > 25% GGBS Floor Slabs

30.89% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost

\$52,420

Utility Cost Savings

\$1,250/month

Payback in Years

3.5

Operational CO<sub>2</sub> Savings

160 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 33% Savings through:

- Reduced Window To Wall Ratio
- Reflective Paint For Roof And External Walls And Low-e Coated Glass
- Air Conditioning With Water-cooled Chiller
- Variable Frequency Drives In AHUs and Pumps With Variable Speed Drives
- Occupancy Sensors
- Energy-saving Light Bulbs For Internal And External Spaces



### Water – 38% Savings through:

- Low-flow Plumbing Fixtures For Washbasins And Kitchens
- Rainwater Harvesting System.



### Materials – 21% Savings through:

- Hollow-core Precast Floor Slabs, Steel Sheets For Roof
- Polymeric Render On Concrete Blocks For External Walls
- Plasterboards On Metal Studs With Insulation For Internal Walls And Flooring
- Nylon Carpets; And Finished Concrete Flooring



## CENTRO NACIONAL DE CONGRESOS Y CONVENCIONES (COSTA RICA)

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

# OFFICES – PERU CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 22% Savings through:

- Variable refrigerant flow system
- Air Conditioning with Air Cooled Screw Chiller



Water – 45% Savings through:

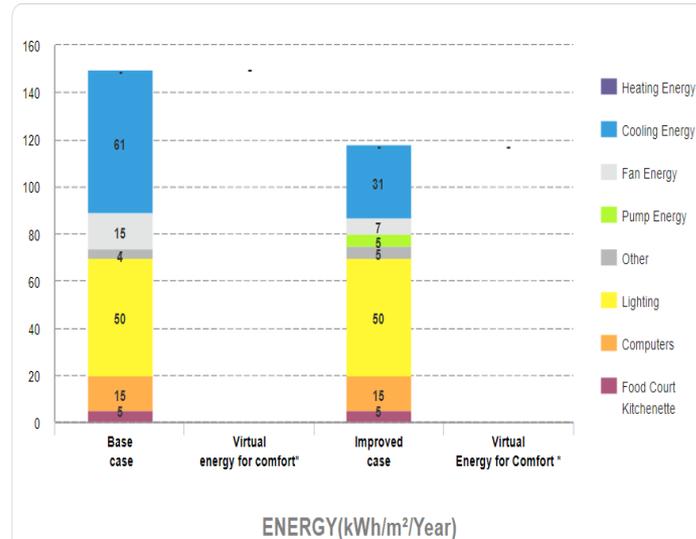
- Black Water Treatment and Recycling
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms
- Low Flow Faucets in Bathroom



Materials – 35% Savings through:

- In-Situ Concrete with > 25% GGBS Floor Slabs

21.91% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost

68,200 S

Utility Cost Savings

6,660 S/month

Payback in Years

1

Operational CO<sub>2</sub>

Savings

280 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 32% Savings through:

- External shading, roof insulation
- variable refrigerant volume cooling system
- energy-saving lighting system
- solar photovoltaics



Water – 54% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets
- dual flush water closets



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.



## GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN MENA



*Creating Markets, Creating Opportunities*

# OFFICES – EGYPT CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 25% Savings through:

- Low-E Coated Glass - U-Value of 3 W/m<sup>2</sup> K and SHGC
- Reduced Window To Wall Ratio
- Energy-Saving Light Bulbs - Internal Spaces



### Water – 23% Savings through:

- Low-Flow Faucets in Bathrooms - 2 lt./min
- Dual flush for water closets in bathrooms
- Single Flush/Flush Valve

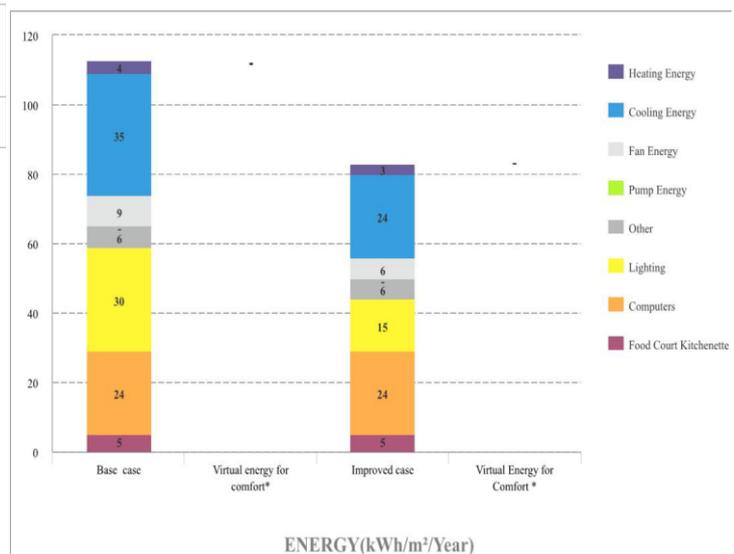


### Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck

Energy Efficiency Measures 25.38%

ENERGY SAVINGS Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$211,000

Utility Costs Savings  
\$26,500 / month

Payback in Years  
0.6

Operational CO<sub>2</sub>  
Savings  
\$ 130 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 30% Savings through:

- Reflective paint and tiles for roof.
- Insulation of roof, low-E coated glass.
- Variable refrigerant volume cooling system.
- Energy-saving light bulbs for internal and external spaces.



### Water – 70% Savings through:

- Low-flow faucets in kitchens and bathrooms.
- Dual-flush water closets.
- Rainwater harvesting system, and grey water treatment.



### Materials – 45% Savings through:

- Curtain walling for external walls, autoclaved aerated concrete blocks for internal walls, and finished concrete floor with a small percentage of stone tiles.



**Daan Mogot Baru Office Park**

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



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 20% Savings through:

- Reflective Paint for External Walls -Solar Reflectivity
- External Shading Devices - Annual Average Shading
- Insulation of Roof
- Insulation of External Walls
- Natural Ventilation with Operable Windows and No



### Water – 23% Savings through:

- Low-Flow Faucets in Bathrooms
- Dual flush for water closets in bathrooms
- Single Flush/Flush Valve

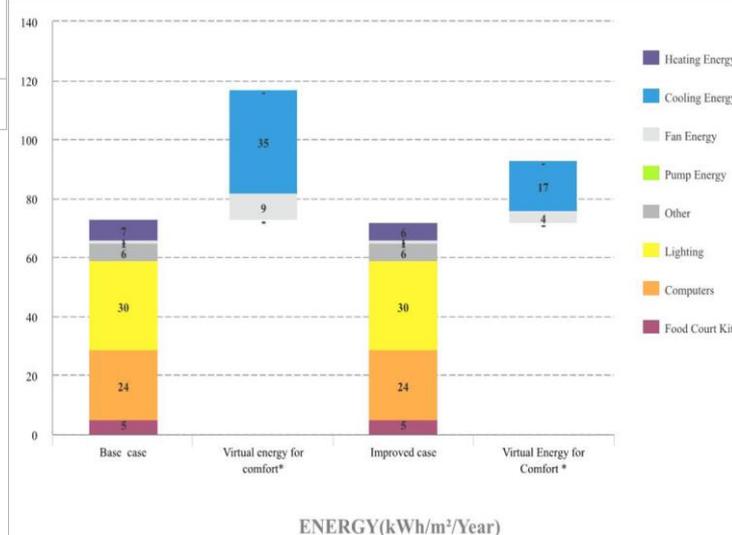


### Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck

Energy Efficiency Measures 20.44%

ENERGY SAVINGS Meets EDGE Energy Star **PROJECT METRICS**



Incremental Cost  
\$ 44,100

Utility Costs Savings  
\$ 780 / month

Payback in Years  
5

Operational CO<sub>2</sub>  
Savings  
\$ 110 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 41% Savings through:

- Reduced window to wall ratio
- External shading
- Air conditioning with air-cooled chiller and a 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 Office Building (Lebanon)

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

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 22% Savings through:

- Reflective Paint for External Walls -Solar Reflectivity
- External Shading Devices - Annual Average Shading Factor
- Reduced Window To Wall Ratio
- Variable Refrigerant Flow (VRF) System



Water – 23% Savings through:

- Low-Flow Faucets in Bathrooms
- Dual flush for water closets in bathrooms



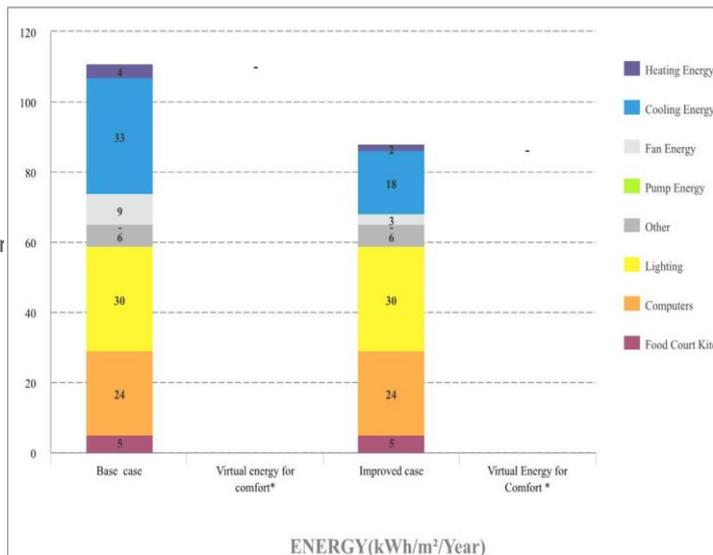
Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck

Energy Efficiency Measures 21.59%

ENERGY SAVINGS Meets EDGE Energy Sta

## PROJECT METRICS



Incremental Cost  
\$ 34,300

Utility Costs Savings  
\$ 1,400 / month

Payback in Years  
2

Operational CO<sub>2</sub>  
Savings  
\$ 70 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 32% Savings through:

- External shading
- Roof insulation
- Variable refrigerant volume cooling system
- Energy-saving lighting system
- Solar photovoltaics



Water – 54% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets



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.

# OFFICES – PAKISTAN CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 23% Savings through:

- Variable Refrigerant Flow (VRF) System
- Reduced Window To Wall Ratio
- External Shading Devices - Annual Average Shading Fact
- Reflective Paint/Tiles for Roof -Solar Reflectivity



Water – 23% Savings through:

- Low-Flow Faucets in Bathrooms
- Dual flush for water closets in bathrooms



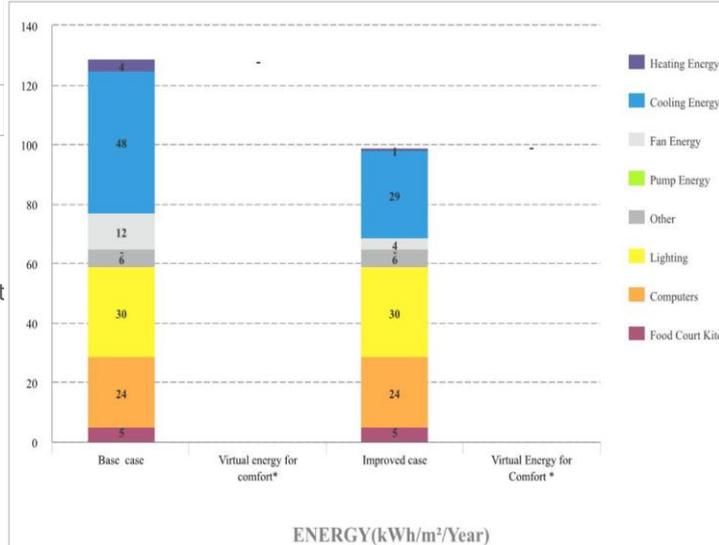
Materials – 30% Savings through:

- Composite In-Situ Concrete and Steel Deck

Energy Efficiency Measures 22.59%

ENERGY SAVINGS Meets EDGE Energy Star

## PROJECT METRICS



Incremental Cost  
\$ 40,000

Utility Costs Savings  
\$ 750 / month

Payback in Years  
4.5

Operational CO<sub>2</sub>  
Savings  
\$ 70 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 33% Savings through:

- Reduced window to wall ratio
- Higher thermal performance glass
- Variable refrigerant volume (VRV) cooling system
- Sensible heat recovery from exhaust air
- Energy saving light-bulbs in 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 Pvt. Ltd. (India)

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



## GREEN BUILDINGS RETURN ON INVESTMENT: OFFICES IN EASTERN EUROPE



*Creating Markets, Creating Opportunities*

# OFFICES – ARMENIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 35% Savings through:

- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Energy Saving Light Bulbs



### Water – 35% Savings through:

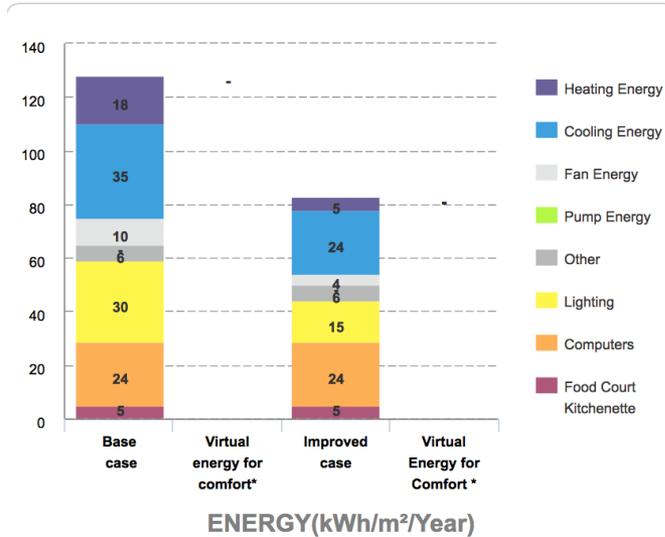
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



### Materials – 35% Savings through:

- Floor Slabs: In-Situ Concrete with >30% PFA

35.21% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$27,842

Utility Costs Savings  
\$1,639/ month

Payback in Years  
1.42

Operational CO<sub>2</sub> Savings  
93 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 27% Savings through:

- High Performance Glass
- Reduced Window To Wall Ratio
- Energy-Saving Lighting
- Efficient Cooling Systems



### Water – 65% Savings through:

- Low-Flow Faucets For Washbasins
- Dual Flush For Water Closets
- Water-efficient Urinals



### Materials – 37% Savings through:

- Gypsum Walls And Stone Tile Floors For The Retail Space
- Steel Profile Cladding and Finished Concrete Floors



## CITRA TOWERS KEMAYORAN (JAKARTA)

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

# OFFICES – POLAND CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 35% Savings through:

- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Energy Saving Light Bulbs



### Water – 35% Savings through:

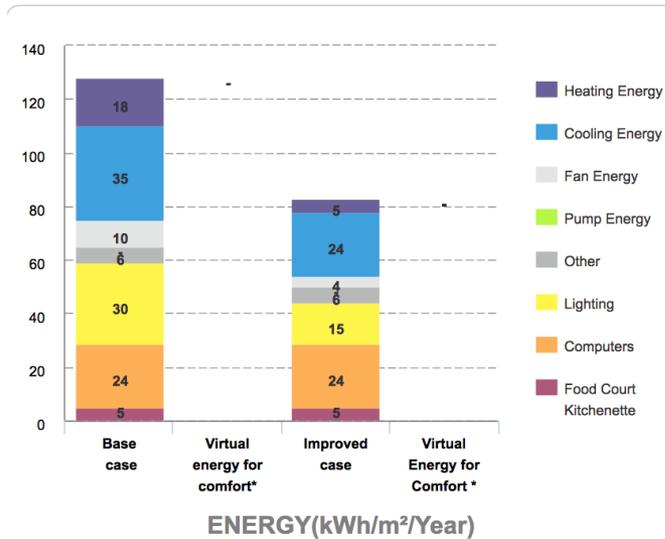
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



### Materials – 35% Savings through:

- Floor Slabs: In-Situ Concrete with >30% PFA

35.21% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$25,735

Utility Costs Savings  
\$3,800/ month

Payback in Years  
0.56

Operational CO<sub>2</sub>  
Savings

185 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 45% Savings through:

- Reduced Window to Wall Ratio
- Insulation of Roof and External Walls
- Higher Thermal Performance Glass
- Energy-Efficient Air Conditioning with Water-Cooled Chiller
- Sensible Heat Recovery from Exhaust Air



### Water – 42% Savings through:

- Low-Flow Plumbing Fixtures and Dual-Flush Water Closets
- Grey Water Treatment and Recycling System



### Materials – 21% Savings through:

- In-situ Concrete with Pulverized Fly Ash for Floor Slabs and Roof Construction



JOHNSON CONTROLS HQ (SHANGHAI)

# OFFICES – RUSSIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 36% Savings through:

- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Energy Saving Light Bulbs



Water – 35% Savings through:

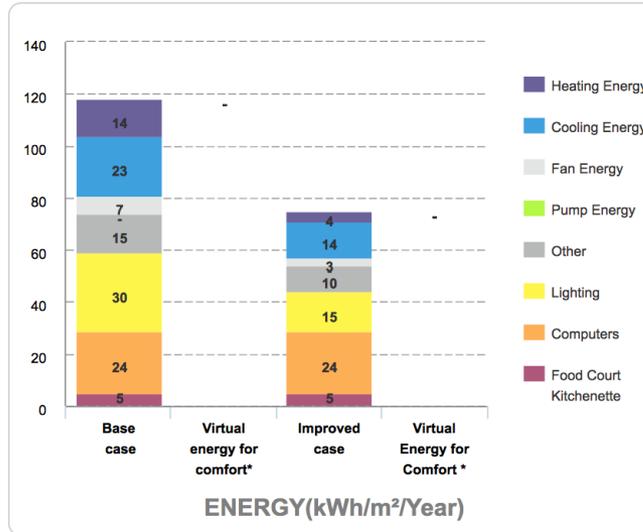
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



Materials – 23% Savings through:

- Floor Slabs: In-Situ Concrete with >30% PFA

36.49% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$25,101

Utility Costs Savings  
\$2,489/ month

Payback in Years  
0.84

Operational CO<sub>2</sub> Savings  
91 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



Energy Measures – 25% Savings through:

- Low E-Coated Glass
- Variable Refrigerant Volume Cooling System
- Sensible Heat Recovery from Exhaust Air
- Energy-Saving Light Bulbs for Internal and External Spaces
- Occupancy sensors for bathrooms and offices



Water – 57% Savings through:

- Low-Flow faucets in bathrooms
- Water-Efficient Urinals and kitchen faucets
- Dual-flush water closets



Materials – 32% Savings through:

- In-situ reinforced concrete for floors and roofs
- Autoclaved aerated concrete blocks in internal and external walls



## M-BUILDING COMMERCIAL OFFICE TOWER (VIETNAM)

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

# OFFICES – SERBIA CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



Energy Measures – 23% Savings through:

- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Ground source heat pump



Water – 35% Savings through:

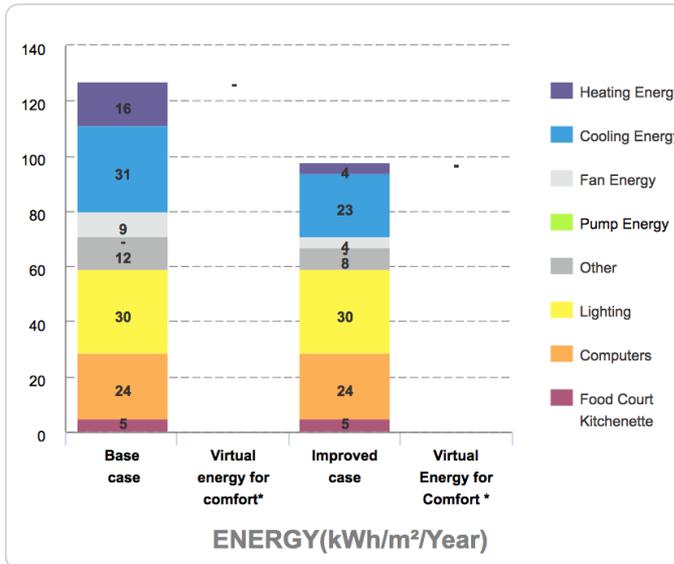
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



Materials – 23% Savings through:

- Floor Slabs: In-Situ Concrete with >25% GGBS

22.50% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$5,339

Utility Costs Savings  
\$555/ month

Payback in Years  
0.8

Operational CO<sub>2</sub>  
Savings

115 tCO<sub>2</sub>/Year



## RELEVANT CERTIFIED PROJECT

Energy Measures – 27% Savings through:

- Reduced window to wall ratio
- Reflective paint and tiles for the roof and external walls
- Energy-Saving lighting for internal and external spaces



Water – 26% Savings through:

- Low-flow showerheads
- Low-flow faucets in kitchens and bathrooms
- Water-efficient water closets



Materials – 53% Savings through:

- Plasterboards on metal studs for internal walls



## ALEGRA CONJUNTO CERRADO (COLOMBIA)

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

# OFFICES – UKRAINE CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 22% Savings through:

- Occupancy Sensors in conference rooms and cabins
- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Ground source heat pump



### Water – 35% Savings through:

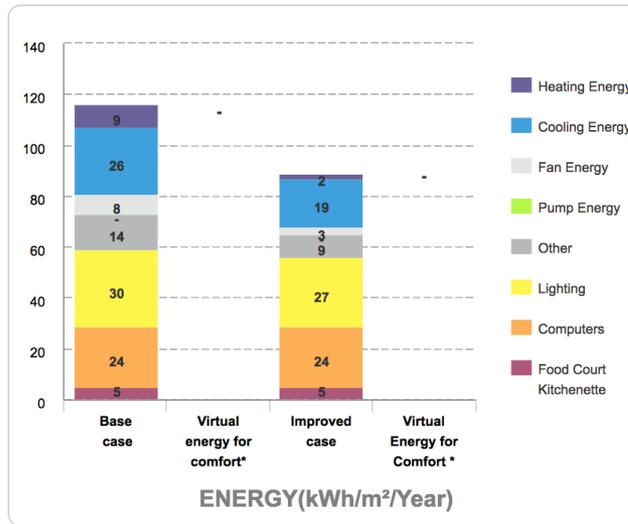
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



### Materials – 22% Savings through:

- Floor Slabs: In-Situ Concrete with >25% GGBS

21.83% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost  
\$7,460

Utility Costs Savings  
\$563/ month

Payback in Years  
1.25

Operational CO<sub>2</sub>  
Savings

72 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED 35PROJECT



### Energy Measures – 30% Savings through:

- Reflective Paint, Tiles, and Insulation for Roof
- Low E-Coated Glass
- Variable Refrigerant Volume Cooling System
- Sensible Heat Recovery from Exhaust Air
- Energy-Saving Light Bulbs for Internal and External Spaces



### Water – 70% Savings through:

- Low-Flow Faucets in Kitchens and Bathrooms
- Water-Efficient Urinals and Water Closets
- Grey Water Treatment and Recycling System



### Materials – 45% Savings through:

- Curtain Walling for External Walls



## DAAN MOGOT BARU OFFICE PARK (INDONESIA)

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



## BUILDING DETAILS

Gross Internal Area	Floors Above Grade	Floors Below Grade	Floor-to-Floor Height
5000m <sup>2</sup>	3	2	3.5m



### Energy Measures – 26% Savings through:

- Occupancy Sensors in Open Offices
- Air Conditioning with Air Cooled Screw Chiller
- Variable refrigerant flow system
- Ground source heat pump



### Water – 35% Savings through:

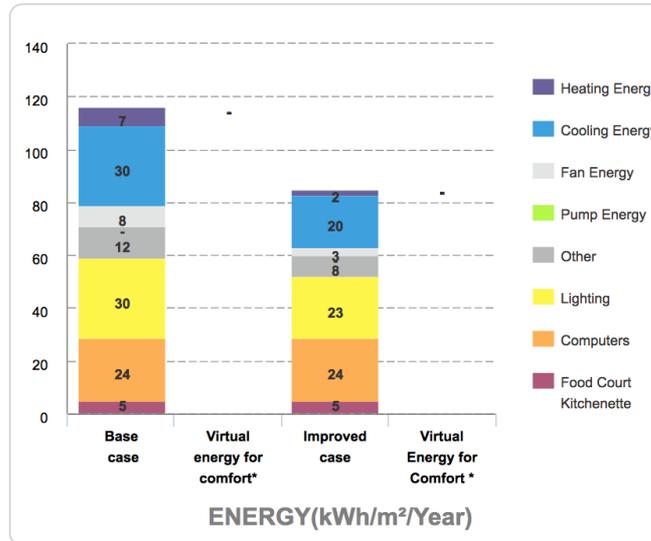
- Water-efficient bathroom urinals and faucets for kitchen sinks
- Dual flush for water closets in bathrooms



### Materials – 22% Savings through:

- Floor Slabs: In-Situ Concrete with >25% GGBS

25.81% Meets EDGE Energy Standard



## PROJECT METRICS

Incremental Cost

\$12,181

Utility Costs Savings

\$563/ month

Payback in Years

0.5

Operational CO<sub>2</sub>

Savings

55 tCO<sub>2</sub>/Year

## RELEVANT CERTIFIED PROJECT



### Energy Measures – 68% Savings through:

- Reduced Window To Wall Ratio
- Reflective Paint and Insulation
- Higher Thermal Performance Glass;
- Variable Refrigerant Volume (VRV) Cooling System
- Sensible Heat Recovery From Exhaust Air
- Energy-Saving Light Bulbs For Internal Spaces
- Lighting Controls For Corridors And Staircases
- Solar Photovoltaics



### 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:

- Stone And Ceramic Tiles For Floors; UPVC Window Frames; Polystyrene Roof Insulation; And Autoclaved Aerated Concrete Blocks For External Walls



## ABHIKALPAN OFFICE (INDIA)

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



## METHODOLOGY, NOTES, ACKNOWLEDGMENTS



*Creating Markets, Creating Opportunities*

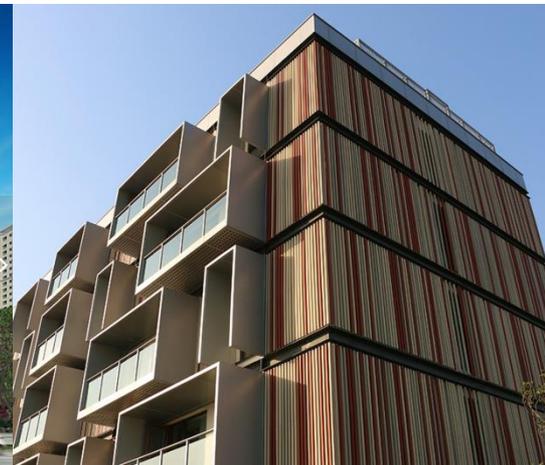
# RESEARCH OBJECTIVE: MOST EFFECTIVE INTERVENTIONS TO REACH THE EDGE STANDARD

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



20%



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](http://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.

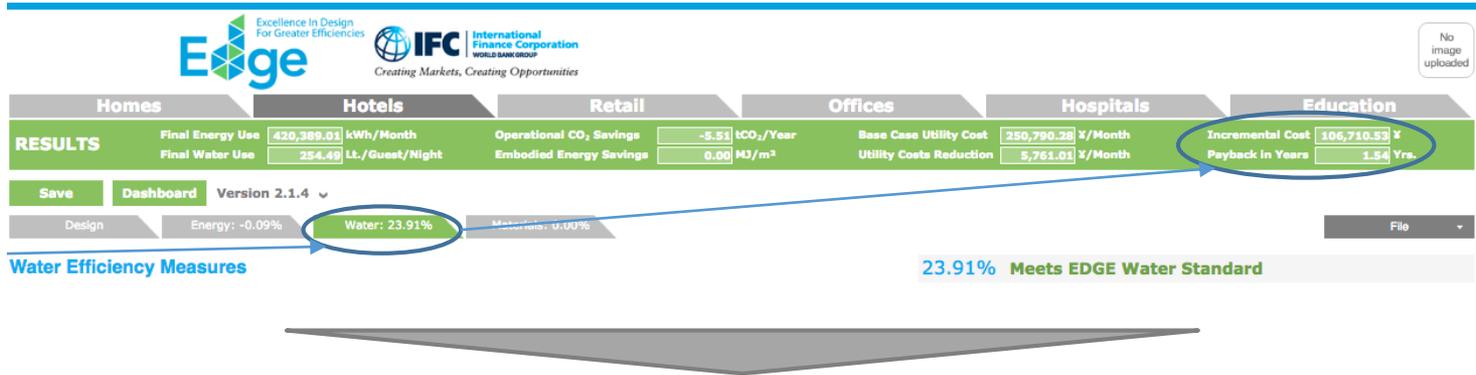
Third party certification verifies the resource efficiency savings so they can be credibly communicated between investors, developers, and buyers.

# RESEARCH METHODOLOGY

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

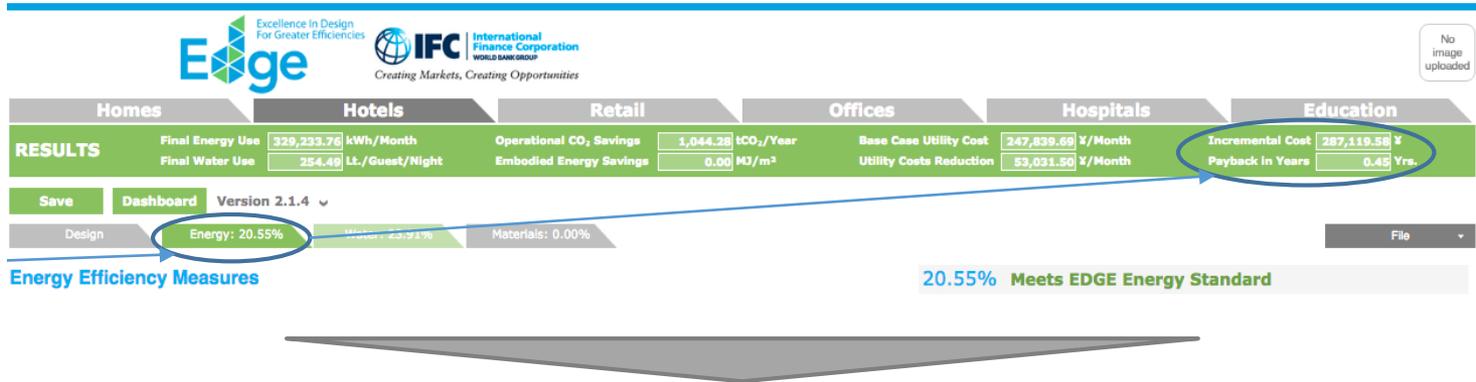
1

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.



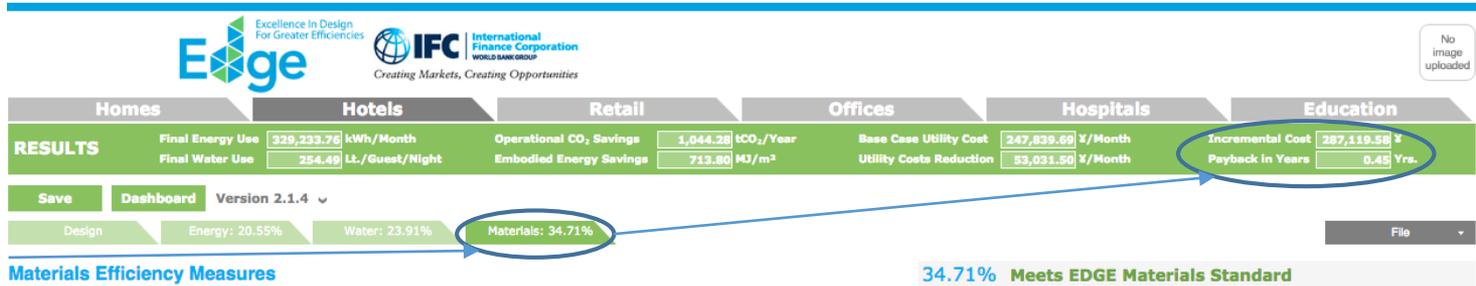
2

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/>



# ACKNOWLEDGEMENTS

## **DONOR ACKNOWLEDGEMENT**

IFC thanks the following national donors for their generous support of the EDGE program: the State Secretariat for Economic Affairs of Switzerland (SECO); the European Union; the Ministry of Finance of Japan; the Hungarian Export Import Bank; the Canada Climate Change Program and the Department of Foreign Affairs, Trade and Development Canada; the Royal Ministry of Foreign Affairs of Denmark and the Danish Green Growth Fund; the Federal Ministry of Finance of Austria; and the Ministry of Foreign Affairs of Finland.

In addition, IFC thanks contributors to the GEF-IFC Earth Fund Platform, and the Energy Sector Management Assistance Program (ESMAP) of the World Bank whose support helped seed EDGE.

## **COLLABORATION ACKNOWLEDGEMENT**

IFC thanks the Georgetown University McDonough School of Business for collaborating on developing the market intelligence reports.

Visit [www.edgebuildings.com](http://www.edgebuildings.com) for more information