



## GREEN BUILDINGS RETURN ON INVESTMENT: SCHOOLS



*Creating Markets, Creating Opportunities*

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# SCHOOLS IN EAST ASIA



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Cambodia	\$3,740	\$1,000	0.3
China	2,720 ¥ \$400	2,220 ¥ \$300	0.1
Fiji	\$8,510	\$2,500	0.3
Indonesia	21,860 Thousand Rp \$1,400	11,300 Thousand Rp \$750	0.2
Philippines	475,230 PhP \$8,900	80,000 PhP \$1,500	0.5
Thailand	\$460	\$200	0.2
Vietnam	14 MVnd \$600	8 MVnd \$350	0.1



## ENERGY

The most cost effective measures include:

- Natural Ventilation for Corridors and Classrooms
- Reduced Window To Wall Ratio
- Energy-Efficient Ceiling Fans
- Low-E Coated Glass
- Insulation of Roof and Walls



## WATER

Best ROI is reached through these measures:

- Low-Flow Faucets for Washbasins
- Dual Flush Water Closets
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



## MATERIALS

- Floor slabs are biggest cost drivers averaging 30% of material costs out of 7 total interventions
- Using other materials in this element usually saves over 20%





# SCHOOLS IN SOUTH ASIA



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Bangladesh	\$1,620	\$390	0.4
India (Delhi)	Rs482,260 \$6,500	Rs31,870 \$430	1.2
India (Mumbai)	Rs646,585 \$8,700	Rs44,810 \$600	1.2
Sri Lanka	\$7,645	\$950	1



## ENERGY

The EDGE standard can be reached through:

- Natural Ventilation for Corridors and Classrooms
- Energy-Efficient ceiling fans
- Insulation of roof
- Occupancy sensors in classrooms and bathroom
- Photoelectric sensors to harvest daylight



## WATER

Effective strategies include:

- Low-Flow Faucets
- Dual Flush Water Closet
- Water-Efficient urinals



## MATERIALS

Potential measures may include:

- In-Situ Concrete: reinforced
- Aerated Autoclaved Concrete blocks for internal & external wall
- Ceramic tiles



Image sourced from: <https://www.lafargeholcim-foundation.org/media/news/awards/integrated-solutions-in-burkina-faso-brazil-and-germany-win-top>



## ROI ON MEASURES NEEDED TO REACH THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Angola	\$6,840	\$1,400	0.4
Cote D'Ivoire	\$10,425	\$295	3
Ghana	\$19,000	\$3,710	0.4
Kenya	\$2,110	\$780	0.2
Nigeria	\$2,100	\$325	0.5
South Africa	ZAR 112,280 \$7,800	ZAR 4,670 \$325	2



Natural Ventilation Diagram

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



## ENERGY

The most effective interventions include:

- Natural Ventilation for Corridors and Classrooms
- Ceiling Fans
- Reflective Paint/Tile for Roof
- Sensible Heat Recovery from Exhaust Air



## WATER

The most effective interventions include:

- Low-Flow Faucets
- Dual-Flush for Water Closets
- Water-Efficient Urinals



## MATERIALS

- Floor slabs are the biggest efficiency drivers, ranging from 25% - 45% of material costs out of 7 total interventions.



## ROI ON MEASURES NEEDED TO REACH THE EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Argentina	\$17,740	\$200	7.5
Brazil	\$46,375	\$635	6
Colombia	\$20,700	\$225	8
Costa Rica	16,882,000 CRC \$29,500	412,700 CRC \$700	3.4
Mexico	\$25,200	\$290	7.2
Peru	95,500 S \$29,000	2,660 S \$840	3



## ENERGY

The most cost effective measures include:

- Reduced Window To Wall Ratio
- External Shading Device
- Insulation of Roof and External Wall

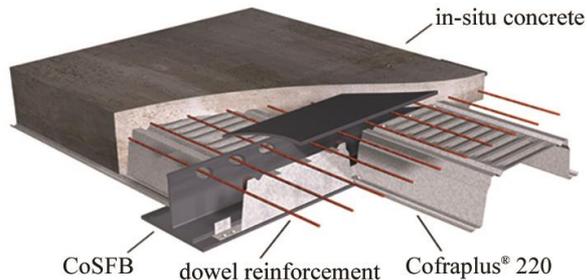


## WATER

The best ROI is from the following measures:

- Low-Flow Faucets for Washbasins
- Dual Flush Water Closets
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks

## Composite Slim Slab with Steel I-Beam



## MATERIALS

- Floor slabs are biggest efficiency drivers averaging 35% of material costs out of 7 total interventions.
- Composite Slim Slabs with Steel I-Beam generally saved the most material.



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Egypt	\$14,000	\$430	3
Jordan	\$14,600	\$200	2
Morocco	\$20,300	\$150	6
Pakistan	\$10,100	\$140	6



## ENERGY

Effective strategies include:

- Reduced Window To Wall Ratio
- Natural Ventilation for Corridors and Classrooms
- Energy-Efficient ceiling fans
- Low-E Coated Glass
- Insulation of Roof and Walls



## WATER

The EDGE standard can be reached through:

- Water-Efficient Dishwashers and Bathroom Faucets
- Low-Flow Faucets
- Dual Flush for Water Closets



## 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%

# SCHOOLS IN EAST EUROPE



## ROI ON MEASURES NEEDED TO REACH EDGE STANDARD

	Incremental Cost	Utility Savings / month	Payback Period in Years
Armenia	\$9,830	\$850	1
Poland	\$9,480	\$1,590	0.5
Russian Federation	\$9,520	\$2,480	0.3
Serbia	\$29,980	\$770	3.2
Ukraine	\$11,640	\$430	2.2
Turkey	\$9,120	\$1,070	0.7



## ENERGY

The EDGE standard can typically be reached through:

- Reduced Window To Wall Ratios
- Insulation Of Roof And External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning With Air And Water Cooled Chiller
- Ground Source Heat Pump
- Photoelectric Sensors To Harvest Daylight



## WATER

Effective measures include:

- Low-Flow Faucets for Washbasins
- Dual Flush Water Closets
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



## MATERIALS

- Floor slabs are biggest cost drivers averaging 30% of material costs out of 6 total interventions
- Using other materials in these elements of a school usually saves over 20%



## GREEN BUILDINGS RETURN ON INVESTMENT: SCHOOLS IN EAST ASIA



*Creating Markets, Creating Opportunities*

# SCHOOLS – CAMBODIA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 28% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Low-E Coated Glass
- Insulation of Roof



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

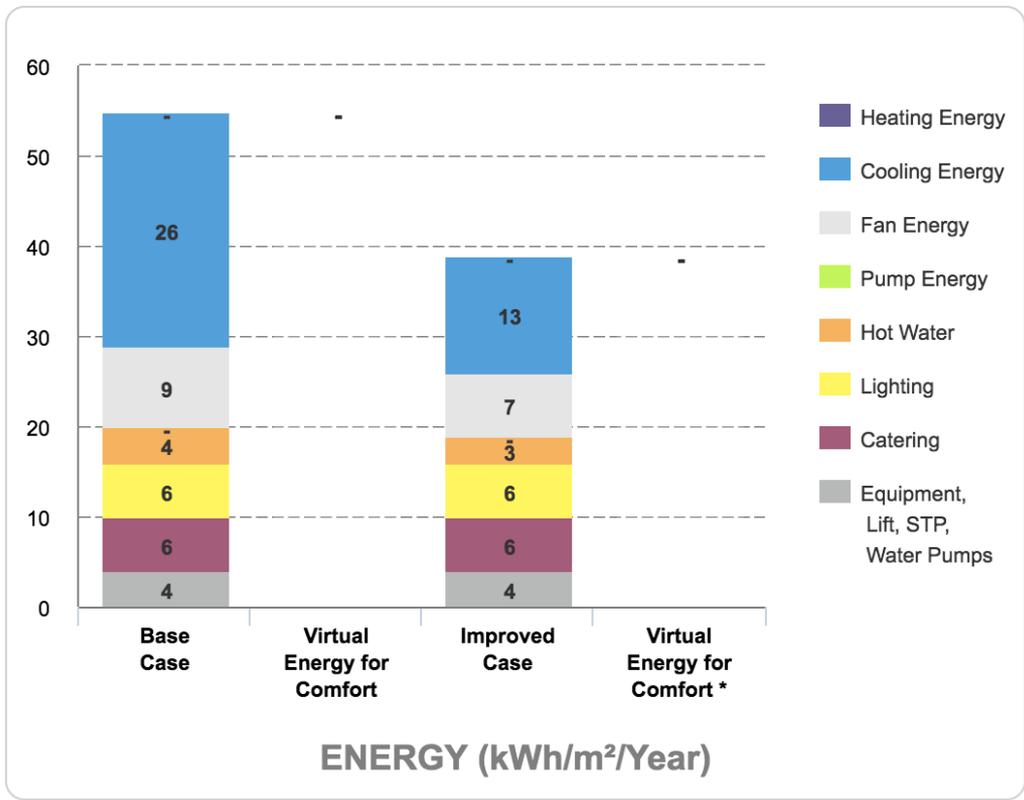
Incremental Cost  
\$3,740

Utility Bill Savings  
\$1,000 / month

Payback in Years  
0.30 Years

Operational CO2 Savings  
61 tCO<sub>2</sub>/Year

**28.2% 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.

# SCHOOLS— CHINA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 22% Savings through:

- Sensible Heat Recovery from Exhaust Air



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

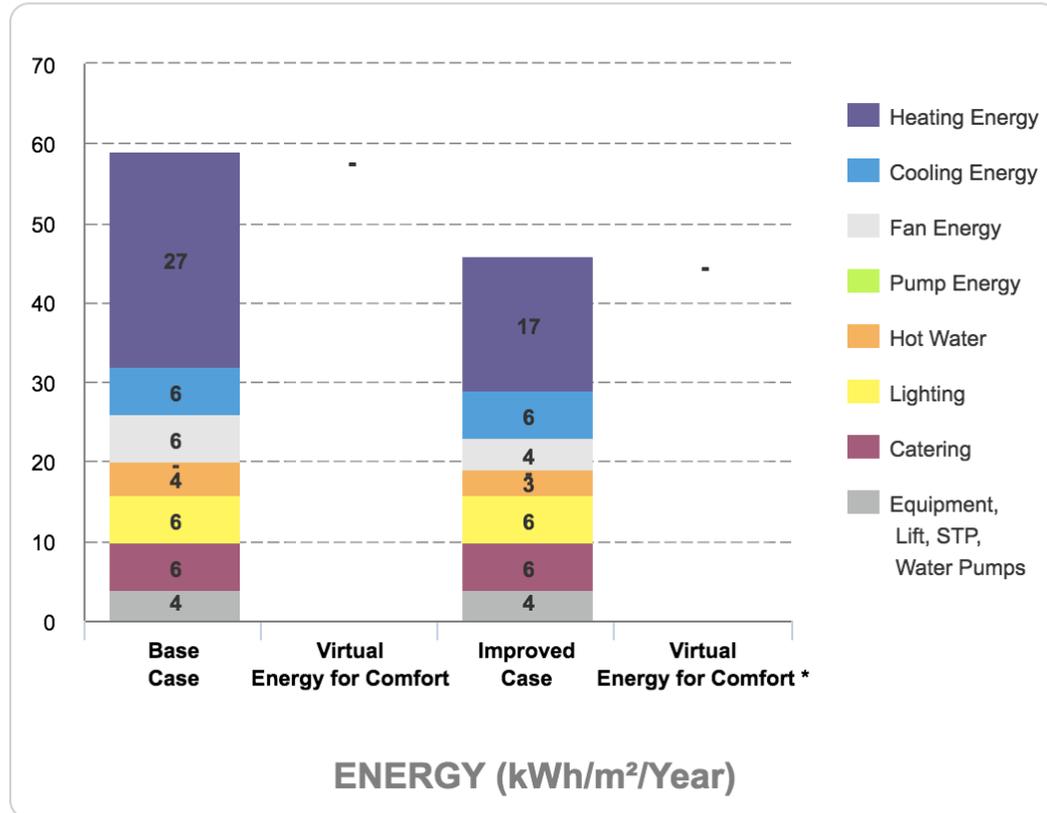
Incremental Cost  
2,720 ¥

Utility Bill Savings  
2,220 ¥ / month

Payback in Years  
0.1 Years

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

**22.1% Meets EDGE Energy Standard**



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# SCHOOLS – FIJI CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 32% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Insulation of Roof & External Walls
- Low-E Coated Glass
- Energy Efficient Ceiling Fans



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

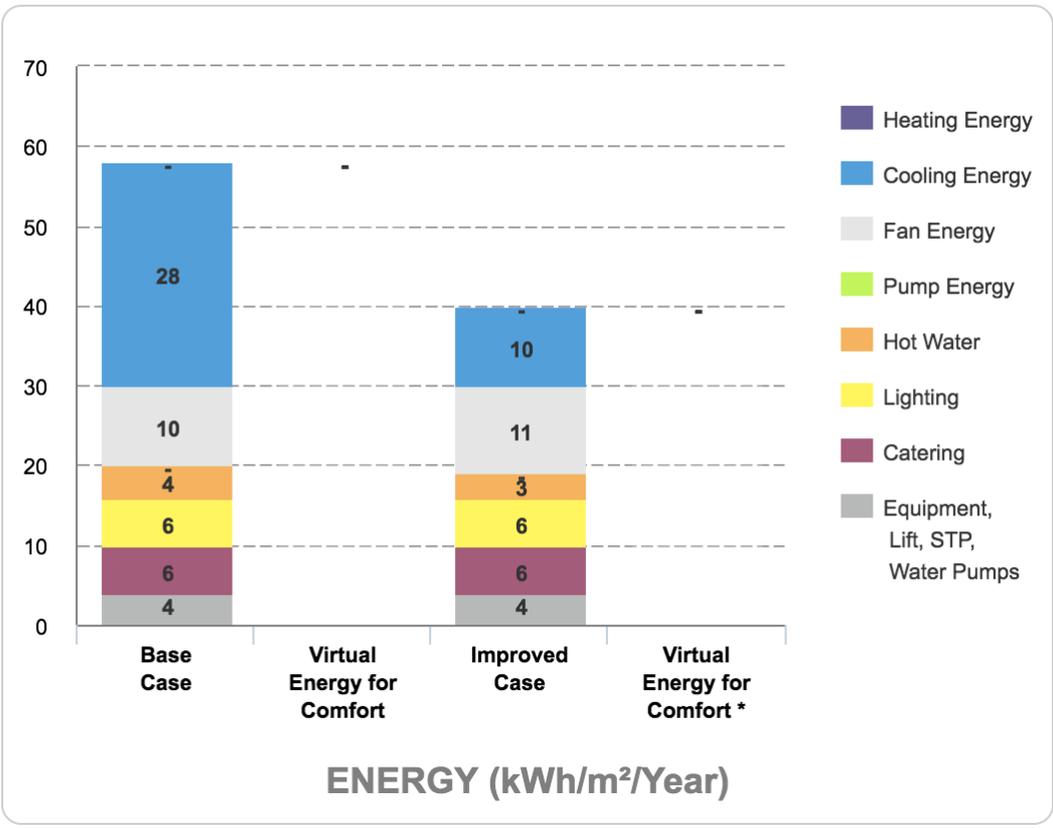
Incremental Cost  
\$8,510

Utility Bill Savings  
\$2,500 / month

Payback in Years  
0.3 Years

Operational CO2 Savings  
51 tCO<sub>2</sub>/Year

**32.0%** Meets EDGE Energy Standard



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# SCHOOLS – INDONESIA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 30% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Low-E Coated Glass
- Insulation of Roof



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 27% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

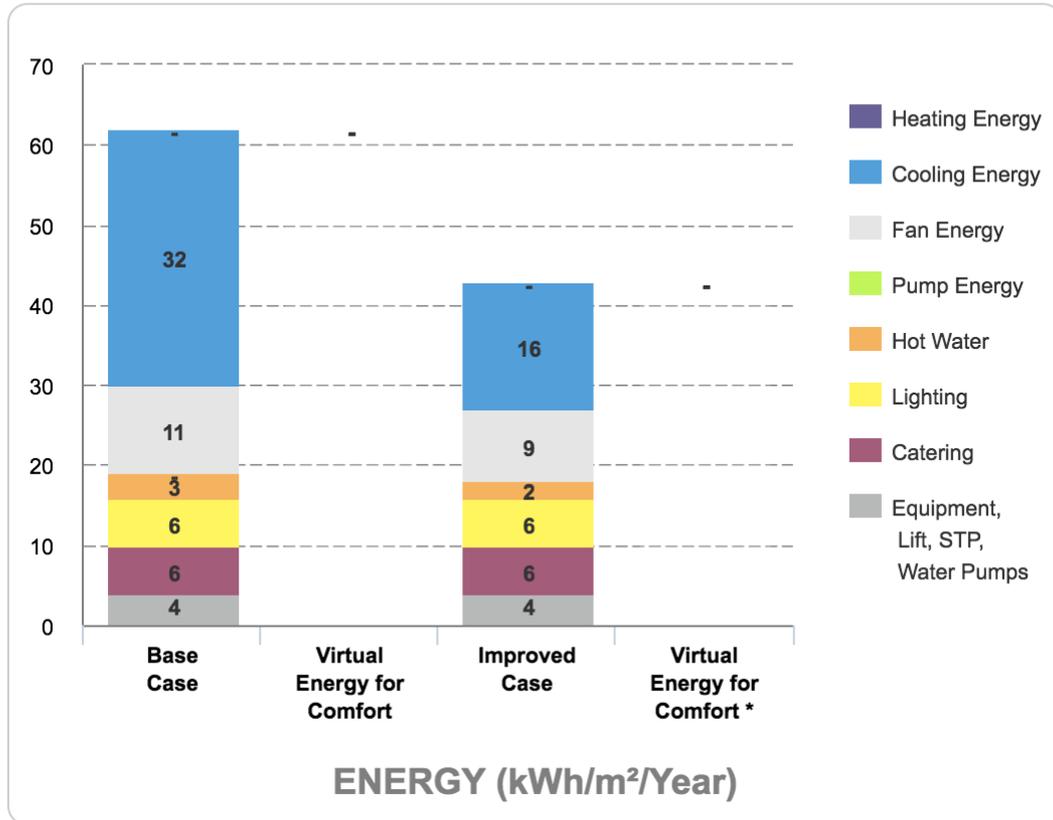
Incremental Cost  
21,860 Thousand Rp

Utility Bill Savings  
11,300 Thousand Rp / month

Payback in Years  
0.2 Years

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

**30.2% Meets EDGE Energy Standard**



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# SCHOOLS – PHILIPPINES CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 23% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Reflective Paint/Tiles for Roof & Walls
- Insulation of Roof



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

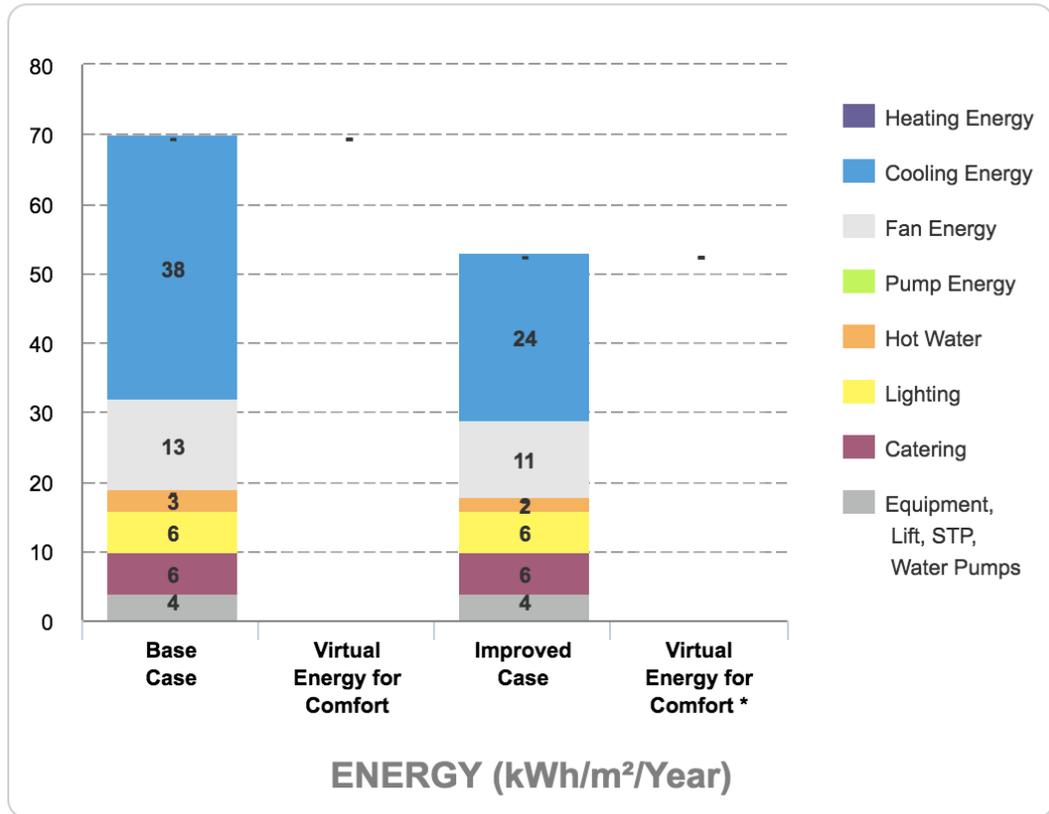
Incremental Cost  
476,230 PhP

Utility Bill Savings  
80,000 PhP / month

Payback in Years  
0.5 Years

Operational CO2 Savings  
39 tCO<sub>2</sub>/Year

**23.2%** Meets EDGE Energy Standard



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# SCHOOLS – THAILAND CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 24% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Reflective Paint/Tiles for Roof & Walls
- Low-E Coated Glass
- Energy Efficient Ceiling Fans



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

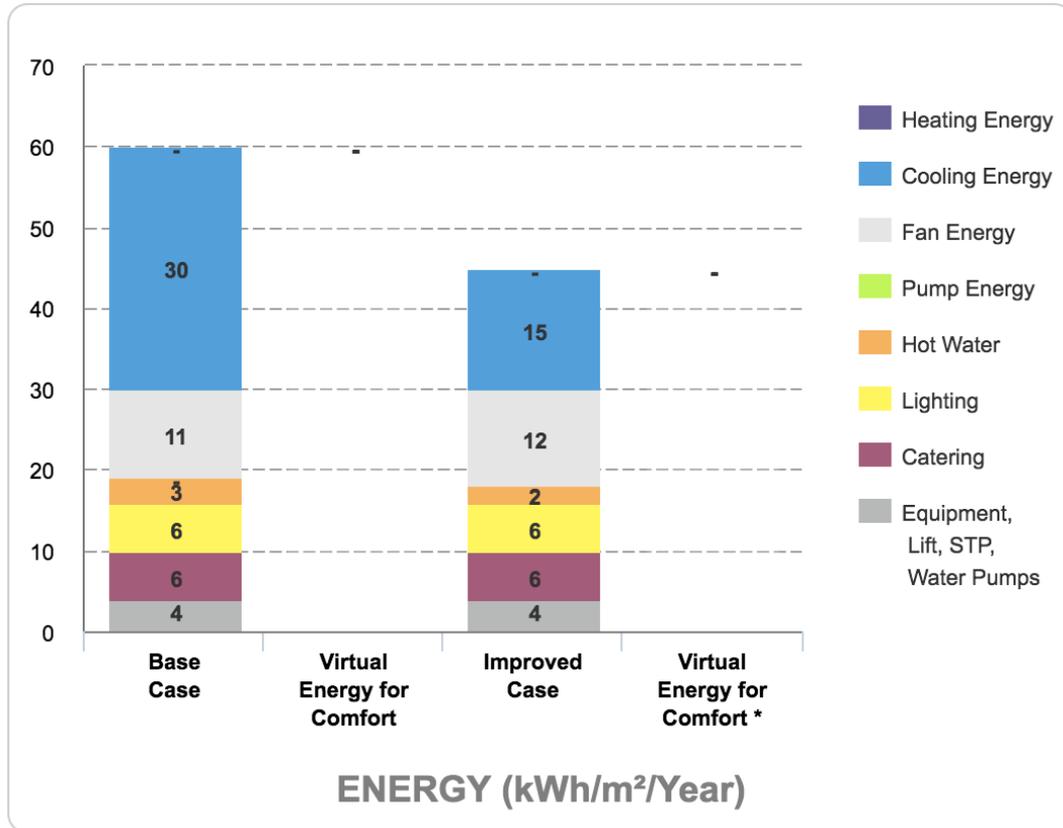
Incremental Cost  
\$460

Utility Bill Savings  
\$200 / month

Payback in Years  
0.2 Years

Operational CO2 Savings  
37 tCO<sub>2</sub>/Year

**24.0%** Meets EDGE Energy Standard



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# SCHOOLS – VIETNAM CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 28% Savings through:

- Natural Ventilation for Corridors & Classrooms
- Reflective Paint/Tiles for Roof & Walls
- Low-E Coated Glass
- Energy Efficient Ceiling Fans
- Solar Hot Water Collectors



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals & Kitchen Sinks



Materials – 29% Savings through:

- Timber Floor Construction Floor Slabs

## PROJECTED PROJECT METRICS

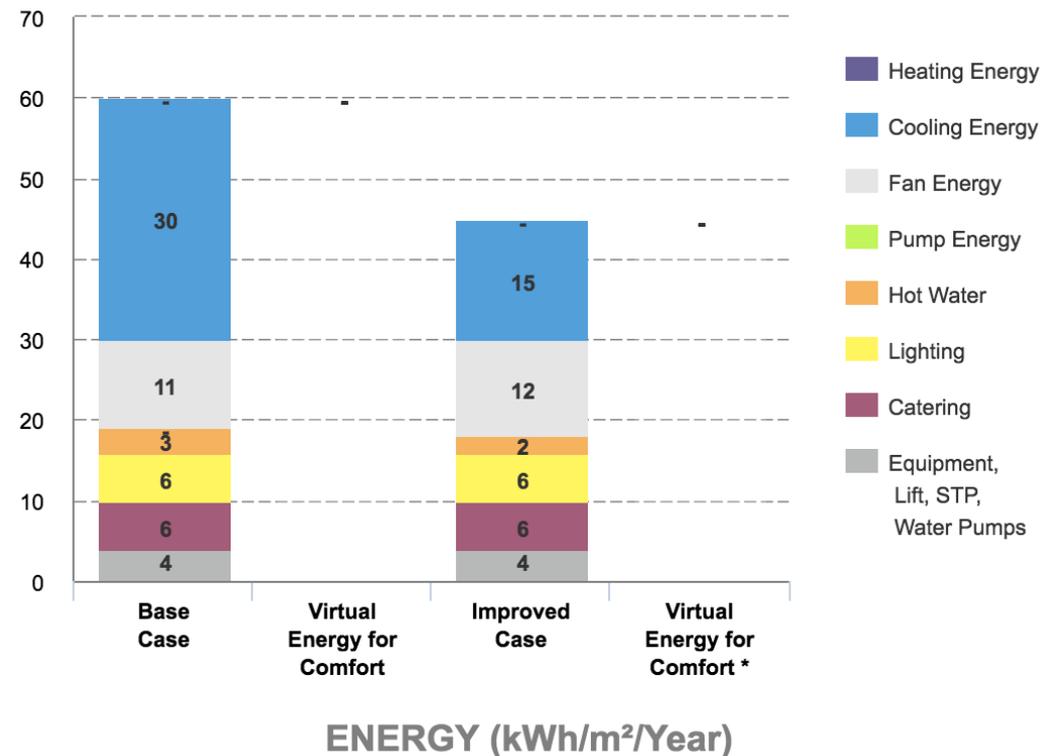
Incremental Cost  
14 mVND

Utility Bill Savings  
8 mVND / month

Payback in Years  
0.2 Years

Operational CO2 Savings  
31 tCO<sub>2</sub>/Year

**24.0%** Meets EDGE Energy Standard



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



*Creating Markets, Creating Opportunities*



# SCHOOLS – BANGLADESH CASE STUDY

## BUILDING DETAILS

Floors Above and below Ground	Classroom	Gross Internal Area
4/1	1000	5,000 m <sup>2</sup>



Energy Measures – 31% Savings through:

- Insulation of roof
- External shading devices



Water – 23% Savings through:

- Water efficient faucets for kitchen sink
- Dual Flush Water Closet
- Water-Efficient urinals



Materials – 28% Savings through:

- In-Situ Concrete reinforced
- Aerated Autoclaved Concrete Blocks
- Ceramic tiles

## PROJECTED PROJECT METRICS

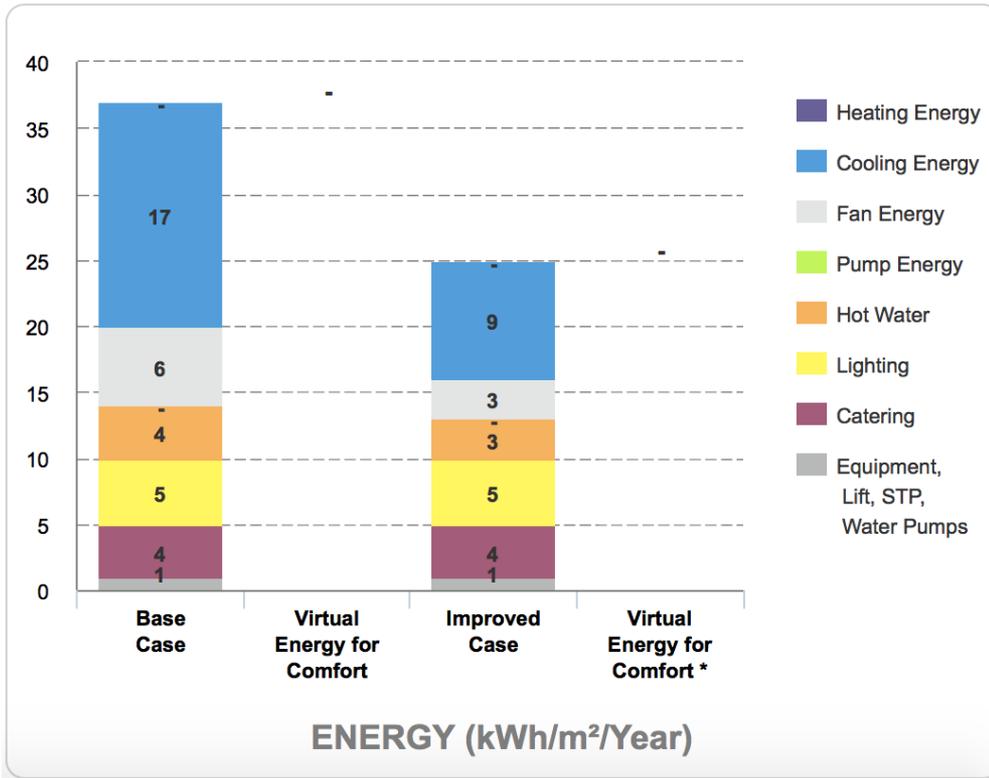
Incremental Cost  
\$1,620

Utility Costs Savings  
\$390 / month

Payback in Years  
0.4

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

**30.9% 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.

# SCHOOLS – INDIA (DELHI) CASE STUDY

## BUILDING DETAILS

Floors Above and below Ground	Classroom	Gross Internal Area
4/1	1000	5,000 m <sup>2</sup>



Energy Measures – 23% Savings through:

- Insulation of roof
- Occupancy sensors in classrooms and bathroom
- Photoelectric sensors to harvest daylight



Water – 20% Savings through:

- Low-Flow Faucets
- Dual Flush Water Closet
- Water-Efficient urinals



Materials – 22% Savings through:

- In-Situ Concrete: reinforced
- Aerated Autoclaved Concrete blocks
- Ceramic tiles

## PROJECTED PROJECT METRICS

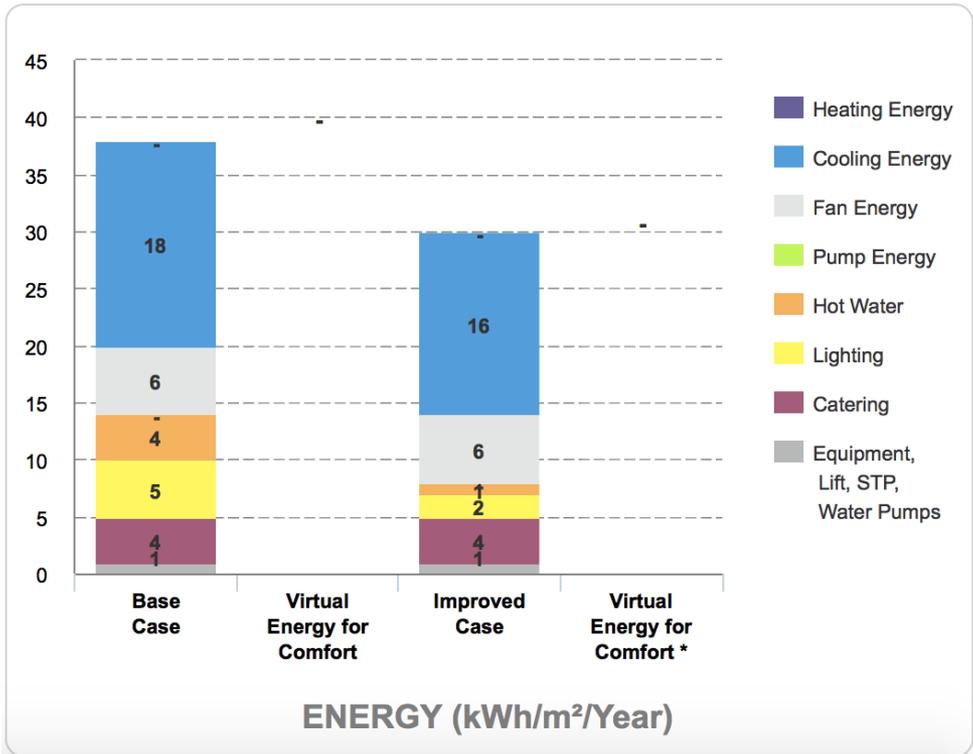
Incremental Cost  
Rs 482,260

Utility Costs Savings  
Rs 31,870 / month

Payback in Years  
1.2

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

**22.8% Meets EDGE Energy Standard**



# SCHOOLS – INDIA (MUMBAI) CASE STUDY

## BUILDING DETAILS

Floors Above and below Ground	Classroom	Gross Internal Area
4/1	1000	5,000 m <sup>2</sup>



Energy Measures – 21% Savings through:

- Natural Ventilation: Corridors
- External shading devise



Water – 25% Savings through:

- Low-Flow Faucets
- Dual Flush Water Closet
- Water-Efficient urinals



Materials – 28% Savings through:

- In-Situ Concrete: reinforced
- Aerated Autoclaved Concrete blocks
- Ceramic tiles

## PROJECTED PROJECT METRICS

Incremental Cost

Rs 646,855

Utility Costs Savings

Rs 44,810 / month

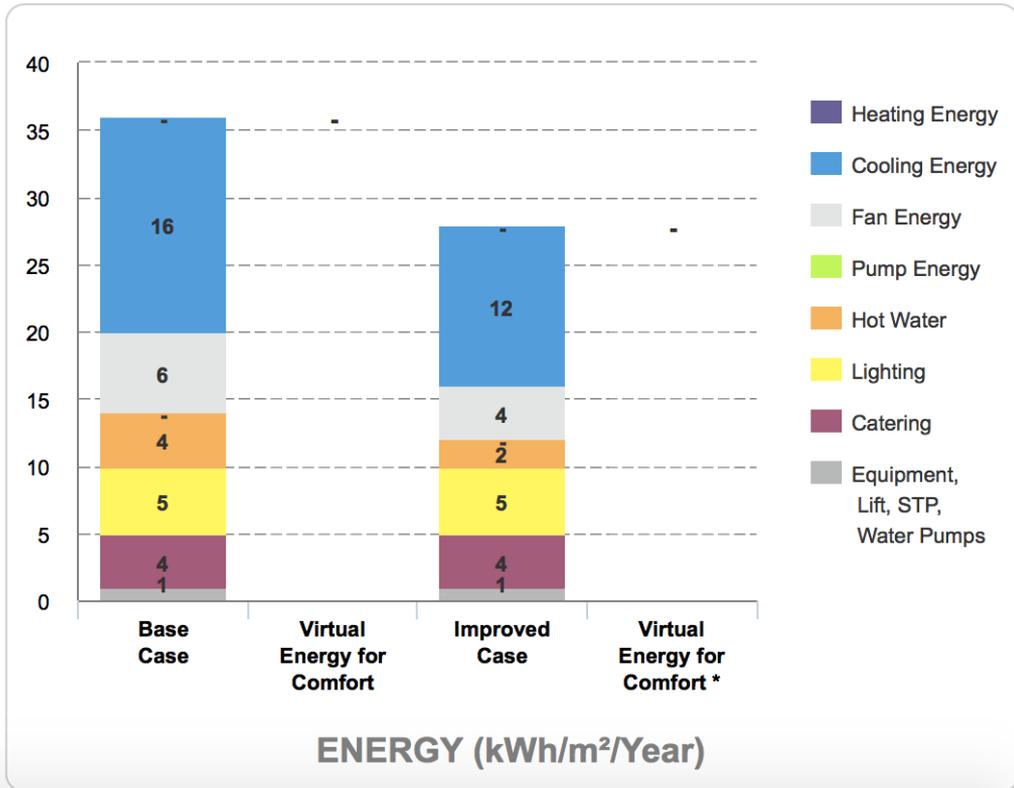
Payback in Years

1.2

Operational CO<sub>2</sub> Savings

29 tCO<sub>2</sub>/Year

**21.3% Meets EDGE Energy Standard**





# SCHOOLS – SRI LANKA CASE STUDY

## BUILDING DETAILS

Floors Above and below Ground	Classroom	Gross Internal Area
4/1	1000	5,000 m <sup>2</sup>



Energy Measures – 28% Savings through:

- Natural Ventilation: Corridors
- Energy Efficient Ceiling fans



Water – 25% Savings through:

- Low-Flow Faucets
- Dual Flush Water Closet
- Water-Efficient urinals



Materials – 25% Savings through:

- In-Situ Concrete: >25% GGBS
- Aluminum Sheet on timber roofing
- Plant Fiber Carpet

## PROJECTED PROJECT METRICS

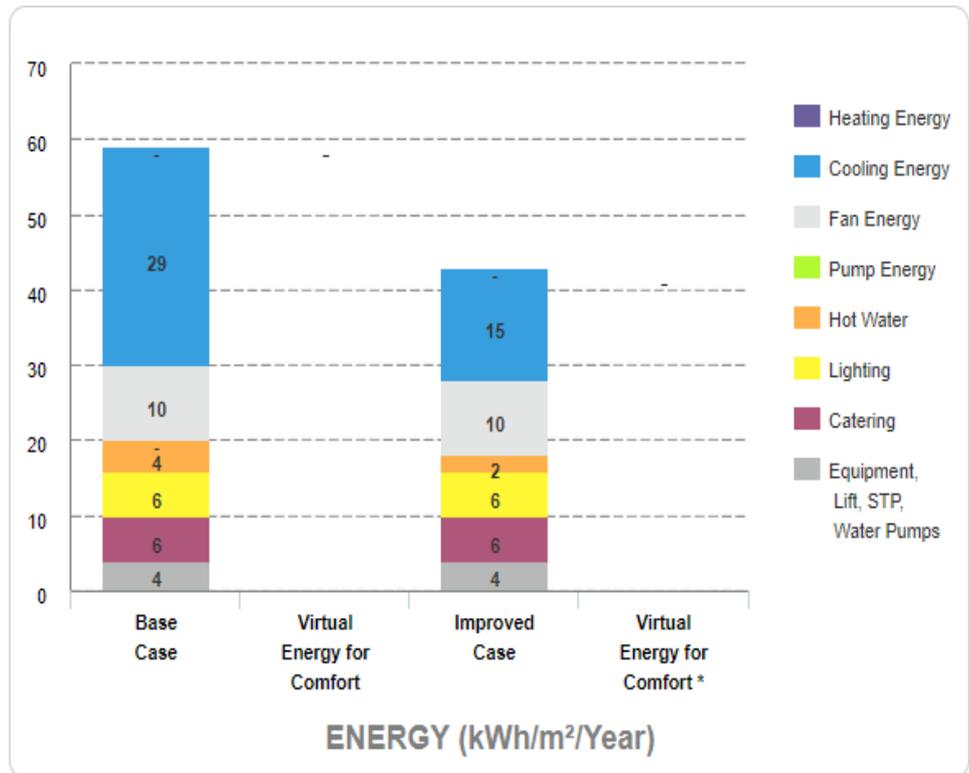
Incremental Cost  
\$7,645

Utility Costs Savings  
\$950 / month

Payback in Years  
1

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

**27.8%** 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.



## GREEN BUILDINGS RETURN ON INVESTMENT: SCHOOLS IN AFRICA



*Creating Markets, Creating Opportunities*

# 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

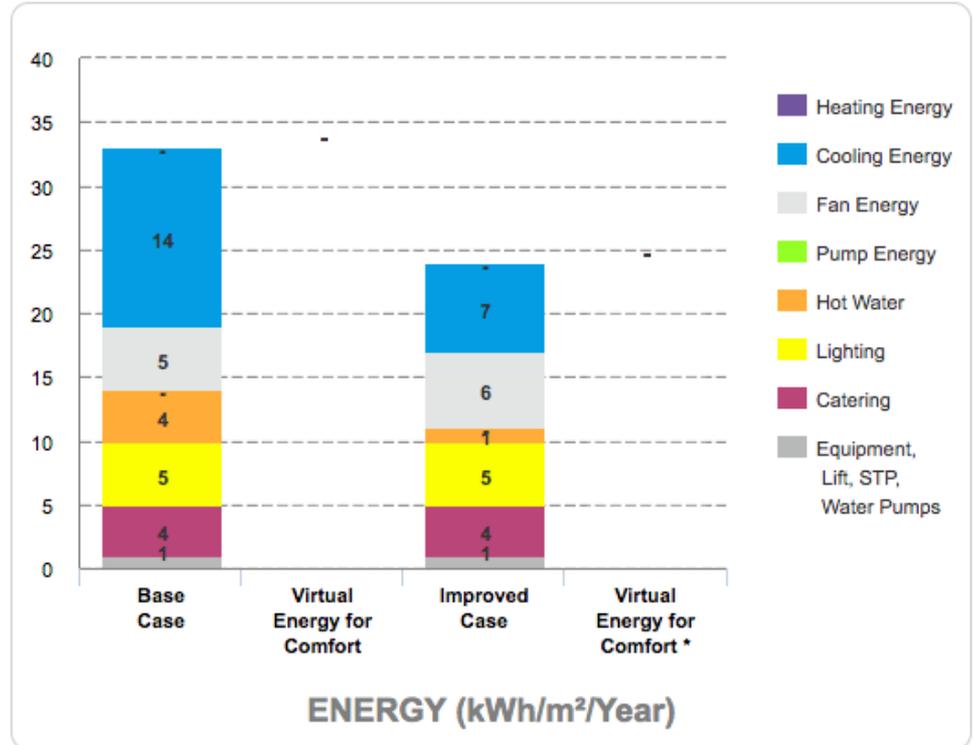
Incremental Cost  
\$6,840

Utility Costs Savings  
\$1,400 / month

Payback in Years  
0.4 Years

Operational CO2 Savings  
26 tCO<sub>2</sub>/Year

**24.8%** Meets EDGE Energy Standard



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# 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

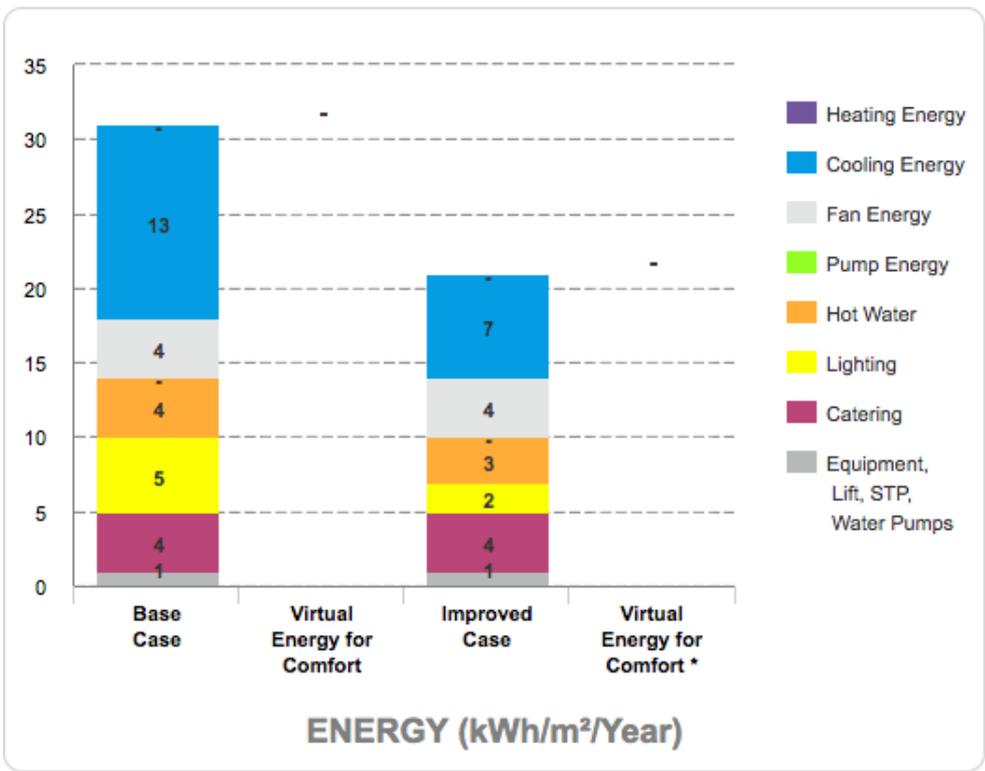
Incremental Cost  
\$10,425

Utility Costs Savings  
\$295 / month

Payback in Years  
3 Years

Operational CO2 Savings  
24.4 tCO<sub>2</sub>/Year

**31.6% 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.

# 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

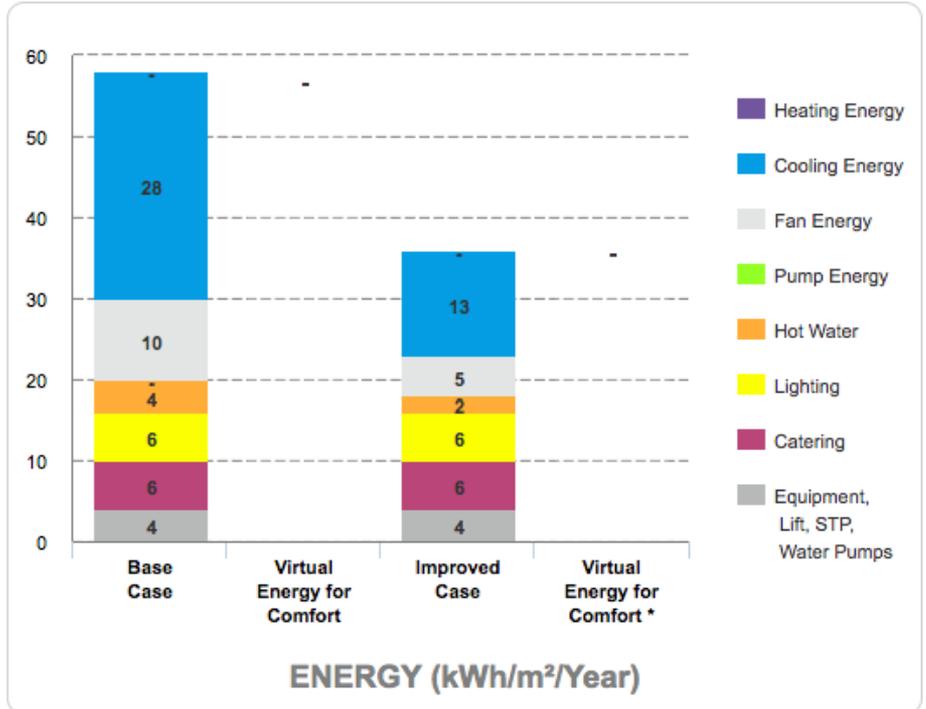
Incremental Cost  
\$19,000

Utility Costs Savings  
\$3,710 / month

Payback in Years  
0.4 Years

Operational CO<sub>2</sub> Savings  
41 tCO<sub>2</sub>/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.

# 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

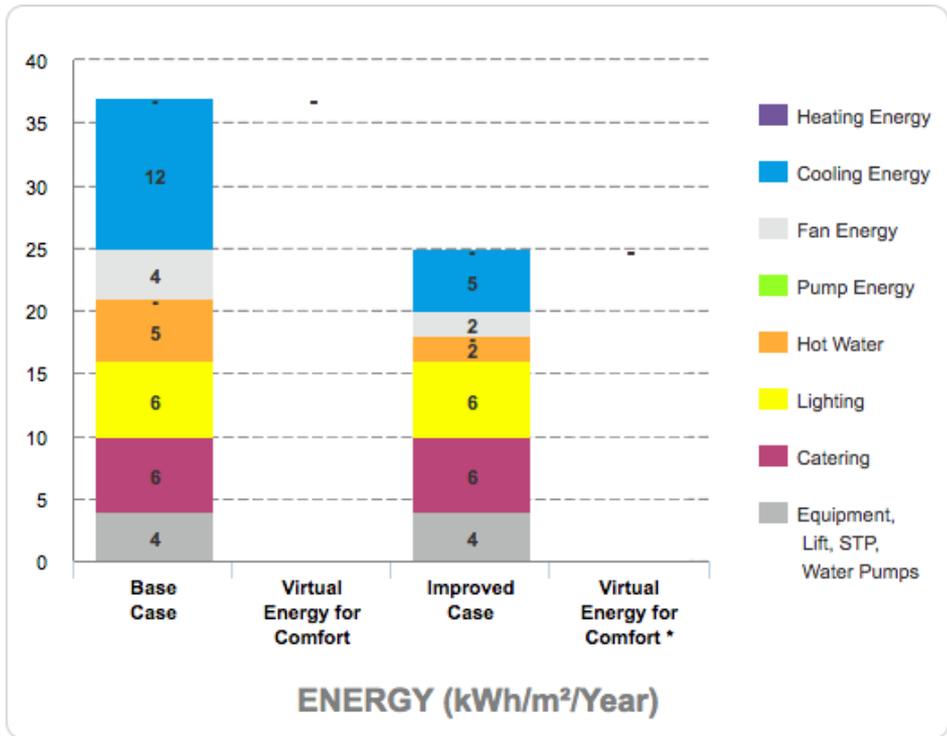
Incremental Cost  
\$2,110

Utility Costs Savings  
\$780 / month

Payback in Years  
0.2 Years

Operational CO2 Savings  
28 tCO<sub>2</sub>/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.

# 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

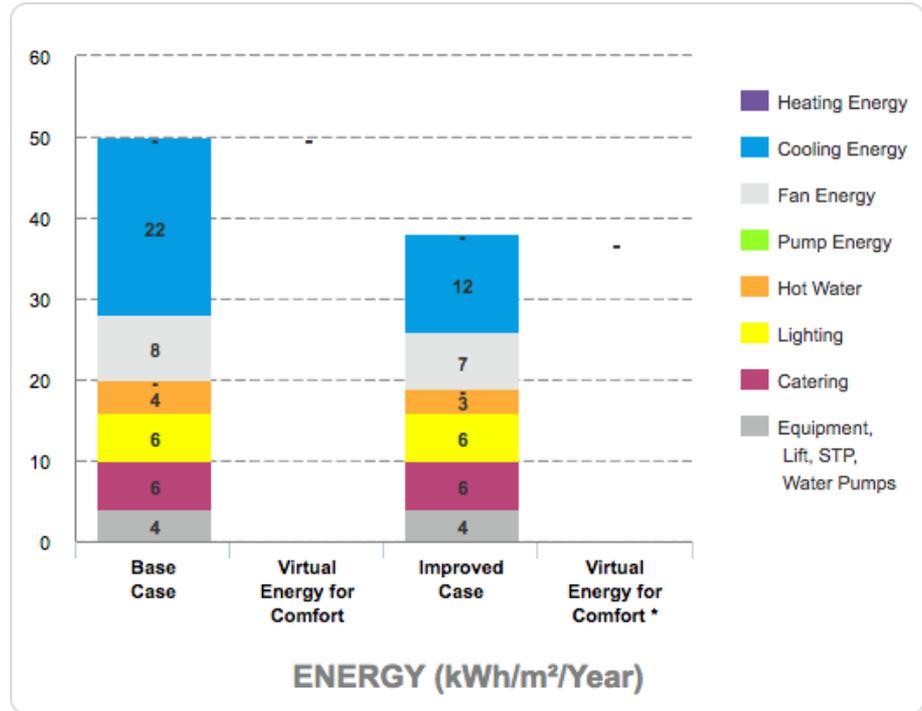
Payback in Years

0.5 Years

Operational CO2 Savings

26 tCO<sub>2</sub>/Year

**25.8% Meets EDGE Energy Standard**



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# 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

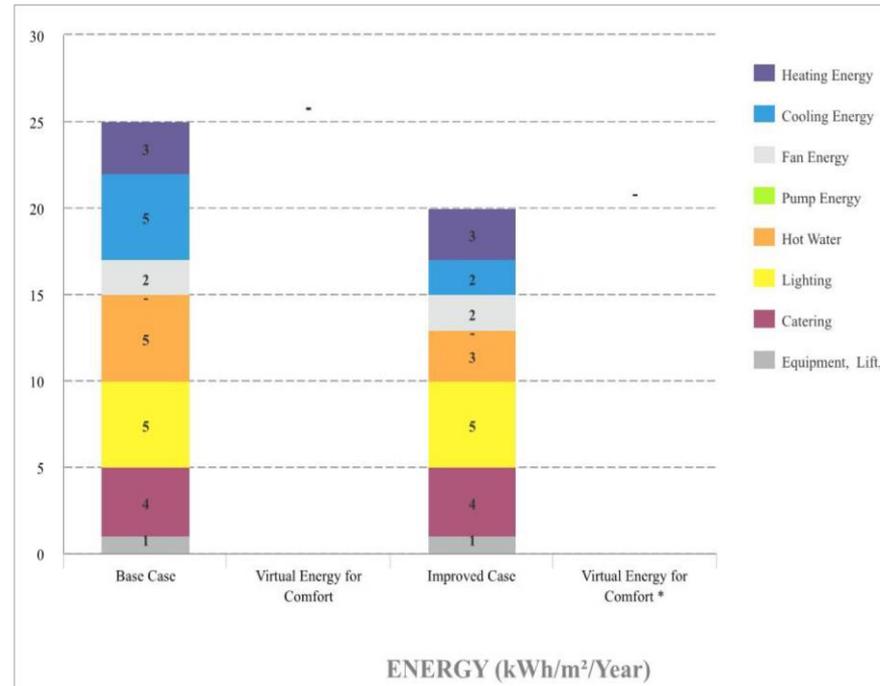
2 Years

Operational CO2 Savings

26 tCO<sub>2</sub>/Year

Energy Efficiency Measures 20.9%

ENERGY SAVINGS Meets EDGE Energy



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



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



*Creating Markets, Creating Opportunities*

# SCHOOLS – ARGENTINA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 21% Savings through:

- Reduce Window to Wall Ratio
- External Shading Device
- Natural Ventilation for Corridors



Water – 30% Savings through:

- Low Flow Faucet
- Water-Efficient Urinals
- Dual Flush Water Closet
- Water Efficient Faucet for Kitchen Sink



Materials – 23% Savings through:

- Concrete Filler Floor Slabs

## PROJECTED PROJECT METRICS

Incremental Cost

\$17,740

Utility Cost Savings

\$200/month

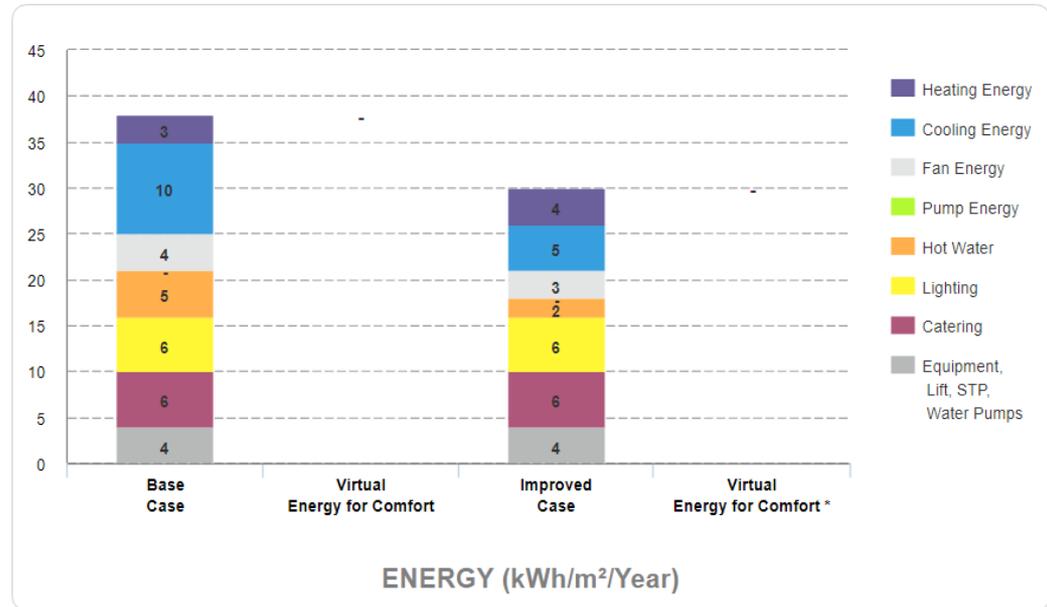
Payback in Years

7.5 Years

Operational CO2 Savings

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

21.4% 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.

# SCHOOLS – BRAZIL CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 28% Savings through:

- Variable Refrigeration Flow Cooling System
- Air Conditioning with Air or Water Chiller
- Insulation of Roof and External Wall



Water – 22% Savings through:

- Dual Flush Water Closet
- Low Flow Faucet
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 20% Savings through:

- Composite Slim Slab with Steel I-Beam Floor

## PROJECTED PROJECT METRICS

Incremental Cost

\$46,375

Utility Cost Savings

\$635/month

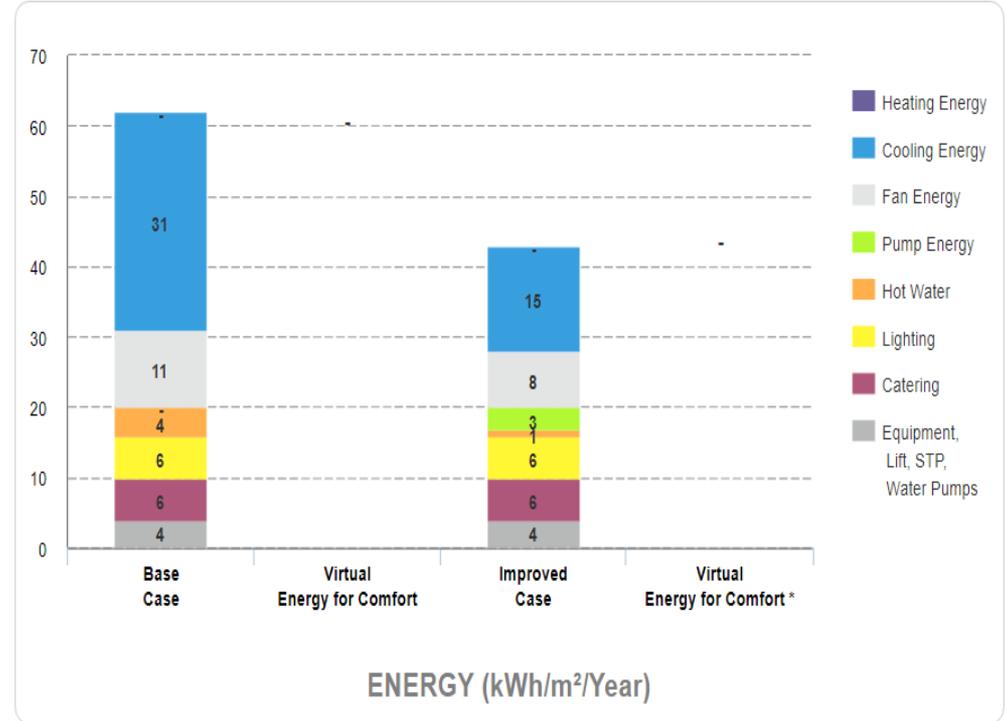
Payback in Years

6 Years

Operational CO2 Savings

97 tCO<sub>2</sub>/Year

27.7% 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.

# SCHOOLS – COLOMBIA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 22% Savings through:

- Low-E Coated Glass
- Energy Efficient Ceiling Fan
- Insulation of Roof



Water – 31% Savings through:

- Low Flow Faucet and Showerhead
- Dual Flush Water Closet
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 20% Savings through:

- Composite Slim Slab with Steel I-Beam Floor Slab

## PROJECTED PROJECT METRICS

Incremental Cost

\$20,700

Utility Cost Savings

\$225/month

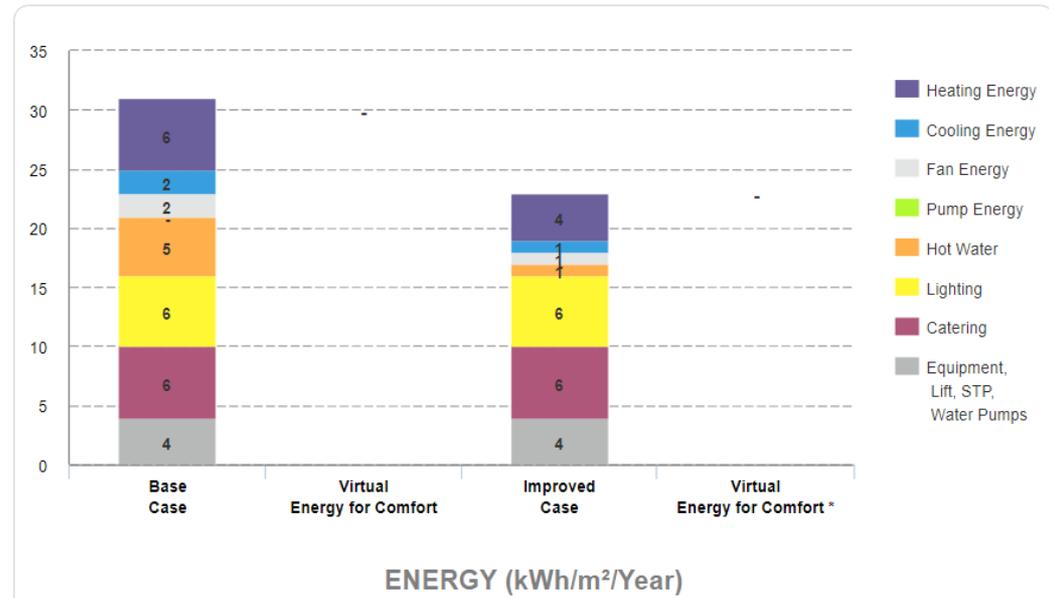
Payback in Years

8 Years

Operational CO2 Savings

25 tCO<sub>2</sub>/Year

22.4% 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.

# SCHOOLS – COSTA RICA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 25% Savings through:

- Variable Refrigerant Flow Cooling System
- Insulation of Roof and External Wall



Water – 31% Savings through:

- Dual Flush
- Low Flow Faucet in
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 20% Savings through:

- Composite Slim Slabs with I-Beam Floor

## PROJECTED PROJECT METRICS

Incremental Cost

16,882,000 CRC

Utility Cost Savings

412,700 CRC/month

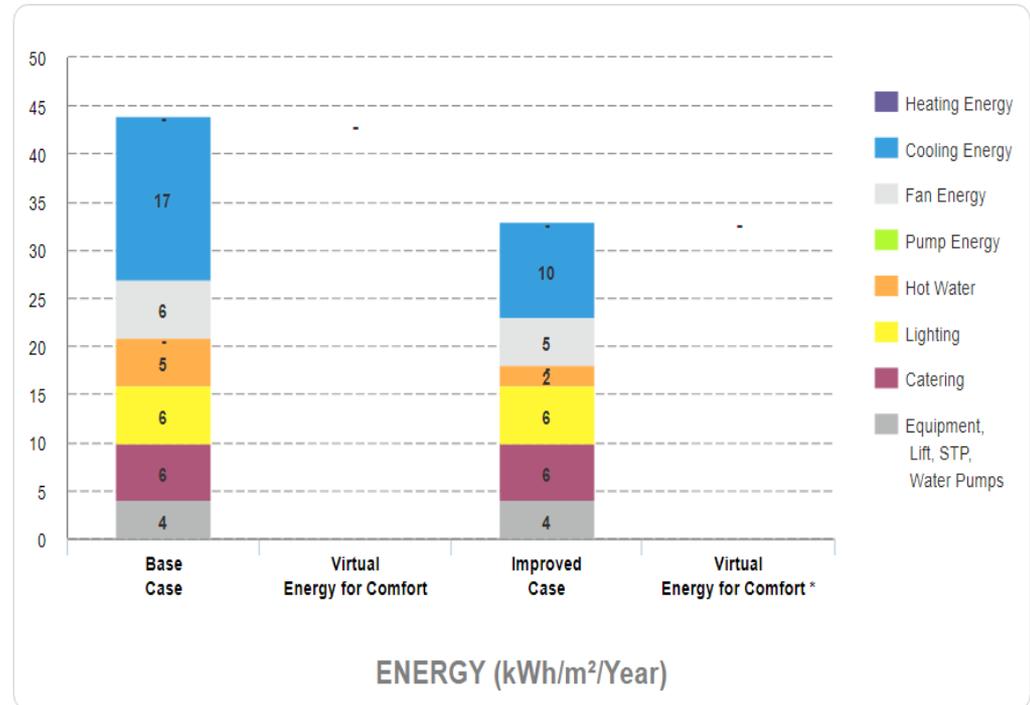
Payback in Years

3.4 Years

Operational CO2 Savings

30 tCO<sub>2</sub>/Year

25.2% 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.

# SCHOOLS – MEXICO CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 24% Savings through:

- Reduced Window to Wall Ratio
- Insulation of Roof and External Wall
- Natural Ventilation for Classroom



Water – 31% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 29% Savings through:

- Concrete Filler Floor Slabs

## PROJECTED PROJECT METRICS

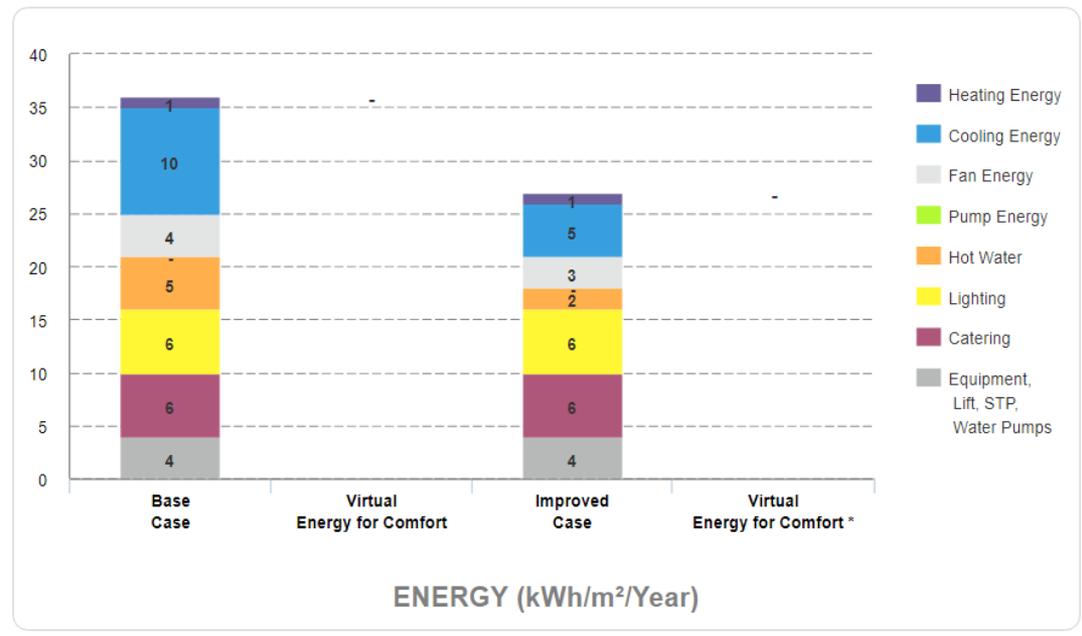
Incremental Cost  
\$25,200

Utility Cost Savings  
\$290/month

Payback in Years  
7.2 Years

Operational CO2 Savings  
60 tCO<sub>2</sub>/Year

24.4% 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.

# SCHOOLS – PERU CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 39% Savings through:

- External Shading Device
- Insulation of Roof and External Wall



Water – 23% Savings through:

- Dual Flush
- Water-Efficient Urinals
- Water-Efficient Faucets for Kitchen Sinks



Materials – 23% Savings through:

- Concrete Filler Floor Slabs

## PROJECTED PROJECT METRICS

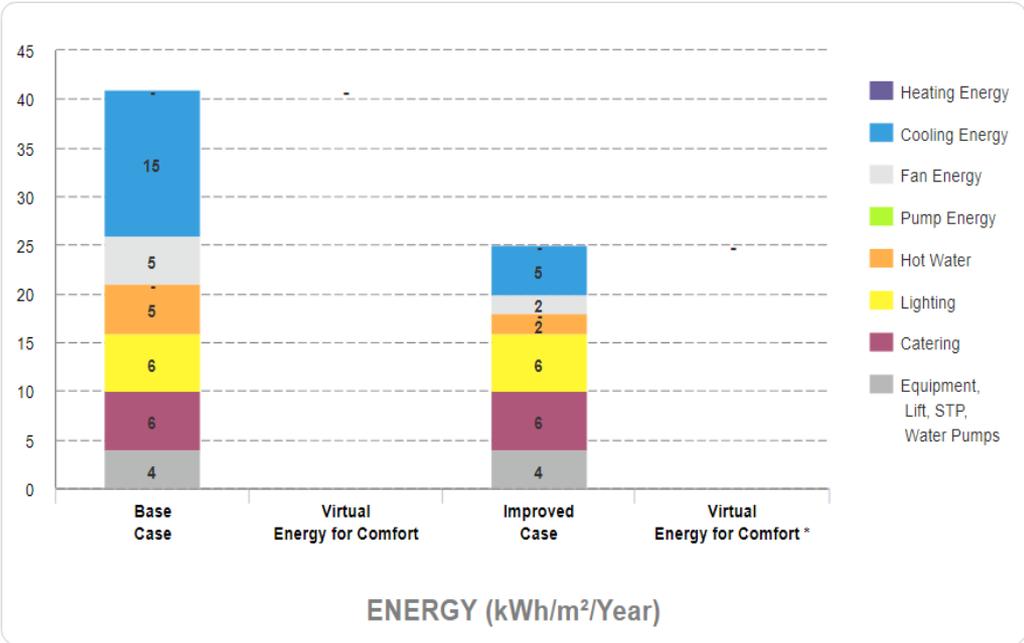
Incremental Cost  
95,500 S

Utility Cost Savings  
2,660 S/month

Payback in Years  
3 Years

Operational CO2 Savings  
60 tCO<sub>2</sub>/Year

**39.3% 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.



## GREEN BUILDINGS RETURN ON INVESTMENT: SCHOOLS IN MENA



*Creating Markets, Creating Opportunities*

## BUILDING DETAILS

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



Energy Measures – 22% Savings through:

- Reflective Paint/Tiles for Walls- Solar Reflectivity
- Reflective Paint/Tiles for Roof -Solar Reflectivity
- External Shading Devices - Annual Average Shading Factor



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

## PROJECT METRICS

Incremental Cost  
\$14,300

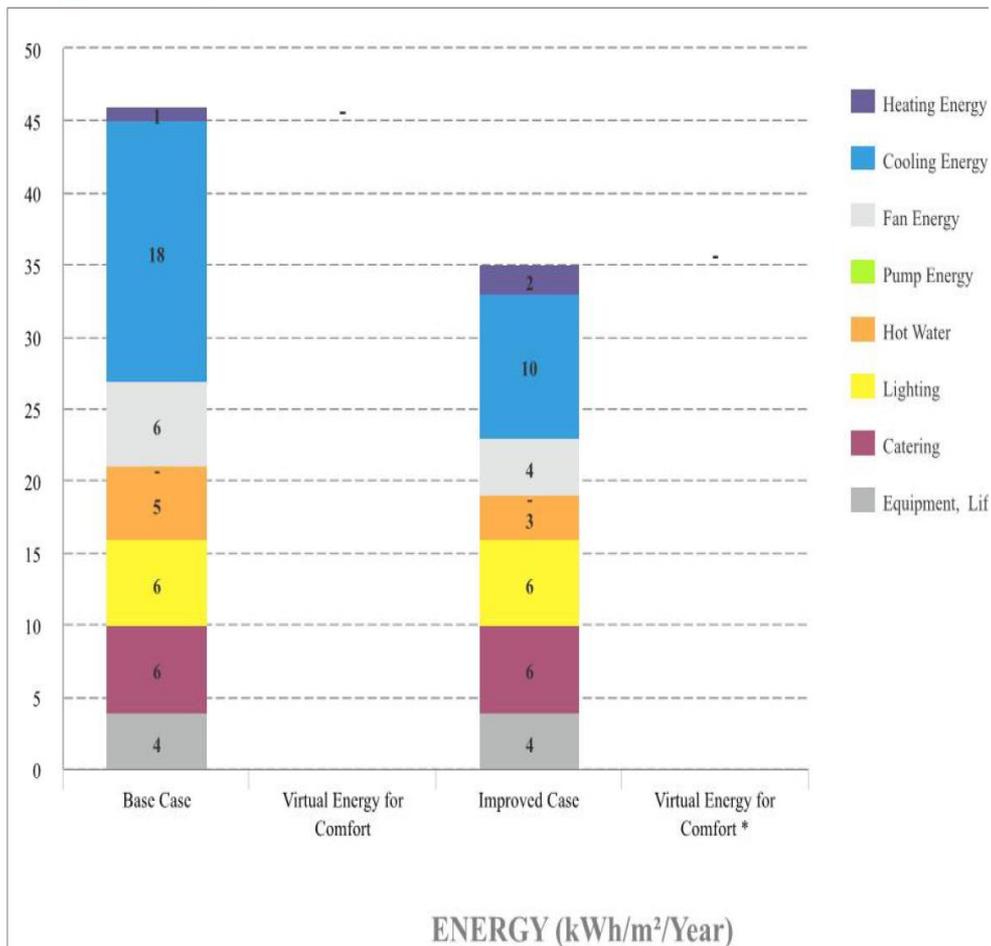
Utility Costs Savings  
\$ 400 / month

Payback in Years  
3

Operational CO<sub>2</sub>  
Savings  
\$ 20 tCO<sub>2</sub>/Year

Energy Efficiency Measures 22.3%

ENERGY SAVINGS Meets EDGE Energy



## BUILDING DETAILS

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



Energy Measures – 21% Savings through:

- Insulation of External Walls
- Natural Ventilation for Corridors
- Natural Ventilation for Classrooms



Water – 21% Savings through:

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



Materials – 26% Savings through:

- Composite In-Situ Concrete and Steel Deck

## PROJECT METRICS

Incremental Cost  
\$ 14,600

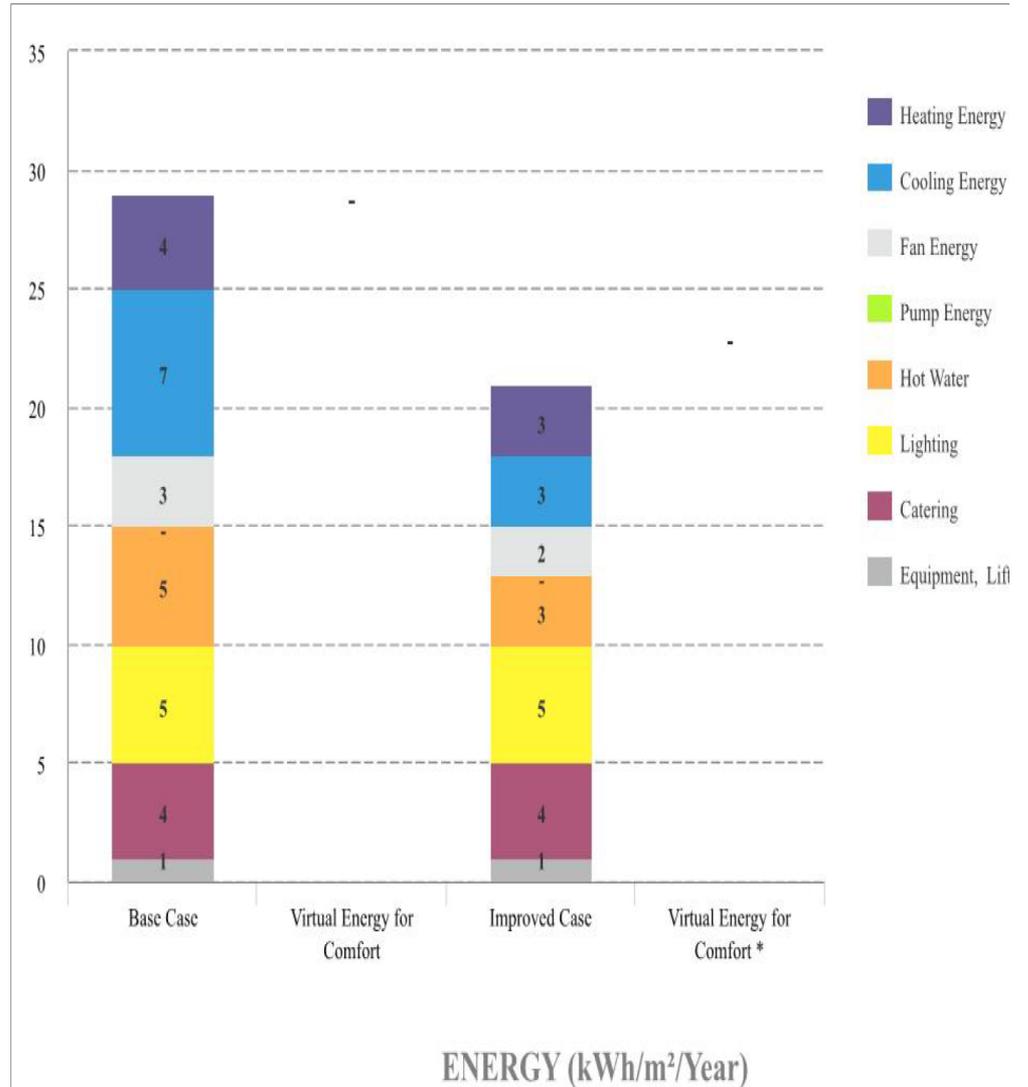
Utility Costs Savings  
\$ 190 / month

Payback in Years  
2

Operational CO<sub>2</sub>  
Savings  
\$ 20 tCO<sub>2</sub>/Year

Energy Efficiency Measures 20.8%

ENERGY SAVINGS Meets EDGE Energy



# SCHOOLS – MOROCCO CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

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



### Energy Measures – 20% Savings through:

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



### Water – 20% Savings through:

- Variable Refrigerant Flow Cooling Systems
- Water-Efficient Dishwashers and Bathroom Faucets
- Pre-rinse Valve for Rinsing Operation



### Materials – 25% Savings through:

- Composite In-Situ Concrete and Steel Deck

## PROJECT METRICS

Incremental Cost  
\$ 20,300

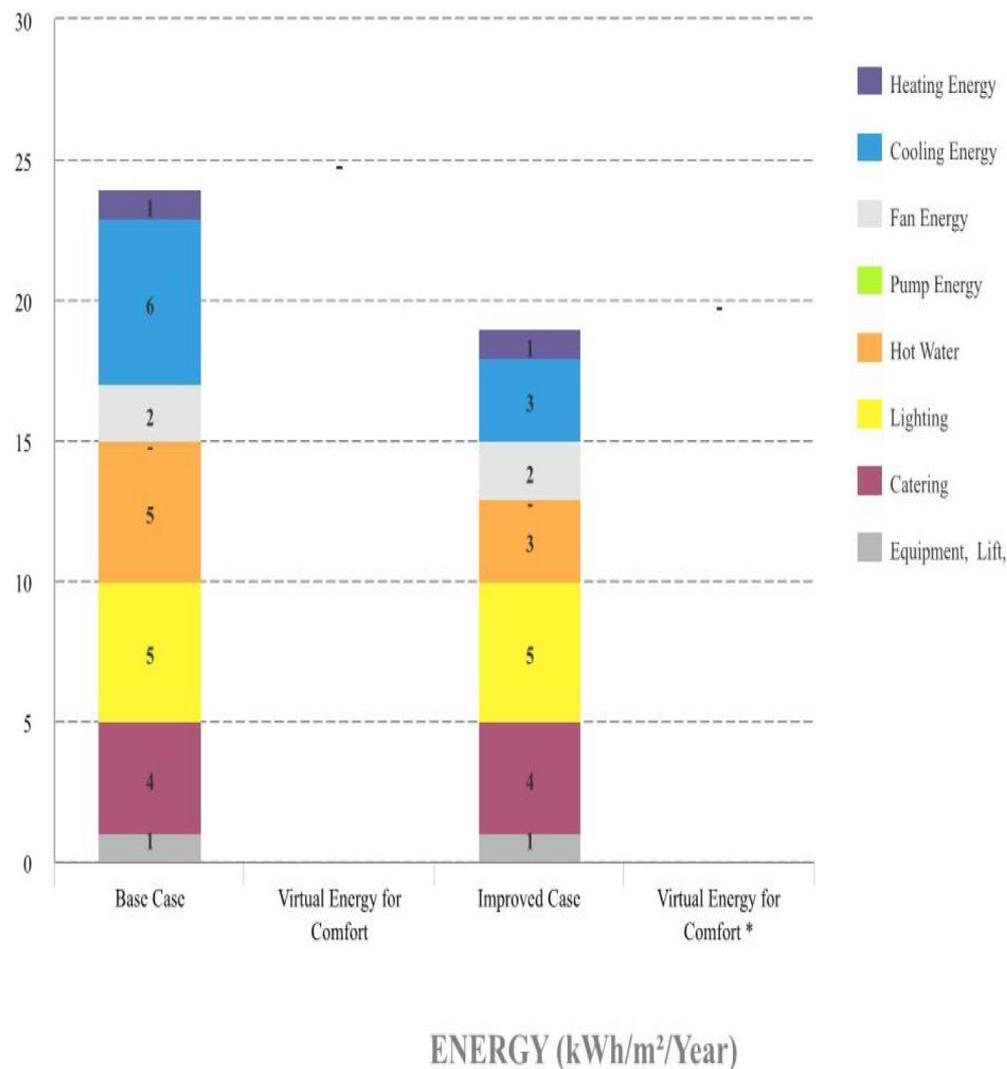
Utility Costs Savings  
\$ 250 / month

Payback in Years  
6

Operational CO<sub>2</sub>  
Savings  
\$ 15 tCO<sub>2</sub>/Year

Energy Efficiency Measures 20.2%

ENERGY SAVINGS Meets EDGE Energy



# SCHOOLS – PAKISTAN CASE STUDY & CERTIFIED PROJECT

## BUILDING DETAILS

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



### Energy Measures – 20% Savings through:

- 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

## PROJECT METRICS

Incremental Cost  
\$ 10,000

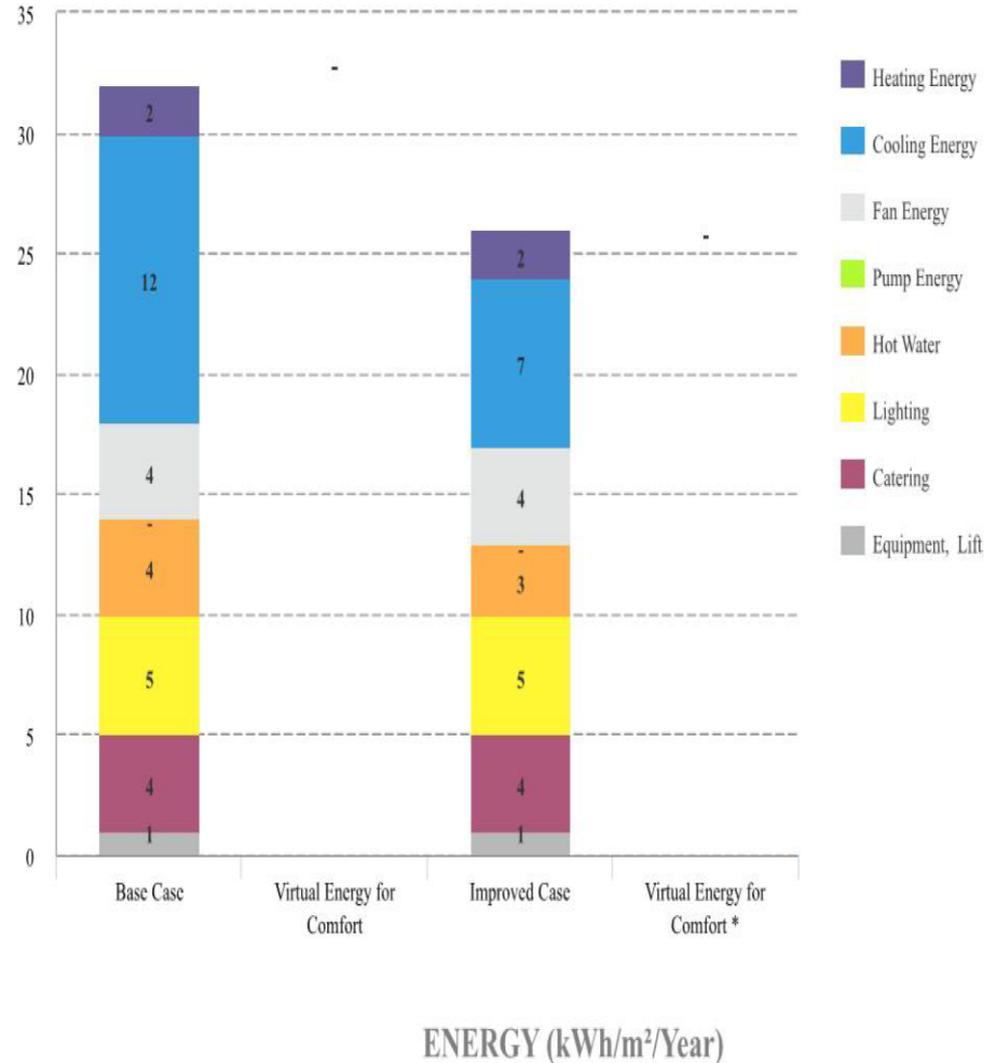
Utility Costs Savings  
\$ 140 / month

Payback in Years  
6

Operational CO<sub>2</sub>  
Savings  
\$ 20 tCO<sub>2</sub>/Year

## Energy Efficiency Measures 20.5%

ENERGY SAVINGS Meets EDGE Energy





## GREEN BUILDINGS RETURN ON INVESTMENT: SCHOOLS IN EAST EUROPE



*Creating Markets, Creating Opportunities*

# SCHOOLS – ARMENIA CASE STUDY

## BUILDING DETAILS

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



### Energy Measures – 50% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump
- Photoelectric Sensors to harvest Daylight



### Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



### Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

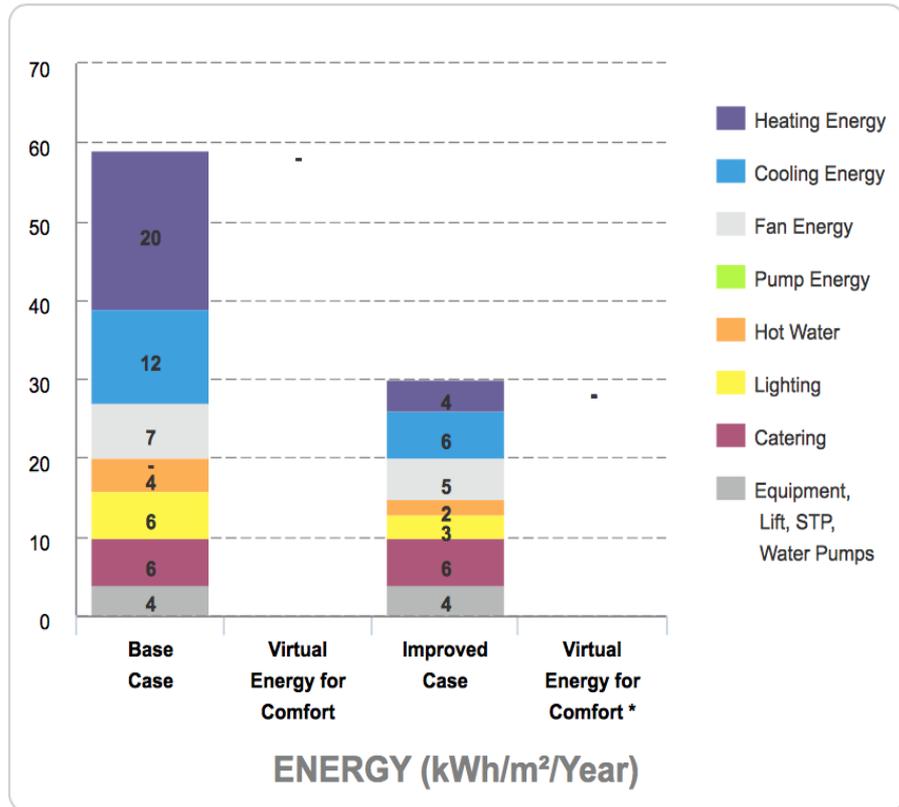
Incremental Cost  
\$9,834

Utility Costs Savings  
\$858 / month

Payback in Years  
0.96

Operational CO2 Savings  
63 tCO<sub>2</sub>/Year

**50.1%** 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.

# SCHOOLS – POLAND CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 48% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump



Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

Incremental Cost

\$9,482

Utility Costs Savings

\$1,592 / month

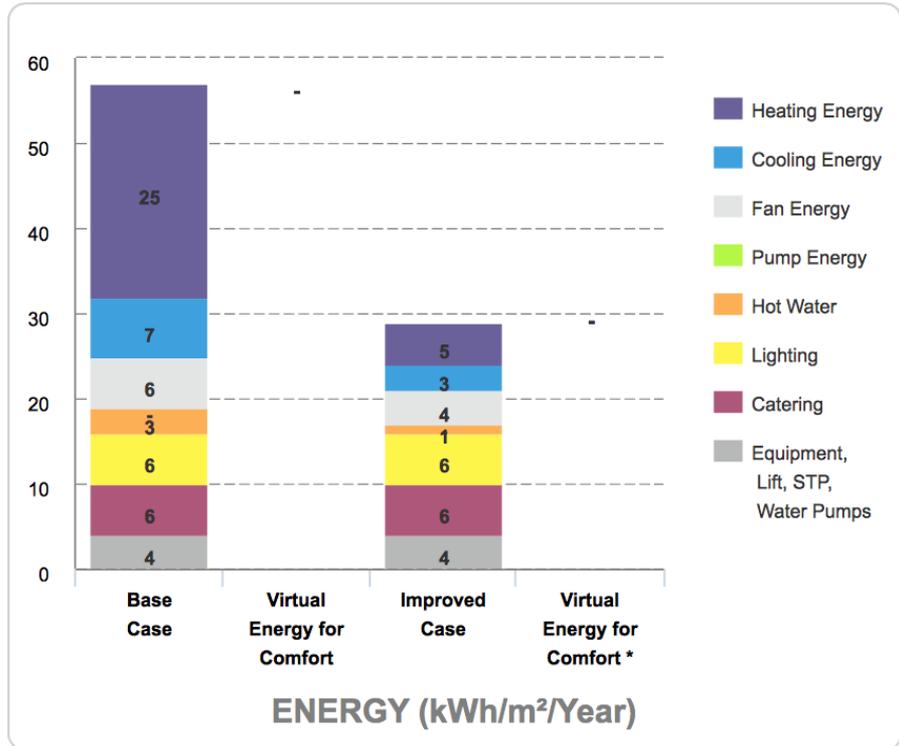
Payback in Years

0.5

Operational CO2 Savings

108 tCO<sub>2</sub>/Year

**47.8%** 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.

# SCHOOLS – RUSSIA CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 57% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump



Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

Incremental Cost

\$9,522

Utility Costs Savings

\$2,489 / month

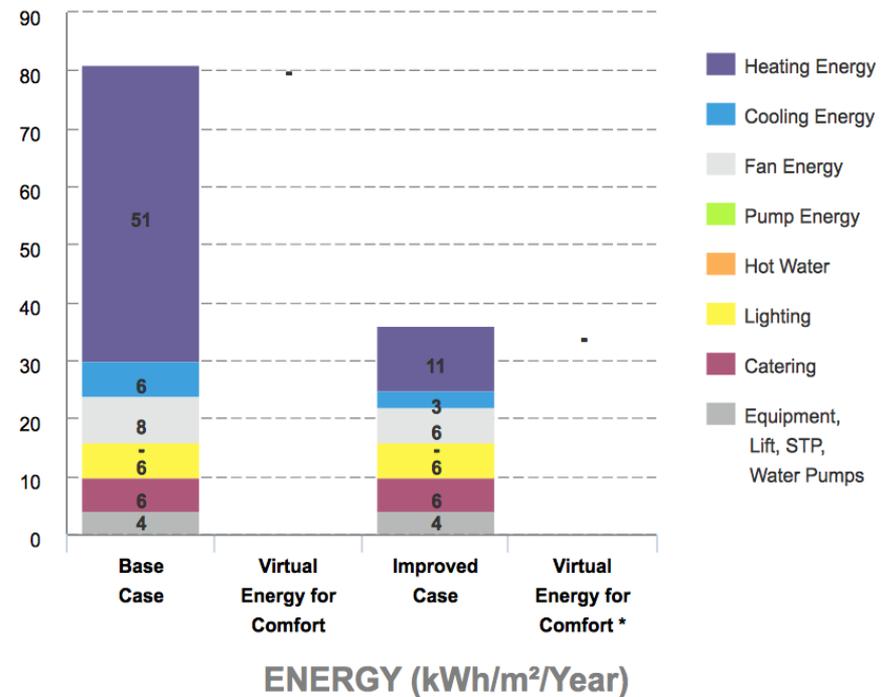
Payback in Years

0.32

Operational CO<sub>2</sub> Savings

101 tCO<sub>2</sub>/Year

**56.8%** 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.

# SCHOOLS – SERBIA CASE STUDY

## BUILDING DETAILS

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



### Energy Measures – 46% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump
- Recovery of Waste Heat from the Generator for Space Heating



### Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



### Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

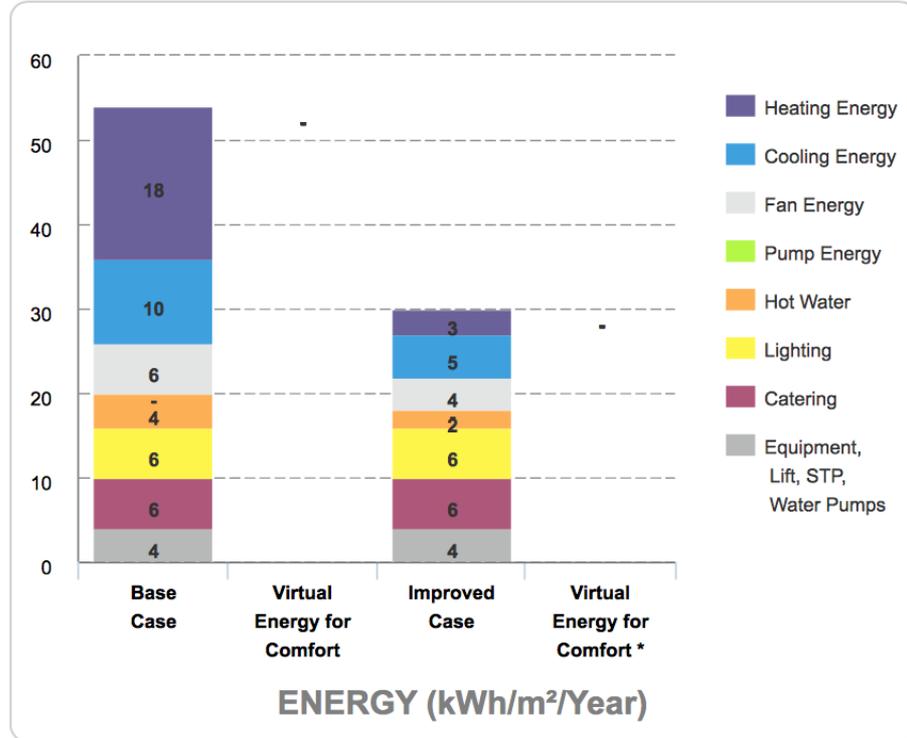
Incremental Cost  
\$29,985

Utility Costs Savings  
\$770 / month

Payback in Years  
3.24

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

**45.5%** 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.

# SCHOOLS – UKRAINE CASE STUDY

## BUILDING DETAILS

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



Energy Measures – 55% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump
- Photoelectric Sensors to harvest Daylight



Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

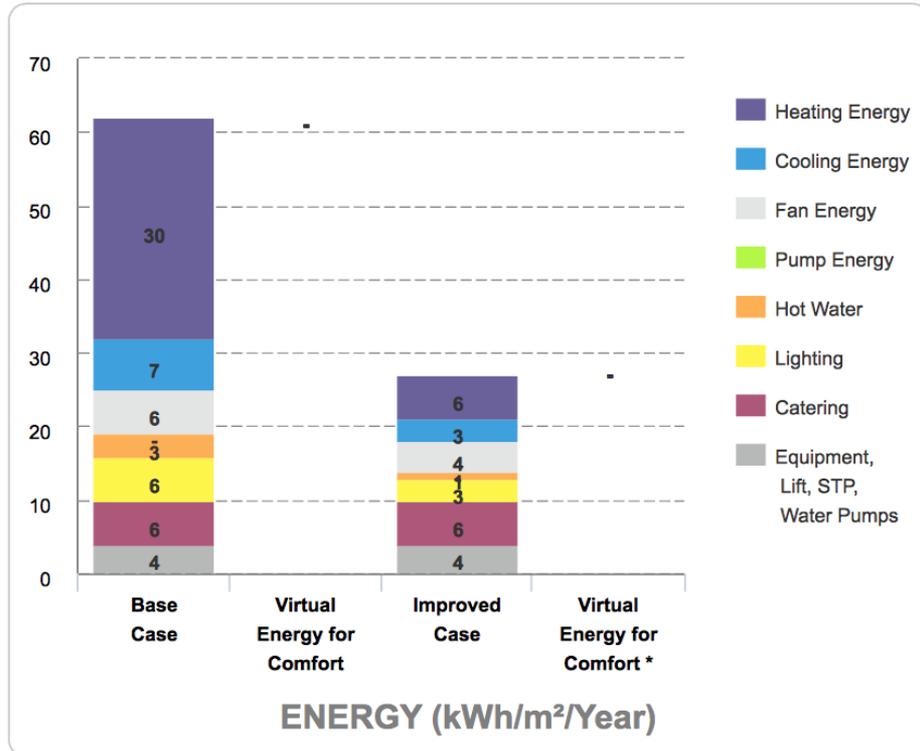
Incremental Cost  
\$11,640

Utility Costs Savings  
\$430 / month

Payback in Years  
2.25

Operational CO2 Savings  
103 tCO<sub>2</sub>/Year

**55.2%** 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.

## BUILDING DETAILS

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



Energy Measures – 44% Savings through:

- Reduced Window to Wall ratios
- Insulation of Roof and External Walls
- Variable Refrigerant Volume Cooling System
- Air Conditioning with Air and Water Cooled Chiller
- Ground Source Heat Pump



Water – 31% Savings through:

- Low-Flow Showerheads and Faucets
- Dual Flush for Water Closets
- Water-Efficient Urinals and faucets for Kitchen Sinks



Materials – 22% Savings through:

- Precast RC Planks and Joist System

## PROJECTED PROJECT METRICS

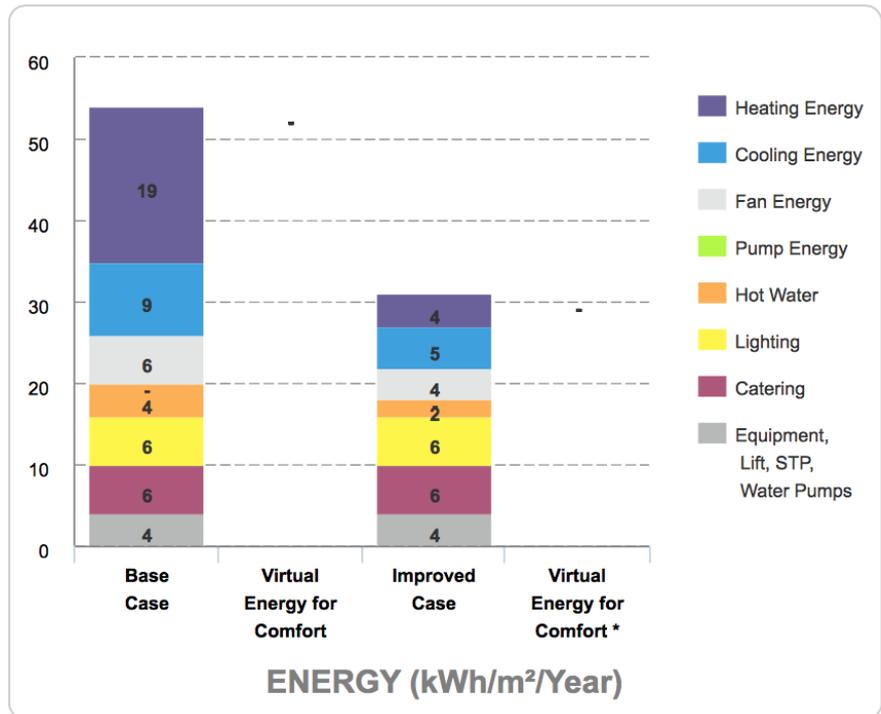
Incremental Cost  
\$9,127

Utility Costs Savings  
\$1,076 / month

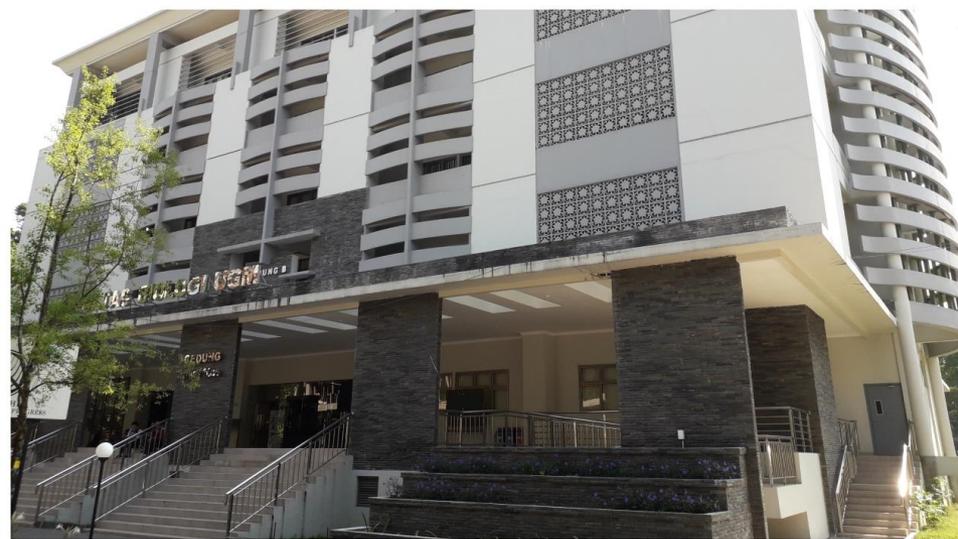
Payback in Years  
0.71

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

**44.0%** 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.



## METHODOLOGY, NOTES, ACKNOWLEDGMENTS



*Creating Markets, Creating Opportunities*

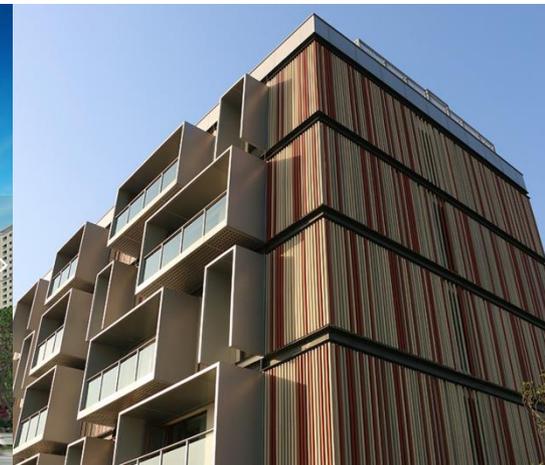
# RESEARCH OBJECTIVE: MOST EFFECTIVE INTERVENTIONS TO REACH THE EDGE STANDARD

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.

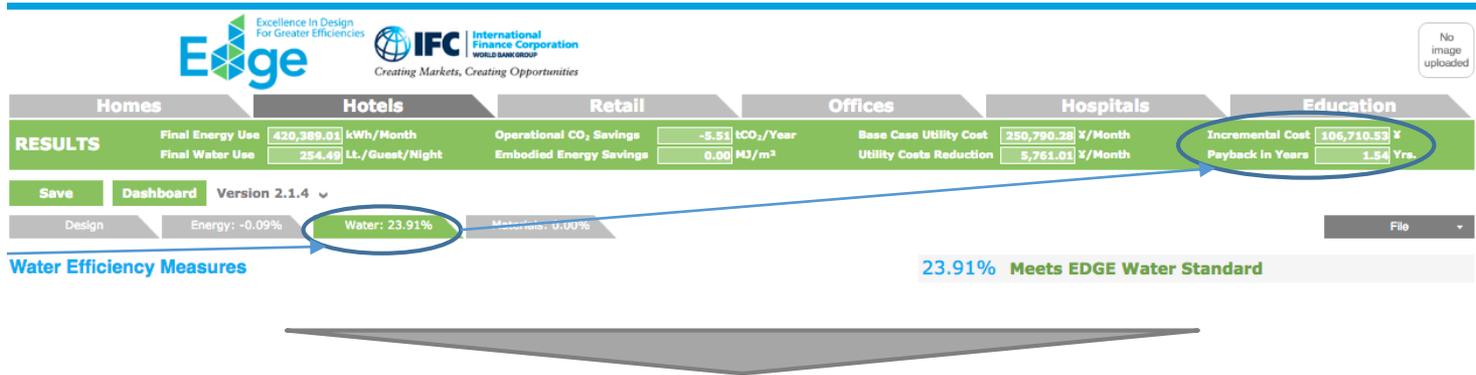
Third party certification verifies the resource efficiency savings so they can be credibly communicated between investors, developers, and buyers.

# RESEARCH METHODOLOGY

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

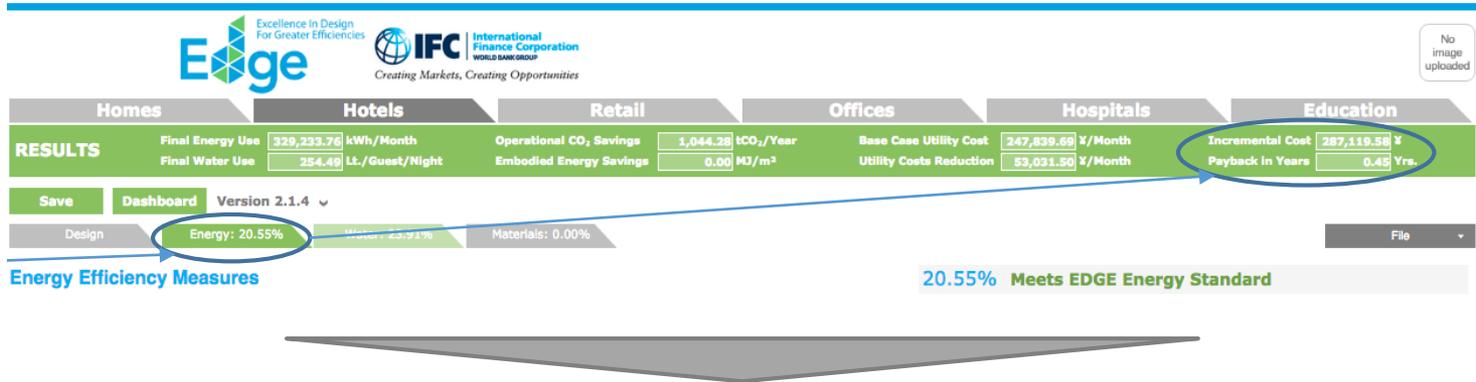
1

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.



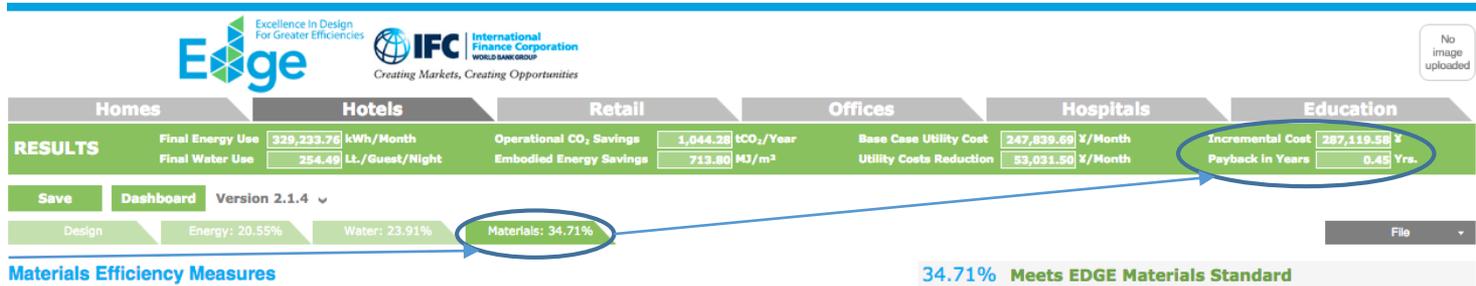
2

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**

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## **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