C40 CITIES

Reducing buildings energy consumption in Accra

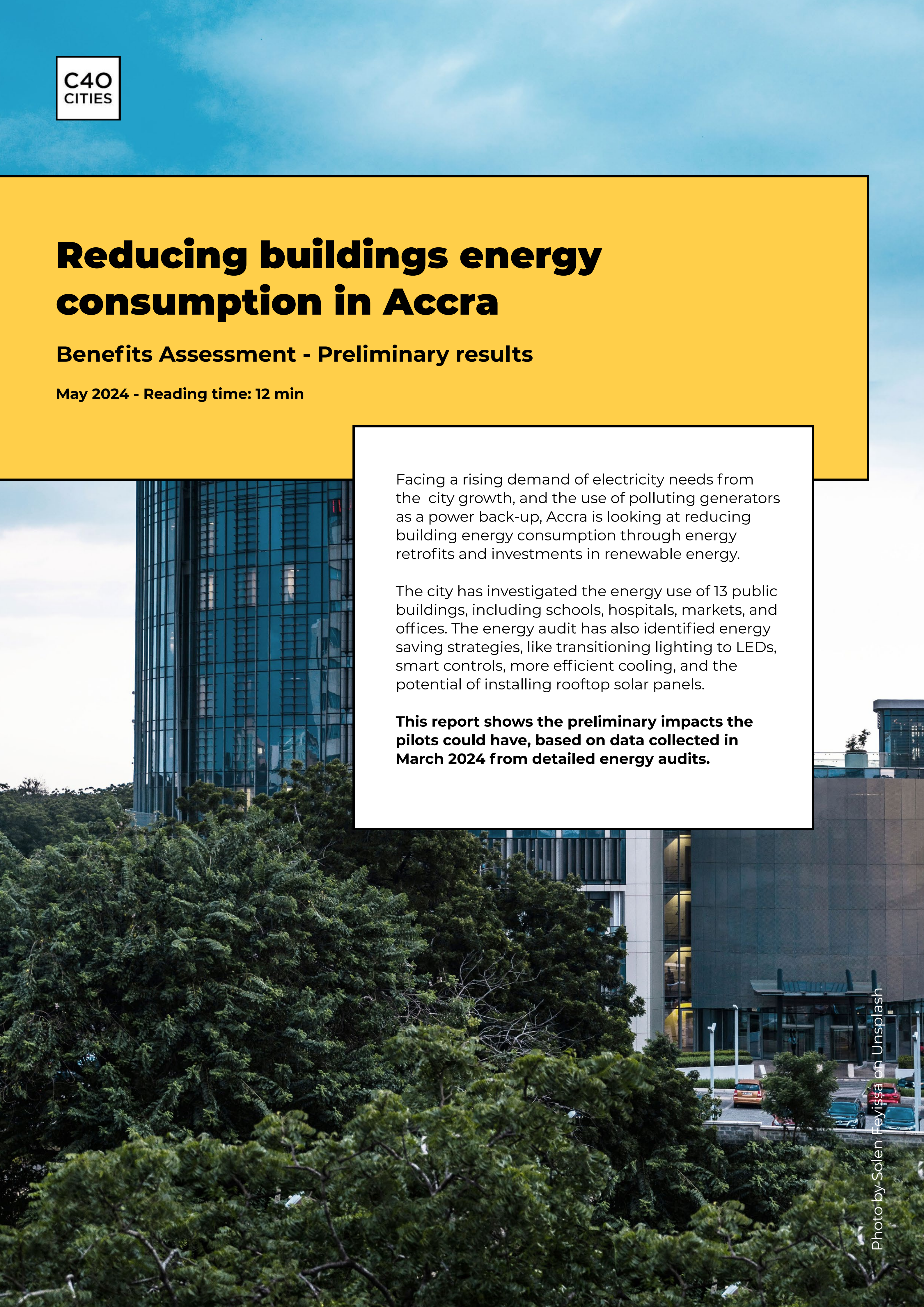
Benefits Assessment - Preliminary results

May 2024 - Reading time: 12 min

Facing a rising demand of electricity needs from the city growth, and the use of polluting generators as a power back-up, Accra is looking at reducing building energy consumption through energy retrofits and investments in renewable energy.

The city has investigated the energy use of 13 public buildings, including schools, hospitals, markets, and offices. The energy audit has also identified energy saving strategies, like transitioning lighting to LEDs, smart controls, more efficient cooling, and the potential of installing rooftop solar panels.

This report shows the preliminary impacts the pilots could have, based on data collected in March 2024 from detailed energy audits.



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Reducing operational costs while reducing emissions

Accra, the capital city of Ghana, serves as the economic, cultural, and administrative centre. With a population just over 2 million residents, Accra combines a diverse mix of high-rise buildings, colonial-era architecture, and vibrant markets. The rapid growth is placing additional pressure on the city's infrastructure and resources.[1]

over 2 million residents

32% of the city GHG emissions come from buildings & energy

Ghana's energy sector is dominated by fossil fuel (Gas and Oil, 65%), followed by hydroelectric power (34%), with marginal contributions from other renewables.[2] However, gas is subject to market fluctuations and availability, and the hydroelectric power is influenced by changes in rainfall and water levels. Commercial and industrial facilities also rely on backup diesel generator. Those generators and cooking fuels emit harmful pollutants which add to the city's air pollution. **In total, the buildings & energy sector is responsible for a third of the city greenhouse gas (GHG) emissions, next to transport and waste.**[3]

The Accra Metropolitan Assembly (AMA) holds the responsibility for governing the Accra Metropolis, its urban planning, infrastructure development, environmental protection, public health services, and revenue generation. While the city of Accra does not have direct control over electricity generation, the city can promote efficiency improvements in buildings and industrial facilities, as well as the installation of distributed solar energy on rooftops.

Efforts to promote energy efficiency (EE) and conservation in Ghana have a history dating back to the mid-1980s as a response to the energy crisis. Ghana's energy efficiency policies have placed a significant focus on the residential sector, aiming to phase out inefficient household appliances and lighting systems. This includes the distribution of 6 million energy-efficient lamps, driving a 124 MW reduction in peak load.[4] In contrast, the industrial sector's energy efficiency efforts are in the developmental stages, partly due to the absence of baseline data.

Accra Metropolitan Assembly wants to lead the way by retrofitting municipal buildings and bridge the gap of data availability. This report summarizes the findings from 13 public buildings energy audits and their recommended efficiency measures. It is estimated that implementing energy retrofits and installing solar energy on those 13 buildings could:

Reduce the electricity use by 65%

Energy efficiency measures could save 445 MWh of electricity each year. The solar PV could also produce 422 MWh of affordable and reliable energy. **This represents a drop of 65% (867 MWh) of the energy demand across all 13 buildings.**

Be paid back in just under 3.5 years

If all renewable energy and energy efficiency measures are implemented, this could cost 4.9 million GHS (392,200 USD). **This could save 1.5 million GHS (117,000 USD) each year, with current energy costs. This means that the investment could be paid back in less than 3 and a half years.**

Save 3,466 t of CO_2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 3,466 tonnes of CO2 over 10 years for all buildings, equivalent to 27 tonnes per building per year on average.

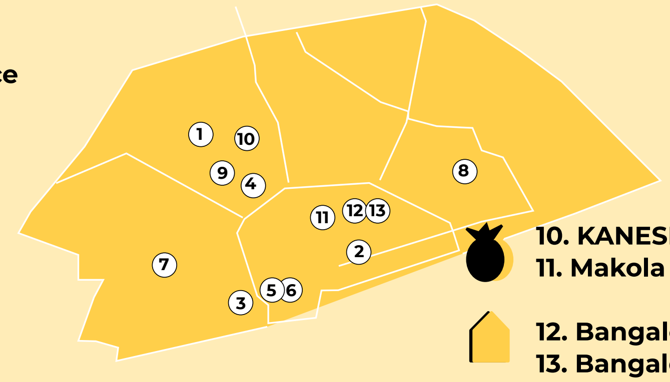
Piloting renewable energy and public building retrofits

The city has investigated the energy use of 13 public buildings across different typologies, including schools, hospitals, markets, and offices. The audit looked at the energy use by type of lighting, appliances and medical technology, cooking and water heating. Overall, the major energy consumption appliance is the AC, followed by lighting, and then office and other equipment (computers, microwaves, kettles, etc.).

1. Accra Metropolitan Old Office
2. Accra Metropolitan New Office
3. Ablekuma South Sub Metro

4. KANESHIE Polyclinic
5. USSHER Maternity
6. USSHER Polyclinic

7. KOJO ABABIO School cluster
8. AWODOME JHS 1
9. AWUDOME JHS 3



10. KANESHIE Market
11. Makola Shopping Mall

12. Bangalow Two
13. Bangalow One

Based on the municipal buildings audits, it is estimated that energy efficient measures and renewable energy could:

		Cost of retrofits (GHS, USD)	Reduce energy use (kWh/year, %)	Lower energy bills (GHS/year, USD)	Avoid CO2 emissions (t/year)
Offices					
	1.	**220,070 GHS** (17,540 USD)	**22,920 kWh** (57%)	**35,960 GHS** (2,870 USD)	**9.2 t/year**
	2.	**1,313,630 GHS** (104,670 USD)	**232,970 kWh** (64%)	**472,940 GHS** (37,680 USD)	**93.2 t/year**
	3.	**97,890 GHS** (7,800 USD)	**15,290 kWh** (49%)	**23,990 GHS** (1,910 USD)	**6.1 t/year**
Healthcare					
	4.	**740,410 GHS** (59,000 USD)	**146,400 kWh** (62%)	**229,850 GHS** (18,320 USD)	**58.6 t/year**
	5.	**281,480 GHS** (22,430 USD)	**42,180 kWh** (76%)	**66,170 GHS** (5,270 USD)	**16.9 t/year**
	6.	**615,910 GHS** (49,080 USD)	**102,480 kWh** (41%)	**160,780 GHS** (12,810 USD)	**41.0 t/year**
Markets					
	7.	**574,390 GHS** (45,770 USD)	**100,910 kWh** (92%)	**158,330 GHS** (12,620 USD)	**40.4 t/year**
	8.	**914,140 GHS** (72,840 USD)	**177,800 kWh** (87%)	**277,370 GHS** (22,100 USD)	**71.1 t/year**
Schools					
	9.	**35,250 GHS** (2,810 USD)	**5,230 kWh** (78%)	**8,160 GHS** (650 USD)	**2.1 t/year**
	10.	**32,930 GHS** (2,620 USD)	**4,310 kWh** (48%)	**7,390 GHS** (590 USD)	**1.7 t/year**
	11.	**44,210 GHS** (3,520 USD)	**6,830 kWh** (67%)	**10,720 GHS** (850 USD)	**2.7 t/year**
Residential					
	12.	**26,410 GHS** (2,100 USD)	**5,390 kWh** (50%)	**9,590 GHS** (760 USD)	**2.2 t/year**
	13.	**25,670 GHS** (2,050 USD)	**3,980 kWh** (36%)	**7,080 GHS** (560 USD)	**1.6 t/year**
Median		**220,073 GHS** (17,536 USD)	**22,920 kWh** (62%)	**35,960 GHS** (2,870 USD)	**9.2 t/year**
Total		**4,922,394 GHS** (392,223 USD)	**866,390 kWh** (65%)	**1,468,330 GHS** (117,000 USD)	**347 t/year**

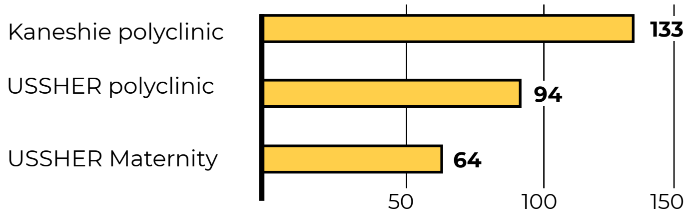
Zooming in on: Enhancing healthcare systems capacity

Energy efficiency in hospitals is critical in ensuring the seamless delivery of quality healthcare while minimising operational costs and environmental impacts. Adopting energy-efficient technologies and practices can help healthcare centers allocate more resources towards patient care and medical advancements.

Moreover, efficient energy management enhances the resilience of healthcare facilities, ensuring uninterrupted power supply during power outages. It also contributes to a healthier environment by reducing air pollution associated with the use of generators.

The pilot audited 3 facilities: Kaneshie, Ussher Maternity and its polyclinic; all operating 24/7. Cooling and lighting energy consumption are a high source of energy use for those buildings.

Energy intensity Use Unit: kWh/m2/year



KANESHIE Polyclinic

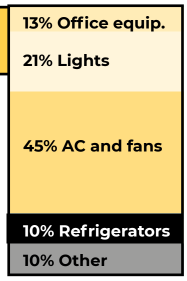
368,800 GHS spent on power every year (28,230 USD)

847 kWh/m²

1,763 m²

24/7 Operations

Typical energy profile:



Different measures can be considered to reduce the energy use of the polyclinic:	**Energy savings (kWh/year, and %)**	**Cost of installation (GHS, and USD)**	**CO_2 emissions avoided (t/year)**
1. Timed plugs for office equipments	**1.6 MWh (1%)**	2,280 GHS (180 USD)	**0.6 t CO_2/year**
2. Switching light bulbs to LED	**3.7 MWh (2%)**	3,750 GHS (300 USD)	**1.5 t CO_2/year**
4. Installing smart lighting controls	**5.0 MWh (2%)**	17,500 GHS (1,400 USD)	**2.0 t CO_2/year**
5. Regular servicing of ACs	**5.6 MWh (2%)**	4,100 GHS (330 USD)	**2.2 t CO_2/year**
7. More efficient fans	**6.2 MWh (3%)**	14,600 GHS (1,160 USD)	**2.5 t CO_2/year**
6. Smart Meters & Raising Awareness	**13.3 MWh (6%)**	49,200 GHS (3,920 USD)	**5.3 t CO_2/year**
3. Smart thermostatic controls	**18.8 MWh (8%)**	10,000 GHS (800 USD)	**7.5 t CO_2/year**
8. Replacing the AC Inverter	**34.6 MWh (15%)**	125,980 GHS (10,040 USD)	**13.8 t CO_2/year**
9. Installation of rooftop solar PV	**57.6 MWh (25%)**	513,000 GHS (40,880 USD)	**23 t CO_2/year**
Savings without solar PV	**88.8 MWh (38%)**	227,410 GHS (18,120 USD)	**35.5 t CO_2/year**
Savings with the solar PV	**146.4 MWh (62%)**	740,410 GHS (59,000 USD)	**58.6 t CO_2/year**

If all retrofits were implemented in the polyclinic, this could:

Reduce the electricity use by 62%

Energy efficiency measures could save 88.8 MWh of electricity each year on average. The solar PV could also produce 58 MWh of affordable and reliable energy. **This represents a drop of 62% (146 MWh) of the energy demand.**

Be paid back in less than 4 years

Although the measures could cost 740,410 GHS (59,000 USD), this could save 229,850 GHS (20,162 USD, 62%) each year with current energy costs. **This means that the investment could be paid back in less than 4 years.**

Save 586 t of CO_2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. **This would reduce the emissions of greenhouse gas (GHG) by 586 tonnes of CO_2 over the next 10 years.**

Similar measures could be implemented for USSHER polyclinic and maternity, including improving lighting and air conditioning efficiency, installation of smart meters and fitting of solar panels on the roof.

USSHER Polyclinic

395,820 GHS spent on power every year (31,540 USD)

94 kWh/m²

2,682 m²

24/7 Operations

Typical energy profile:

- 49% Office equip.
- 10% Lights
- 24% AC and fans
- 7% Refrigerators
- 11% Other

If all retrofits were implemented in the polyclinic, this could:

Reduce the electricity use by 41%

Energy efficiency measures could save 45 MWh of electricity each year on average. The solar PV could also produce 58 MWh of affordable and reliable energy. This represents a drop of 41% (102 MWh) of the energy demand.

Be paid back in less than 4 years

Although the measures could cost 615,900 GHS (49,080 USD), this could save 160,780 GHS (12,810 USD) each year with current energy costs. This means that the investment could be paid back in less than 4 years.

Save 410 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 410 tonnes of CO2 over the next 10 years.

USSHER Maternity

87,200 GHS spent on power every year (6,940 USD)

64 kWh/m²

868 m²

24/7 Operations

Typical energy profile:

- 20% Office equip.
- 20% Lights
- 36% AC and fans
- 13% Refrigerators
- 11% Other

If all retrofits were implemented in the maternity, this could:

Reduce the electricity use by 76%

Energy efficiency measures could save 25 MWh of electricity each year on average. The solar PV could also produce 17 MWh of affordable and reliable energy. This represents a drop of 76% (42MWh) of the energy demand.

Be paid back in 4 and a half years

Although the measures could cost 281,500 GHS (22,430 USD), this could save 66,170 GHS (5,270 USD) each year with current energy costs. This means that the investment could be paid back in 4 and a half years.

Save 169 t of CO2 emissions over 10 years

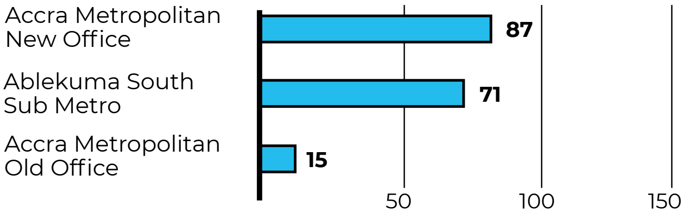
The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 169 tonnes of CO2 over the next 10 years.

Zooming in on: Improving administration buildings

Energy efficiency in administration offices saves government funds, allowing resources to be used elsewhere. It also shows a commitment to the environment by leading the energy transition in the energy sector. Improving the indoor environmental quality of offices can also improve health, well-being and workers' performance: well-cooled, ventilated offices and adequate lighting can reduce drowsiness and help people stay focused.

Woreda 03 Administration, Kirkos Sub City and the EPA buildings are used as offices with a cafeteria for each. The buildings are mainly used during the office hours, so lighting and computers represent the majority of the energy use of the buildings.

Energy intensity use Unit: kWh/m2/year



Accra Metropolitan New Office

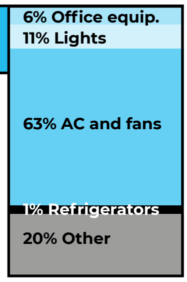
568,560 GHS spent on power every year (41,480 USD)

87 kWh/m²

4,150 m²

8h day, weekdays

Typical energy profile:



Different measures can be considered to reduce the energy use of the office:	**Energy savings (kWh/year, and %)**	**Cost of installation (GHS, and USD)**	**CO2 emissions avoided (t/year)**
1. Switching light bulbs to LED	**1.2 MWh** (0.3%)	2,250 GHS (180 USD)	**0.5 t CO2/year**
2. Timed plugs for office equipments	**1.1 MWh** (0.3%)	4,560 GHS (360 USD)	**0.5 t CO2/year**
3. Installing smart lighting controls	**3.9 MWh** (1%)	14,000 GHS (1,120 USD)	**1.6 t CO2/year**
4. Optimise printers distribution	**6 MWh** (2%)	54,000 GHS (4,300 USD)	**2.4 t CO2/year**
5. Regular servicing of ACs	**23 MWh** (6%)	12,800 GHS (1,020 USD)	**9.1 t CO2/year**
6. Smart Meters & Raising Awareness	**29 MWh** (8%)	10,000 GHS (800 USD)	**11.6 t CO2/year**
7. Smart thermostatic controls	**34 MWh** (9%)	15,600 GHS (1,240 USD)	**13.6 t CO2/year**
8. Installation of rooftop solar PV	**135 MWh** (37%)	1,200,420 GHS (95,650 USD)	**54 t CO2/year**
Savings without solar PV	**98 MWh** (27%)	113,210 GHS (9,020 USD)	**39.2 t CO2/year**
Savings with the solar PV	**233 MWh** (64%)	1,313,630 GHS (104,670 USD)	**93.2 t CO2/year**

If all retrofits were implemented in the office, this could:

Reduce the electricity use by 64%

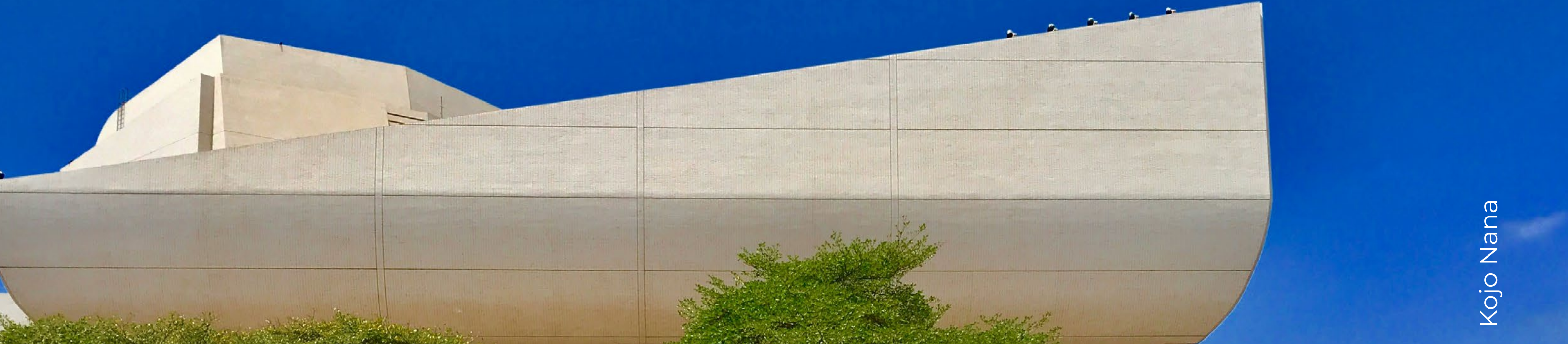
Energy efficiency measures could save 98 MWh of electricity each year on average. The solar PV could also produce 135 MWh of affordable and reliable energy. **This represents a drop of 64% (233 MWh) of the energy demand.**

Be paid back in less than 3 years

Although the measures could cost 1.3 million GHS (104,670 USD), **this could save 472,940 GHS (37,680 USD) each year. This means that the investment could be paid back in just under 3 years.**

Save 932 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. **This would reduce the emissions of greenhouse gas (GHG) by 932 tonnes of CO2 over the next 10 years.**



Similar measures could be implemented for Ablekuma South Sub Metro and the old AMA office, including improving lighting and office equipments efficiency, installation of smart meters and fitting of solar panels.

Ablekuma South Sub Metro

49,000 GHS spent on power every year (3,900 USD)

442 m²

71 kWh/m²

8h day, weekdays

Typical energy profile:

- 16% Office equip.
- 3% Lights
- 45% AC and fans
- 21% Refrigerators
- 16% Other

If all retrofits were implemented in the office, this could:

Reduce the electricity use by 49%

Energy efficiency measures could save 7 MWh of electricity each year. The solar PV could also produce 8 MWh of affordable and reliable energy. This represents a drop of 49% (15 MWh) of the energy demand.

Be paid back in just 4 years

Although the measures could cost 97,890 GHS (7,800 USD), this could save 23,990 GHS (1,910 USD) each year with current energy costs. This means that the investment could be paid back in just over 4 years.

Save 61 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 61 tonnes of CO2 over the next 10 years.

Accra Metropolitan Old Office

63,100 GHS spent on power every year (5,030 USD)

2,708 m²

15 kWh/m²

8h day, weekdays

Typical energy profile:

- 23% Office equip.
- 10% Lights
- 36% AC and fans
- 27% Refrigerators
- 4% Other

If all retrofits were implemented in the office, this could:

Reduce the electricity use by 57%

Energy efficiency measures could save 15 MWh of electricity each year on average. The solar PV could also produce 8 MWh of affordable and reliable energy. This represents a drop of 57% (23 MWh) of the energy demand.

Be paid back in just 6 years

Although the measures could cost 220,070 GHS (17,540 USD), this could save 35,960 GHS (2,870 USD) each year with current energy costs. This means that the investment could be paid back in just over 6 years.

Save 92 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 92 tonnes of CO2 over the next 10 years.

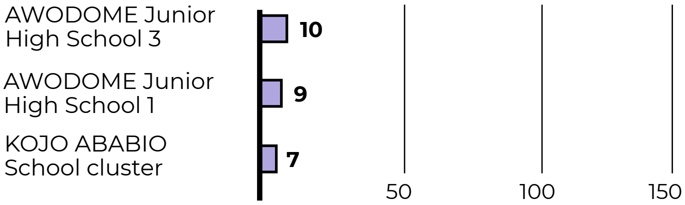
Zooming in on: Improving school environments

Installing solar panels and investing in efficient lighting on schools can lower their energy costs, freeing up budget resources for educational programs and improvements. The initiative can also serve as an educational tool, raising awareness among students and the community about the importance of clean energy and environmental responsibility.

Better school buildings can also improve student performance: thermal comfort improves attention, decreasing air pollution increases cognitive performance, reduced noise supports focus and memory; and good lighting boosts alertness and motivation.

The audit focused on 3 schools: Awodrome Junior High Schools 1 and 3, and Kojo Ababio school cluster. Schools have a much lower energy intensity than previous buildings, mostly because they do not use AC, but more office equipment.

Energy intensity use Unit: kWh/m2/year



AWODOME Junior High School 3

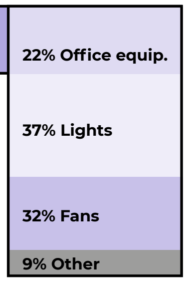
16,090 GHS spent on power every year (1,280 USD)

10 kWh/m²

978 m²

6h day, weekdays

Typical energy profile:



Different measures can be considered to reduce the energy use of the school:	Energy savings (kWh/year, and %)	Cost of installation (GHS, and USD)	CO2 emissions avoided (t/year)
1. Timed plugs for office equipments	**0.03 MWh** (0.3%)	342 GHS (30 USD)	**0.01 t CO2/year**
2. Regular servicing of ACs	**0.2 MWh** (2%)	100 GHS (9 USD)	**0.1 t CO2/year**
3. Smart thermostatic controls	**0.3 MWh** (2%)	1,200 GHS (100 USD)	**0.1 t CO2/year**
4. Installing smart lighting controls	**0.4 MWh** (4%)	2,450 GHS (200 USD)	**0.2 t CO2/year**
5. Smart Meters & Raising Awareness	**1.5 MWh** (15%)	10,000 GHS (800 USD)	**0.6 t CO2/year**
6. More efficient fans	**2.2 MWh** (21%)	9,600 GHS (770 USD)	**0.9 t CO2/year**
7. Installation of rooftop solar PV	**2.3 MWh** (22%)	20,520 GHS (1,640 USD)	**0.9 t CO2/year**
Savings without solar PV	**4.5 MWh** (44%)	23,692 GHS (1,890 USD)	**1.8 t CO2/year**
Savings with the solar PV	**6.8 MWh** (67%)	44,212 GHS (3,520 USD)	**2.7 t CO2/year**

If all retrofits were implemented in the school, this could:

Reduce the electricity use by 67%

Energy efficiency measures could save 4.5 MWh of electricity each year on average. The solar PV could also produce 2.3 MWh of affordable and reliable energy. **This represents a drop of 67% (6.8 MWh) of the energy demand.**

Be paid back in 4 years

Although the measures could cost 44,212 GHS (3,520 USD), this could **save 10,720 GHS (850 USD) each year with current energy costs. This means that the investment could be paid back in just over 4 years.**

Save 27 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. **This would reduce the emissions of greenhouse gas (GHG) by 27 tonnes of CO2 over the next 10 years.**

Similar measures could be implemented for the other schools, including smart lighting and office equipments efficiency, installation of smart controls and fitting of solar panels. Some schools already use LEDs.

AWODOME Junior High School 1

14,180 GHS spent on power every year (1,130 USD)

964 m²

9 kWh/m²

6h day, weekdays

Typical energy profile:

- 35% Office equip.
- 32% Lights
- 14% Fans and AC
- 9% Refrigeration
- 9% Other

If all retrofits were implemented in the school, this could:

Reduce the electricity use by 48%

Energy efficiency measures could save 2.0 MWh of electricity each year on average. The solar PV could also produce 2.3 MWh of affordable and reliable energy. This represents a drop of 48% (4.3 MWh) of the energy demand.

Be paid back in 4 and a half years

Although the measures could cost 32,926 GHS (2,620 USD), this could save 7385 GHS (590 USD) each year with current energy costs. This means that the investment could be paid back in 4 and a half years.

Save 17 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 17 tonnes of CO2 over the next 10 years.

KOJO ABABIO School cluster

10,490 GHS spent on power every year (840 USD)

1,023 m²

7 kWh/m²

6h day, weekdays

Typical energy profile:

- 57% Office equip.
- 15% Lights
- 24% Fans
- 4% Other

If all retrofits were implemented in the school, this could:

Reduce the electricity use by 78%

Energy efficiency measures could save 2.9 MWh of electricity each year on average. The solar PV could also produce 2.3 MWh of affordable and reliable energy. This represents a drop of 78% (5.3 MWh) of the energy demand.

Be paid back in 4 and a half years

Although the measures could cost 35,250 GHS (2,810 USD), this could save 8,155 GHS (650 USD) each year with current energy costs. This means that the investment could be paid back in 4 and a half years.

Save 21 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. This would reduce the emissions of greenhouse gas (GHG) by 21 tonnes of CO2 over the next 10 years.

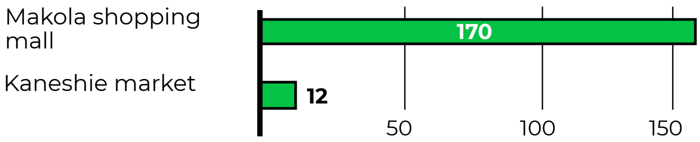
Zooming in on: reducing market costs

Market traders, building managers as well as visitors all benefit from markets improvement. Upgraded lighting improves comfort and working conditions for traders, while providing them a more attractive workspace and visibility for customers.

Replacing generators by clean electricity reduces air and noise pollution. Solar panels can also reduce the market's operating costs on the long run.

The audit looked at both a market and a mall, in Kaneshie and Makola. Light and AC are the leading sources of energy consumption for those buildings.

Energy intensity use Unit: kWh/m2/year



Makola shopping mall

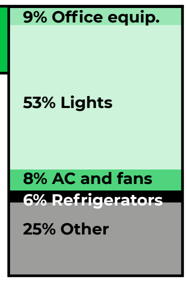
320,270 GHS spent on power every year (25,520 USD)

1,199 m²

171 kWh/m²

15h day

Typical energy profile:



Different measures can be considered to reduce the energy use of the office:	**Energy savings (kWh/year, and %)**	**Cost of installation (GHS, and USD)**	**CO2 emissions avoided (t/year)**
1. Timed plugs for office equipments	**0.9 MWh** (0%)	4,560 GHS (360 USD)	**0.4 t CO2/year**
2. Regular servicing of ACs	**1.5 MWh** (1%)	4,500 GHS (360 USD)	**0.6 t CO2/year**
3. Smart thermostatic controls	**2.3 MWh** (1%)	44,400 GHS (3,540 USD)	**0.9 t CO2/year**
Installing smart lighting controls	**3.3 MWh** (2%)	5,400 GHS (430 USD)	**1.3 t CO2/year**
4. More efficient refrigeration	**5.7 MWh** (3%)	89,985 GHS (7,170 USD)	**2.3 t CO2/year**
5. Replacing the AC Inverter	**10.9 MWh** (5%)	10,500 GHS (840 USD)	**4.3 t CO2/year**
6. Smart Meters & Raising Awareness	**16 MWh** (8%)	20,000 GHS (1,600 USD)	**6.6 t CO2/year**
7. Switching light bulbs to LED	**68 MWh** (33%)	119,200 GHS (9,500 USD)	**27.1 t CO2/year**
8. Installation of rooftop solar PV	**69 MWh** (34%)	615,600 GHS (49,050 USD)	**27.6 t CO2/year**
Savings without solar PV	**108 MWh** (53%)	298,540 GHS (23,790 USD)	**43.6 t CO2/year**
Savings with the solar PV	**178 MWh** (87%)	914,140 GHS (72,840 USD)	**71.2 t CO2/year**

If all retrofits were implemented in the office, this could:

Reduce the electricity use by 87%

Energy efficiency measures could save 109 MWh of electricity each year on average. The solar PV could also produce 69 MWh of affordable and reliable energy. **This represents a drop of 87% (178 MWh) of the energy demand.**

Be paid back in 3 and a half years

Although the measures could cost 0.9 million GHS (72,840 USD), **this could save 277,370 GHS (22,100 USD) each year. This means that the investment could be paid back in 3 and a half years.**

Save 712 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. **This would reduce the emissions of greenhouse gas (GHG) by 712 tonnes of CO2 over the next 10 years.**

KANESHIE Market

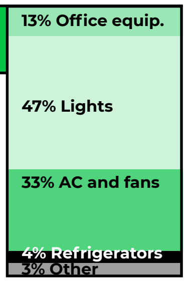
172,500 GHS spent on power every year (13,740 USD)

9,272 m²

12 kWh/m²

15h day

Typical energy profile:



Similar measures could be implemented for the other markets and malls. Kaneshie market measures target in priority the solar panels installation with would cover 52% of reduction of energy use, followed by light switch to LEDs which reduce energy use by 18%. If all retrofits were implemented in the office, this could:

Reduce the electricity use by 92%

Energy efficiency measures could save 43 MWh of electricity each year on average. The solar PV could also produce 58 MWh of affordable and reliable energy. **This represents a drop of 92% (101 MWh) of the energy demand.**

Be paid back in 3 and a half years

Although the measures could cost 0.6 million GHS (45,770 USD), **this could save 158,330 GHS (12,620 USD) each year. This means that the investment could be paid back in 3 and a half years.**

Save 404 t of CO2 emissions over 10 years

The reduction in energy use would reduce the demand to the grid. **This would reduce the emissions of greenhouse gas (GHG) by 404 tonnes of CO2 over the next 10 years.**

References & Methodology

This report shows the preliminary impacts, based on energy audits finalised in March 2024.

References:

[1,2] Ministry of Energy (2022). Ghana National Energy Transition Framework. Available at: https://energymin.gov.gh/sites/default/files/2023-09/FINAL%20GHANA%27S%20NATIONAL%20ENERGY%20TRANSITION%20FRAMEWORK_2023_compressed%20%281%29_compressed%20%282%29.pdf

[3] C40 Cities (2018). Accra GHG emissions in 2021. Accessible at: https://www.c40knowledgehub.org/s/article/C40-cities-greenhouse-gas-emissions-interactive-dashboard?language=en_US

[4] ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) (2015). National Energy Efficiency Action Plan (NEEAP) of Ghana. Available at: https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANEE/Ghana_National_Energy_Efficiency_Action_Plan.pdf

Methodology:

Current energy use
The primary sample survey for the energy audits were conducted at ASHRAE Level 1 and Level 2 Energy Audit where energy supply & demand data from the selected buildings was collected through taking an inventory of electrical and other appliances in the buildings, building physical characteristics (layout and materials), building occupancy and operating hours, daily peak electricity measurements, energy expenditure, power interruption frequency and duration etc...

Data collected from the sample surveys was used to estimate hourly, daily and monthly electricity consumption for the buildings for typical working days. The demand analysis also included other energy types used in the buildings (including diesel fuel consumption for backup generators, petroleum and biomass fuels used for heating and cooking).

The electricity consumption was crossed with Historical data on electricity bills when available, from the Electricity Company of Ghana (ECG).

The grid emission factor considered was 0.4 t CO_2/MWh from the National Energy Statistics 2022, accessible at: https://energycom.gov.gh/files/2022%20Energy%20Statistics.pdf.

Electricity costs were estimated at 1.569 GHS/kWh across the array of buildings, based on the audit results.

Exchange rate from USD to GHS is 12.55, as an average for 2023, according to Forbes.

Energy scenarios
The survey indicated potential opportunities for energy efficiency (EE) and renewable energy (RE) measures for the buildings.

All options for the energy retrofits have been detailed and prioritised in the full report: Energy Audit Report; Gaps and needs assessment for the CAI energy project in Accra, March 2024, ordered by C40 and submitted by DTT Energy Limited.

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