



TRAVELLING
UNIVERSITY
GULU UNIVERSITY
UGANDA

ZECURA

Outline

1 Introduction: *team, vision, mission*

2 Status Quo

3 Ideas & Strategies

4 Evaluation of Technologies

5 Economic Analysis

6 Impacts

7 Conclusion

Our Vision

Our vision is to create innovative resilience strategies for fast growing cities to successfully overcome current and future sustainability challenges.

T H E Z E C U R A T E A M

Our Mission

Our mission is to make Gulu a **resilient city**, a city that withstands socio political and environmental stressors and demographic change whilst accelerating its economic growth.

Gulu University will be the sustainability, technology and transport hub of East Africa through a secure, independent and sustainable economy, whilst sharing its knowledge with surrounding communities.

T H E Z E C U R A T E A M

Research Team

Visiting Team



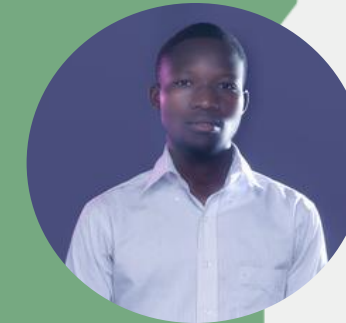
Host Team

Cameroon



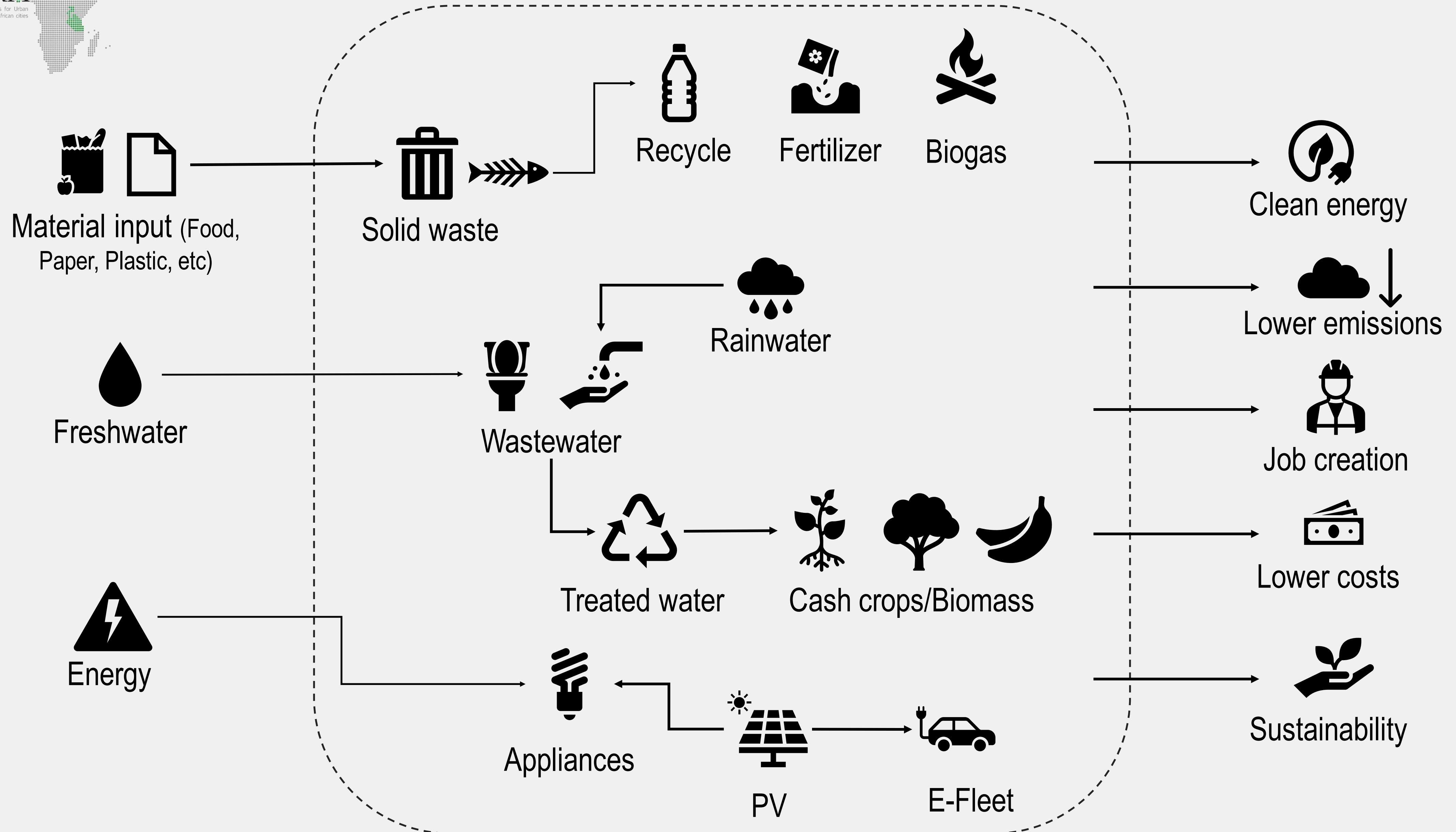
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Uganda



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The System & Flows



Municipal Solid Waste

Status Quo: MSW

Sustainable Resource Management =
Economic Promotion Strategy + Environmental Protection

PET
≈ 878,400 UGX/tonne

PP/PE
≈ 3.3 bn UGX/tonne

Paper
≈ 374,400 UGX/tonne

Status Quo: MSW Trends Sub-Sahara (Worldbank, 2021)

Global average of total MSW:

Average “Low Income” (<1,025USD/capita/year):

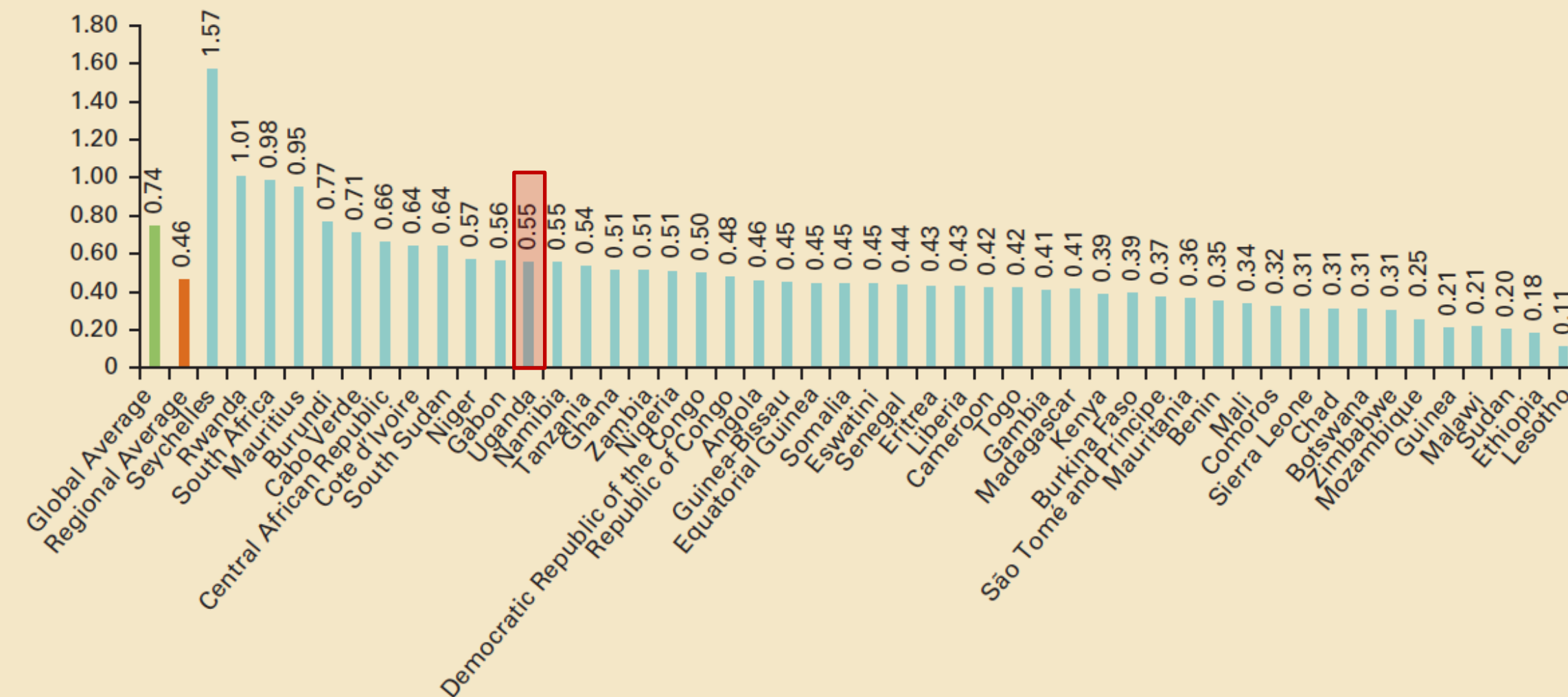
Average Gulu:

0.79 Kg/capita/day

0.41 Kg/capita/day

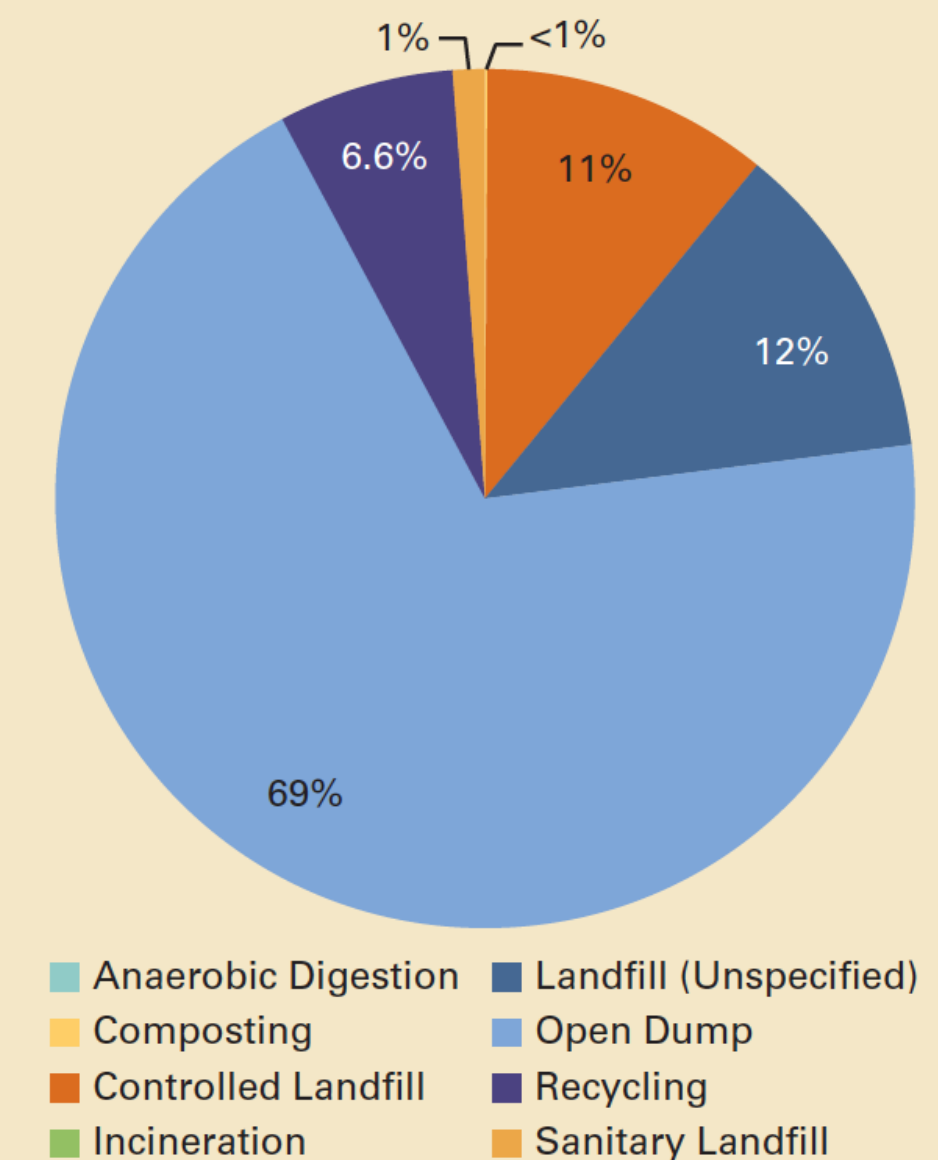
0.15-0.35 Kg/capita/day

Figure 3.32 Waste Generation Rates: Sub-Saharan Africa Region
kg/capita/day



Note: Data adjusted to 2016 as described in box 2.1; kg = kilogram.

Figure 3.36 Waste Disposal and Treatment in Sub-Saharan Africa
percent



Status Quo: MSW Gulu Municipal Council

(IPILC, 2018)

ITEM	SHARE	AMOUNT	
Organic	57.7%	32,987	Biogas
Paper	2.5%	1,429	Balling Press
Hard plastic, PET	1.7%	972	
Plastic foils	4.8%	2,744	
Textiles	0.9%	515	
Mixed (haz.)	0.4%	229	
Fine < 25 mm	30.9%	17,665	Rice Husk
Metals	1.2%	686	
Total	100%	57,226	

Ideas and Strategy: Waste-to-value Potential (Paper & Plastic)

Regional added value potential (Paper & Plastic): > 600,000,000 UGX

ITEM	GMC AMOUNT	University	UNIT
Population equivalent	193,548	5,331	p.e.
MSW production per capita/day (kg)	0.35	0.15	kg/d
MSW production per capita/year (t)	24,726	292	t/a
Paper	0.25%	7%	
Hard plastic, PET	1.70%	5%	
Plastic foils	4.80%	3%	
MSW collection rate	70%	9%	%
Recycling rate	80%	9%	%
Recycling potential - Paper	35	17	t/a
Recycling potential - PET	235	12	t/a
Recycling potential - Plastic	665	7	t/a
Market Value - Secondary Raw Material - Paper	187,200		UGX/t
Market Value - Secondary Raw Material - PET & Plastic	658,800		UGX/t
Regional Added Value Potential – Paper	6,480,126	3,098,002	UGX/a
Regional Added Value Potential - Plastic & PET	592,931,565	12,460,096	UGX/a

Status Quo: Low Waste-to-value Potential

Basic manual collection – low density – high transport cost & emissions

ITEM	UNIT	AMOUNT
Recycling potential - PET	t/a	247
Regional Added Value Potential - PET	UGX/a	162,861,970
Density of PET - Status quo	kg/m³	80
Total PET volume	m ³ /a	3,090
Total truck loading volume	m ³ /truck	24
Total required truck loads	trucks/a	129
Diesel Requirement (Gulu-Kampala Recycling Uptaker)	l/a	24,142
Emissions - Diesel consumption	tCO _{2e} /a	63
Fuel Costs - Diesel	UGX/a	144,849,629
Gross Margin - ex. labour and collection cost	UGX/a	18,012,341



Ideas & Strategy: Increasing Waste-to-value Potential

Invest in balling press for recycling hub

Improve efficiency and save space

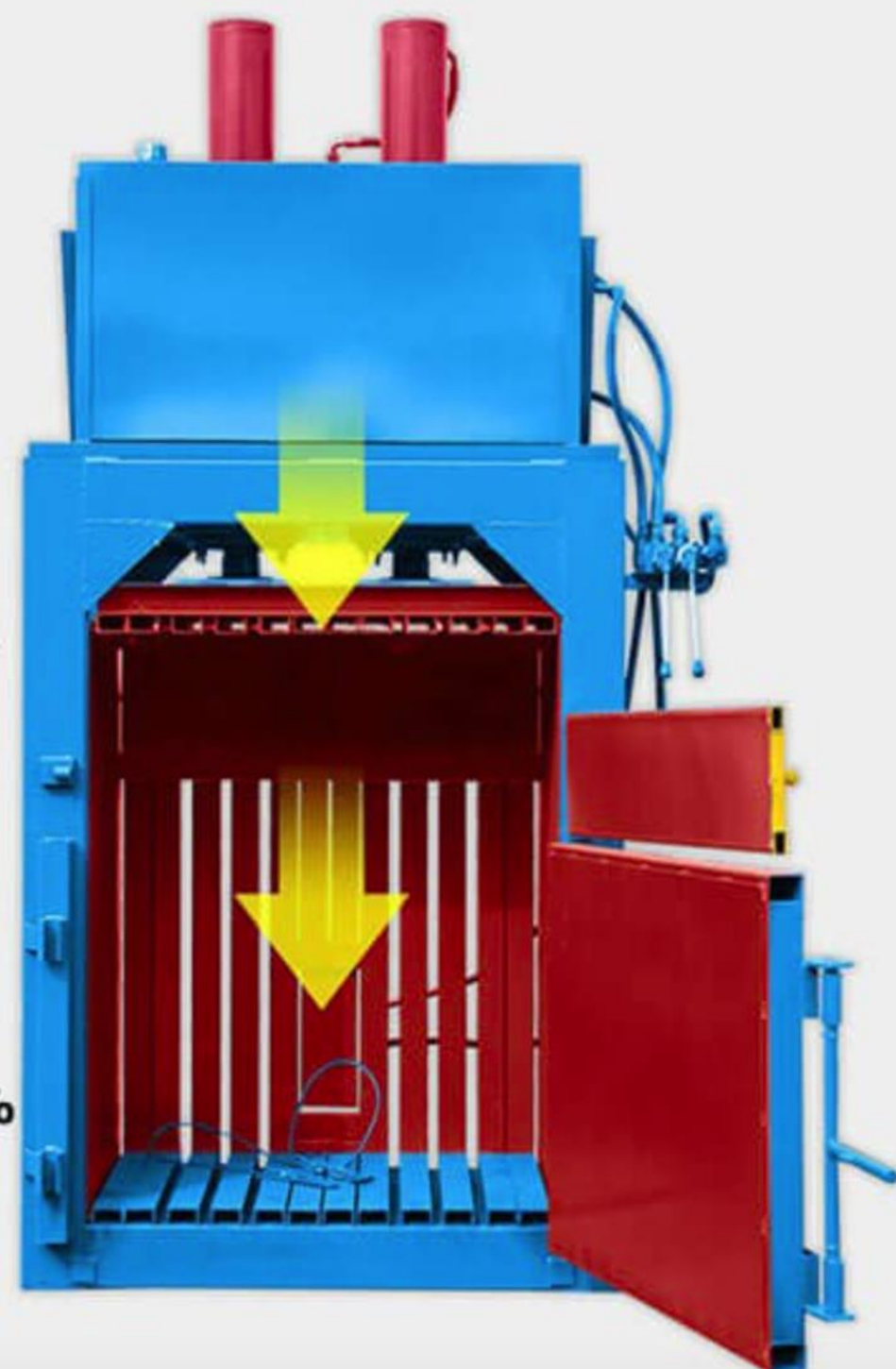
Save space

80%

Compression ratio 5:1

200%

Packing speed is 200%
higher than manual



Develop manual pre-press and optimised collection



TAKATAKA
PLASTICS

Increasing Waste-to-value Potential

Enhance density – reduce transport & emissions – increase profit

ITEM	AMOUNT	UNIT
Recycling potential - PET	247	t/a
Regional Added Value Potential - PET	162,861,970	UGX/a
Density of PET - Status quo	400	kg/m³
Total PET volume	618	m ³ /a
Total truck loading volume	24	m ³ /truck
Total required truck loads	26	trucks/a
Diesel Requirement (Gulu-Kampala Recycling Uptaker)	4,828	l/a
Emissions - Diesel consumption	13	t CO _{2e} /a

Economic Valuation

CAPEX - Balling Press	108,000,000	
CAPEX/y - Annual Depreciation	20,880,000	UGX/a
OPEX - Maintenance	10,800,000	UGX/a
OPEX - Labour	8,000,000	UGX/a
OPEX - Energy (100 kW)	7,436,800	UGX/a
Fuel Costs - Diesel	28,969,926	UGX/a
Gross Margin - ex. labour and collection cost	86,775,244	UGX/a

Increase profit by 80,000,000 UGX

Reduction of more than 21,000l/a diesel and 53 tCO_{2e}

Ideas and Strategy: NEGATIVE Waste-to-value Potential

Rice husks are a part of Fraction “Fine <25 mm” with 17,665 t/a

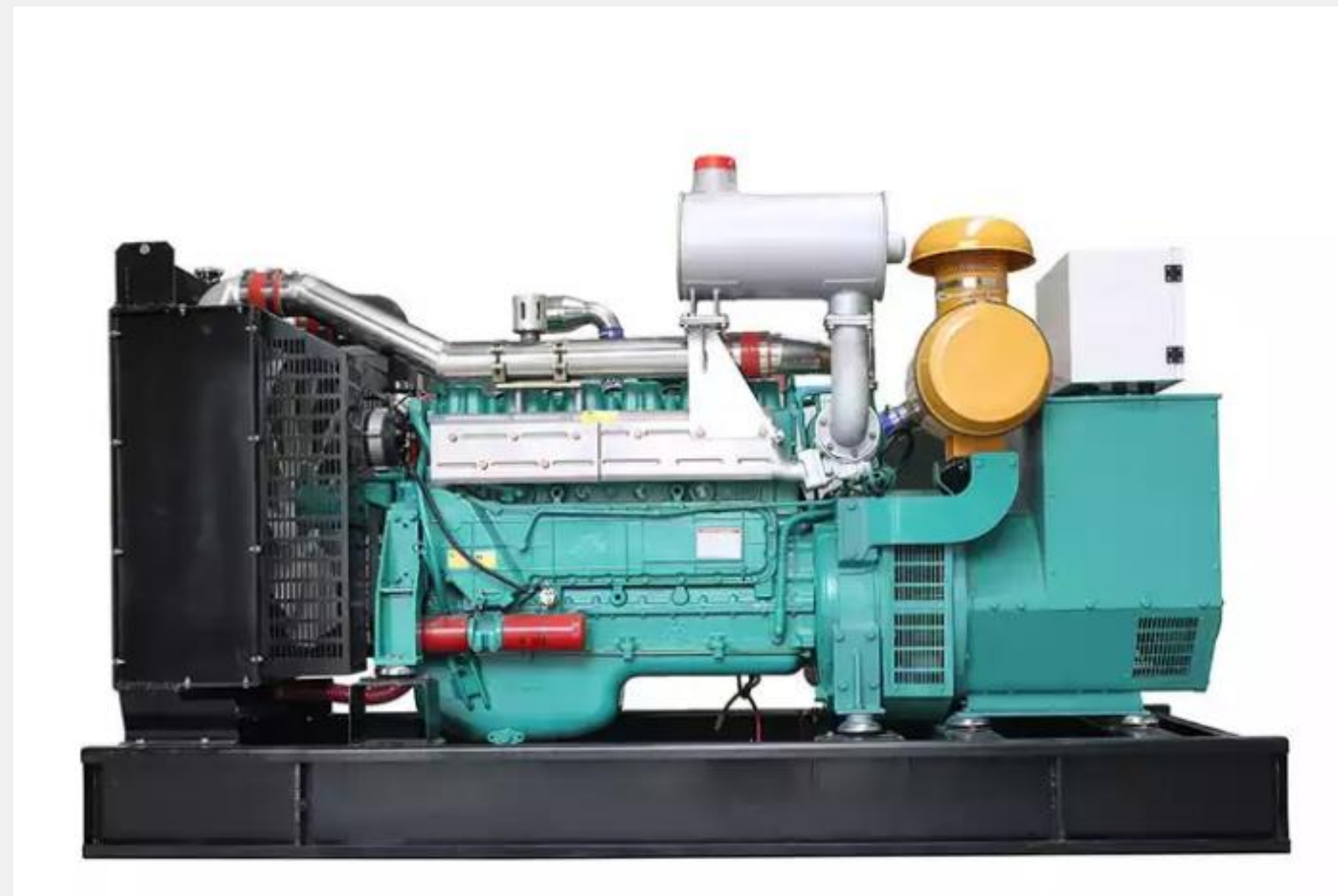


<i>ITEM</i>	<i>AMOUNT</i>	<i>UNIT</i>
Volume of truck (2m width x 8m length x 1.5m height)	18	m ³
Quantity of disposed rice husk	2.25	t
LFG emission mitigation potential	0.3	tCO _{2e}
Cost of Transport	300,000	UGX
Cost of Labour	40,000	UGX
Net energy potential per truck load	8,438	kWh
Replacement potential diesel per truck load	844	l _{Diesel}
Diesel emission mitigation potential	2.2	tCO _{2e}
Cost of diesel	5,062,500	UGX
Avoided landfill cost	343,872	UGX
Total Emission Reduction Potential	868.75	tCO_{2e}
Avoided cost potential ("negative added value")	300,028	UGX

Ideas and Strategy: INCREASING Waste-to-value Potential

Invest in rice husk power production

- 100 kW elec. capacity



Alternatives: rice husk briquetting and carbonizing to replace coal



Ideas and Strategy: INCREASING Waste-to-value Potential

Business opportunity: rice-to-green power

ITEM	UNIT	AMOUNT
CAPEX - rice husk power generator	108,000,000	UGX
Installed power capacity	100	kW
Plant load factor	46%	
Potential power output	400,000	kWh
Rice husk input demand	213,333	kg/a
Amount of truck loads	95	truck loads
Avoided diesel consumption for power	80,000	l/a
Grid emission mitigation potential	112	tCO _{2e}
CAPEX/y - Annual depreciation	20,880,000	UGX
OPEX - Maintenance	10,800,000	UGX
OPEX - Labour	40,000,000	UGX
OPEX - Transport & Logistics	23,703,704	UGX
Total Cost	95,383,704	UGX/a
Income - Avoided electricity cost	232,400,000	UGX/a
Income - Carbon Credits	4,017,600	UGX/a
Total Income	236,417,600	UGX/a
Annual Profit Prediction	141,033,896	UGX/a
Avoided Landfill Costs	32,604,160	UGX/a

Ideas & Strategy: Solid Waste to energy/biogas



Energy generation for cooking

www.irena.org



Appropriate waste collection and sorting



Biogas backpack (reduce deforestation)

Ideas and Strategy: Negative Waste-to-value Potential

Organic MSW is the biggest fractions of MSW with > 60%

Main source of landfill gas formation

ITEM	UNIT	AMOUNT	
		GMC	University
Population equivalent	p.e.	193,548	5,331
MSW production per capita/day (kg)	kg/d	0.35	0.15
MSW production per capita/year (t)	t/a	24,726	292
Organic fraction		57.7%	50%
MSW collection rate	%	70%	90%
Recycling rate	%	80%	90%
Recycling potential	t/a	7,989.39	118
Total LFG emission mitigation potential	tCO2e/a	198.9	2.6

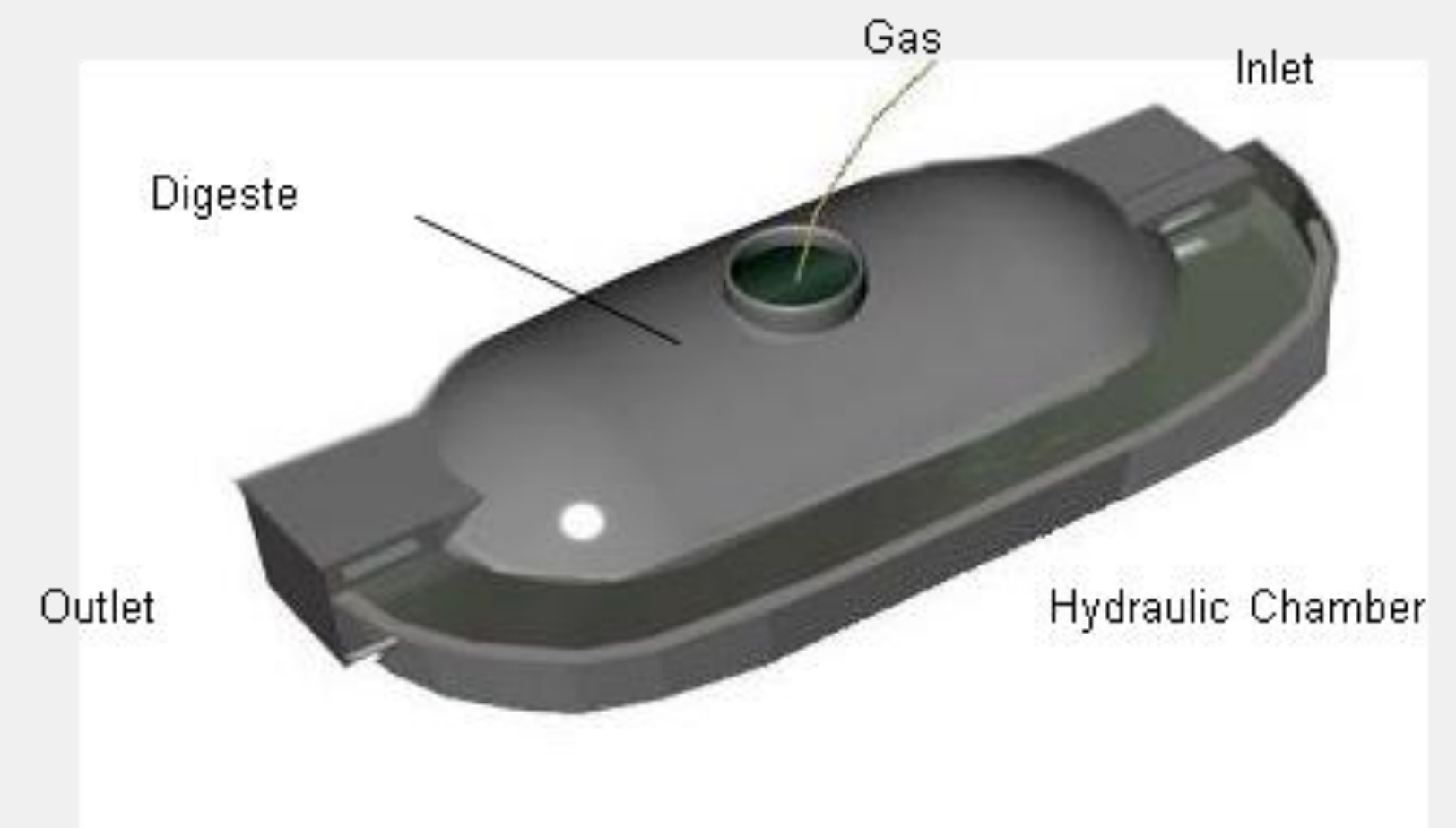


Ideas and Strategy: Negative Waste-to-value Potential

Business opportunity: small-scale biogas replacing cooking gas

Global DIY models to copy

University green economy student group as „business unit“ to transfer technology to schools, etc



Ideas and Strategy: Increasing Waste-to-value Potential

Business opportunity: small-scale biogas replacing cooking gas

ITEM	UNIT	AMOUNT	SOURCE/ ASSUMPTION
Total amount of collectable organic fraction	t/a	118	IPILC, 2018 - University own observation
Digester volume	m ³	66	
Volume of biogas per ton of organic waste	m ³ /t	60	Janathakshan, 2022
Biogas produced	m ³	7,092	
Butan bottle replacement potential	butan bottle	543	EF Butan 2.2 kgCO _{2e} / kg Butan
Butan emission mitigation potential		7.17	
CAPEX - DIY biogas plant	UGX	59,104,131	Unit cost per m ³ fermenter volume 250 EUR Lifespan 6 years - 16% Interest 10 % of CAPEX 10,000 UGX/h - 1,000 h/a
CAPEX/y - Annual depreciation	UGX	11,426,799	
OPEX - Maintenance	UGX	5,910,413	
OPEX - Labour	UGX	10,000,000	
Total Cost	UGX/a	27,337,212	
Income - Replaced butan bottle	UGX/a	29,868,778	Shell Uganda Carbon Credit 36,000 UGX / VERRA
Income - Carbon Credits	UGX/a	352,746	
Total Income		30,221,524	
Annual Profit Prediction	UGX/a	2,884,312	
Avoided Landfill Costs	UGX/a	-	
Income for soil fertilizer	UGX/a	-	

Ideas and Strategy: Resource Centre instead of landfills!

Biowaste is seen and treated as a resource!

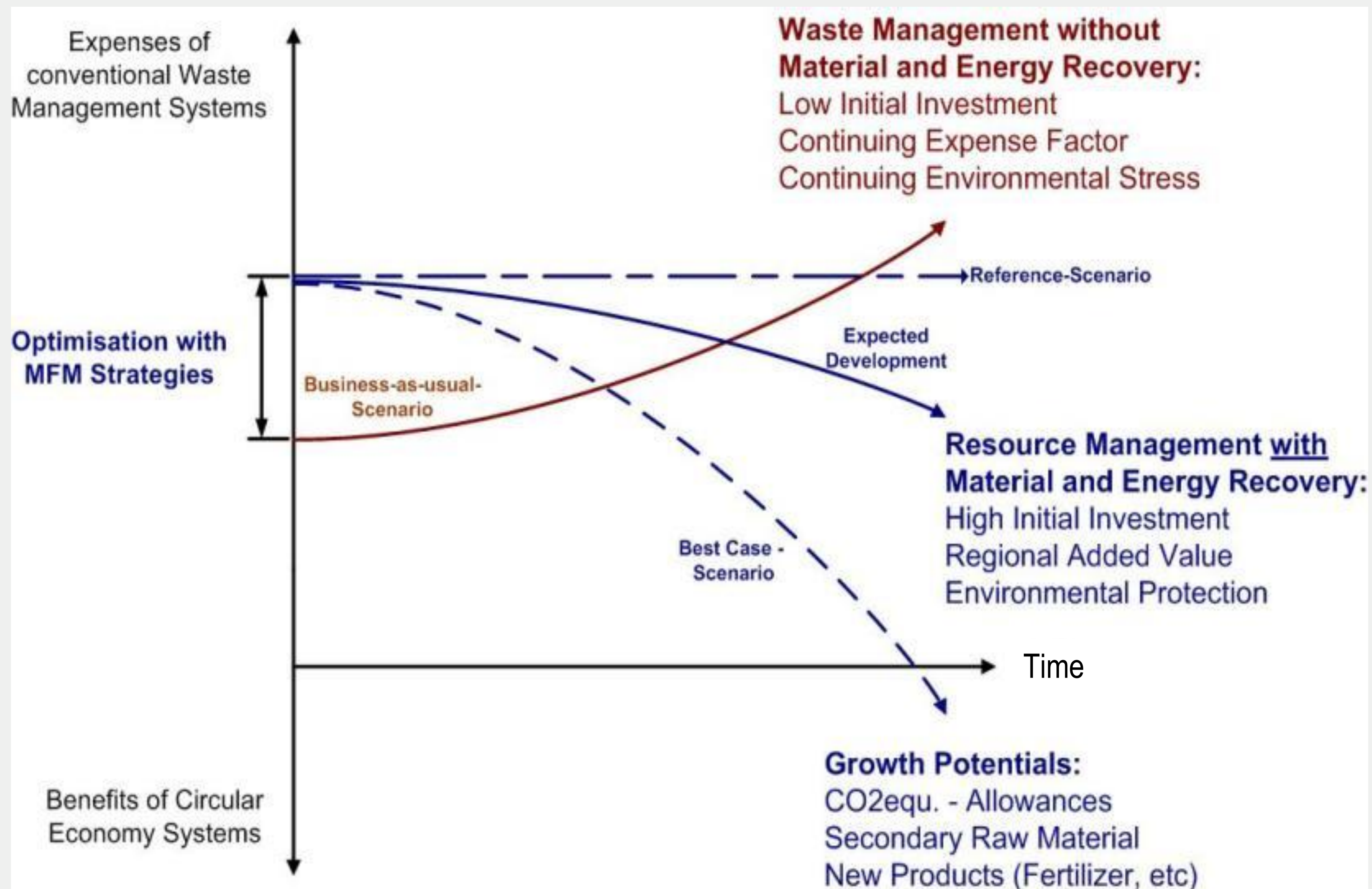
Landfill for inert and valueless material only

Social inclusion for grey sector

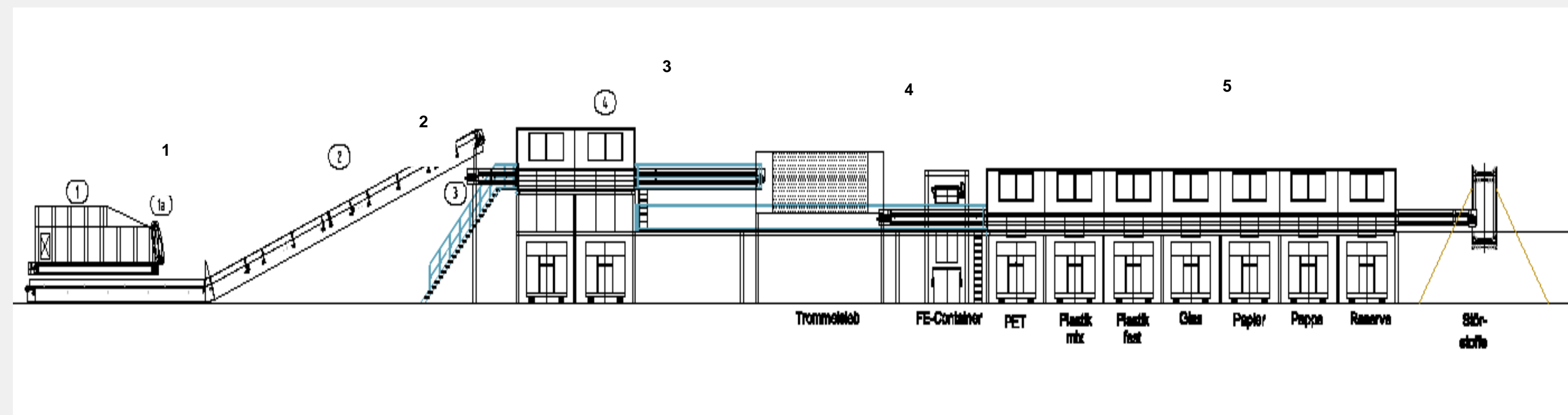


From waste to resource management
No disposal in the future

Conclusion – Cheap is not value creating



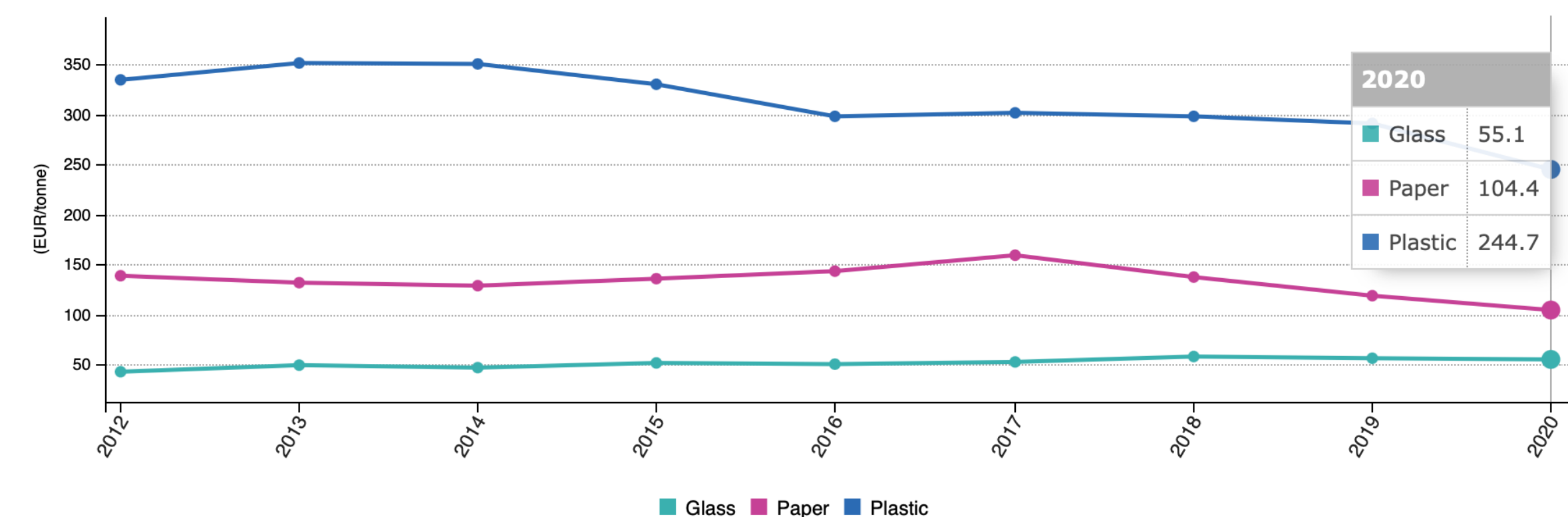
Mechanical treatment – mainly manual



Legend:

1. Reception
2. Transport Band
3. Cabins 1: for separation of disturbing materials
4. Trommel for separation of waste fractions: <80mm and >80mm
5. Cabins 2: for separation of waste fractions (paper, plastics, metals, etc)

Average price indicator for glass, paper and cardboard and plastic, EU-27 (2012-2020) EUR/tonne



Source: Eurostat COMEXT

eurostat

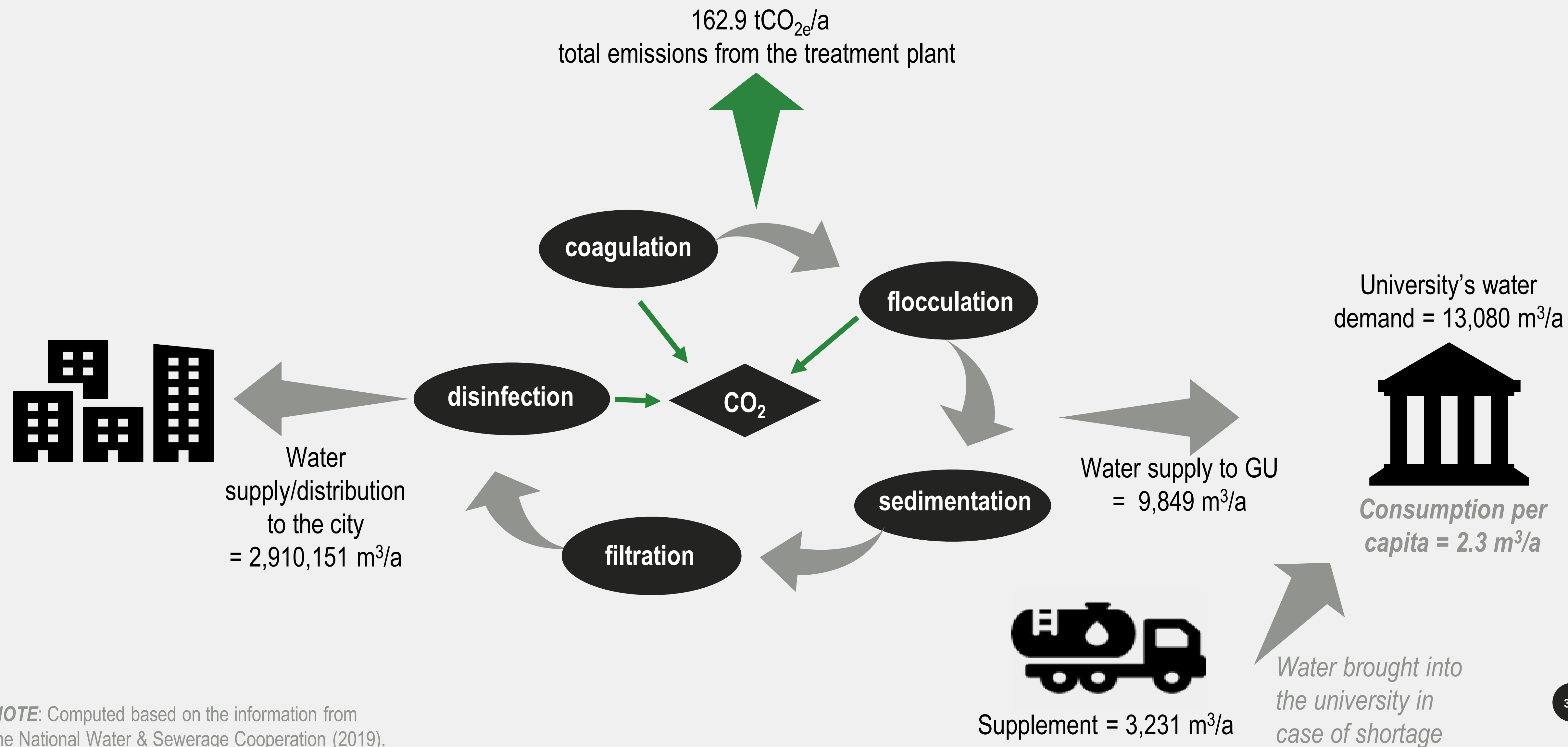
Increasing Waste-to-value potential

Business opportunity: HiTec-Sorting and biogas plant

ITEM	UNIT	AMOUNT	SOURCE/ ASSUMPTION
Total amount of collectable organic fraction	t/a	7,989	IPILC, 2018 - University own observation
Biogas produced	m³	798,939	
Net energy potential	kWh/a	4,394,163	55% CH ₄ content of biogas
Designated electrical capacity	kW	563.35	
Electrical energy generation	kWh	1,757,665	
Thermal energy generation potential	kWh/a	1,977,373	45% ETA
Grid emission mitigation potential	tCO _{2e} /a	490.39	
CAPEX - HiTec biogas plant	UGX	6,084,225,181	CAPEX 3,000 EUR per kW
CAPEX/y - Annual depreciation	UGX	657,096,320	Lifespan 10 years - 8% Interest
OPEX - Maintenance	UGX	304,211,259	5 % of CAPEX
OPEX - Labour	UGX	60,000,000	10,000 UGX/h - 4,000 h/a - 3 skilled labour
Total Cost	UGX/a	1,021,307,579	
Income - Electricity	UGX/a	1,021,203,395	Shell Uganda
Income - Carbon Credits	UGX/a	17,653,988	Carbon Credit 36,000 UGX / VERRA
Income - Avoided Landfill Costs	UGX/a	272,162,146	IPILC, 2018 (OPEX (2022) 540,969 EUR / 57,169 t MSW disposed)
Total Income	UGX/a	1,038,857,383	
Annual Profit Prediction	UGX/a	17,549,805	
Income for thermal energy	UGX/a	-	
Income for soil fertilizer	UGX/a	-	

Water Supply

Status Quo: Fresh Water



Ideas & Strategy: Water use by Faucet

Technology Comparison - Faucet Replacement				
ITEM	UNIT	OLD	NEW	
Water output	l/min	6	2	
Unit	x	10	10	
Usage per day	min	10	10	
Water demand annual	m ³ /a	219	69	
Saving potential	%		68%	
Water savings annual	m ³ /a		150	
Estimated CAPEX	UGX		1,080,000.00	
Monetary Savings	UGX/a		564,330	
Payback	a		1.9	



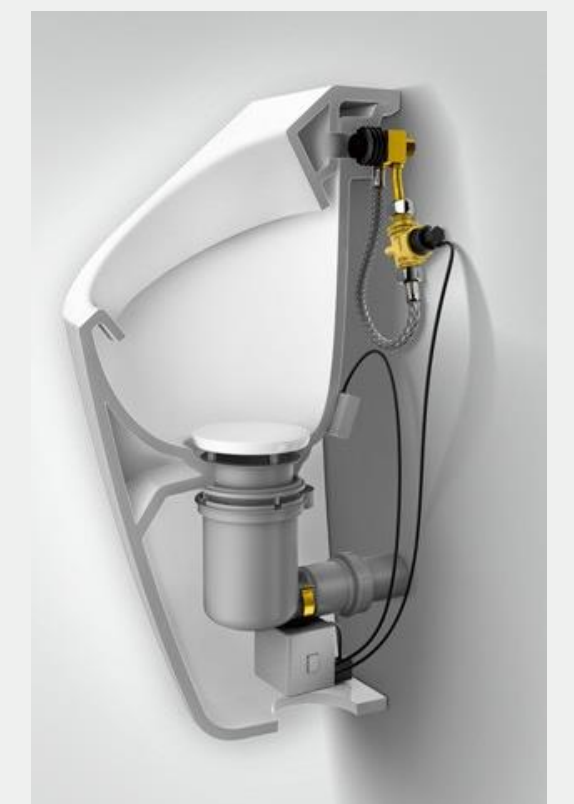
Ideas & Strategy: Water use by Cistern

Technology Comparison - Cistern replacement				
ITEM	UNIT	OLD	NEW	
Water amount single use	l	12	4	
Units	x	10	10	
Usage per day	users/day	10	10	
Water demand annual	m ³ /a	219	73	
Saving potential	%		67%	
Water savings annual	m ³ /a		292	
Estimated CAPEX	UGX		1,728,000.00	
Monetary Savings	UGX/a		1,101,132	
Payback	a		1.7	



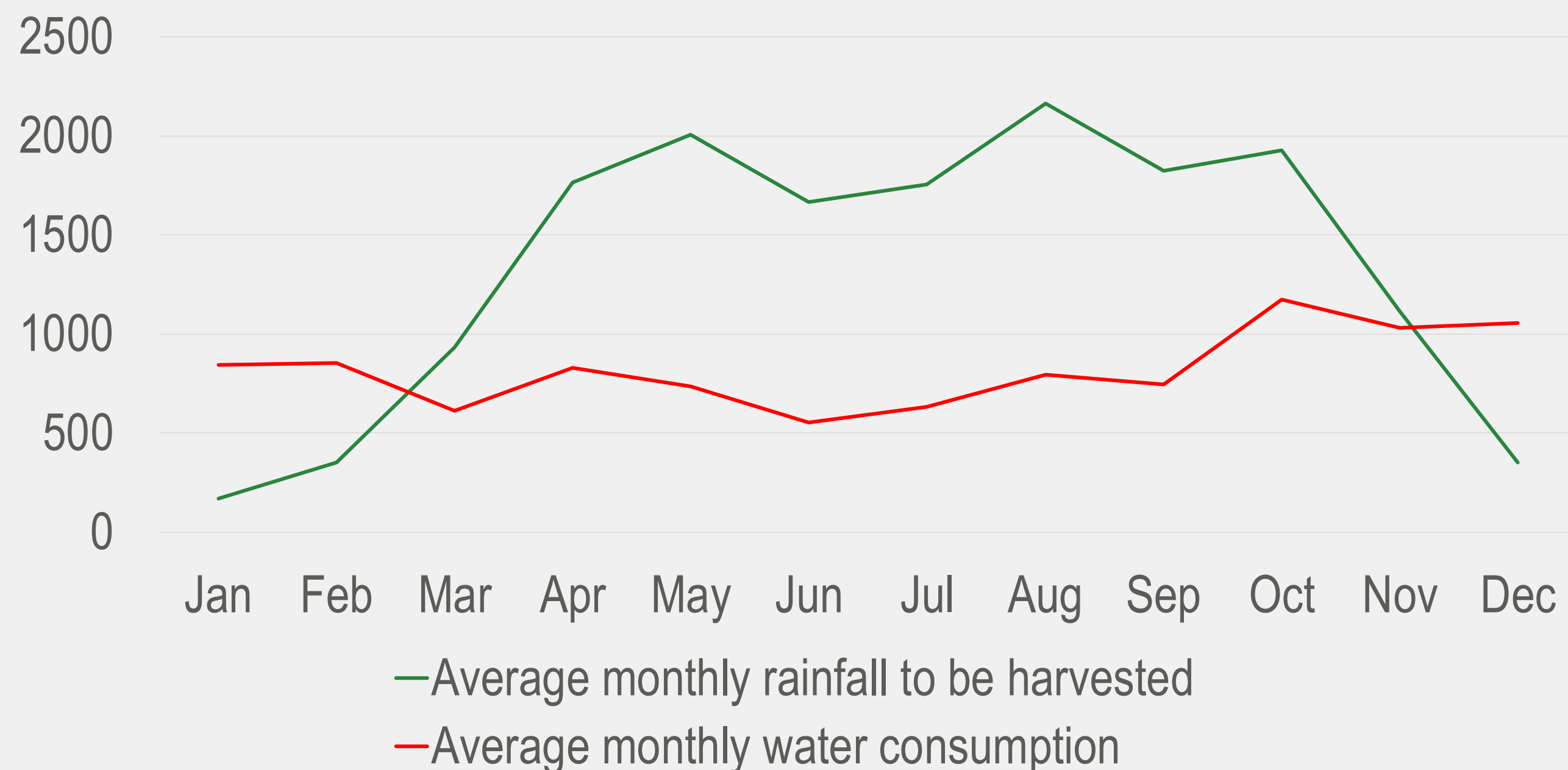
Ideas & Strategy: Waterless urinals

Technology Comparison - Waterless urinals				
ITEM	UNIT	OLD	NEW	
Water output	l/flush	4	0	
Units	x	4	4	
Usage per day	times	30	30	
Water demand annual	m ³ /a	162	0	
Saving potential	%		100%	
Water savings annual	m ³ /a		162	
Odor trap cost	UGX/a		72,000	
Monetary Savings	UGX/a		539,128	
Estimated CAPEX	UGX		3,420,000	
Payback	a		6.6	



Ideas & Strategy: Rain Water Harvesting

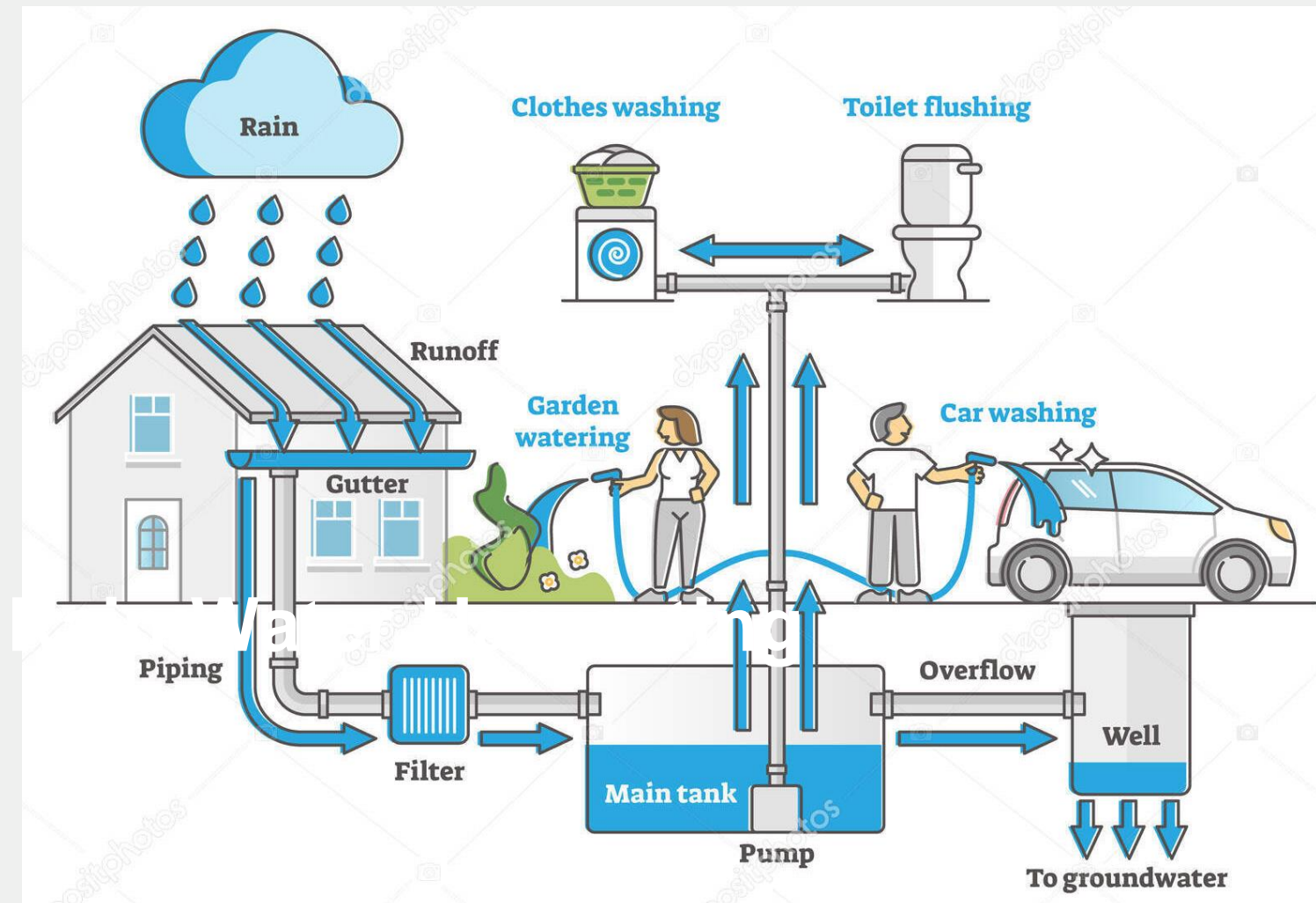
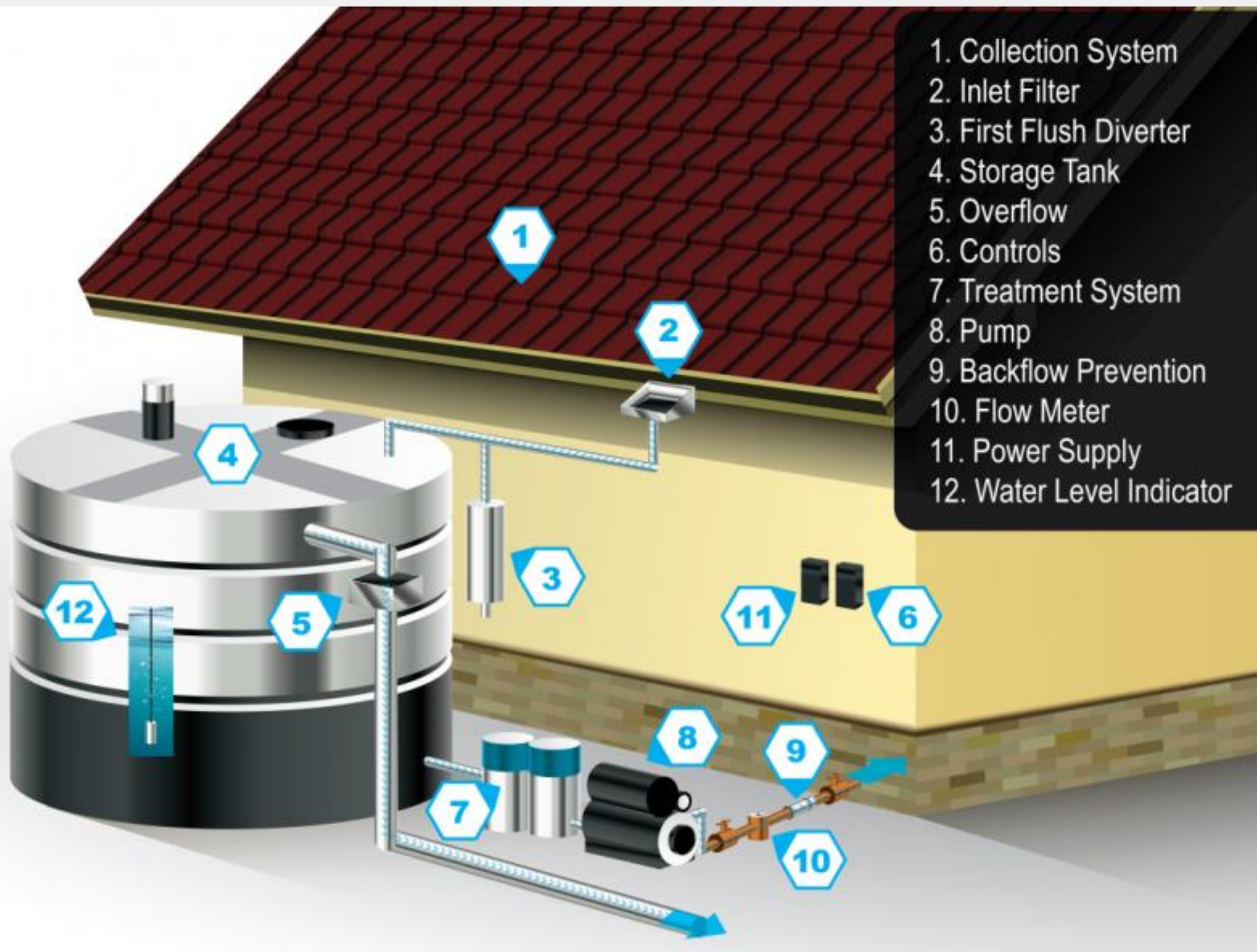
Rainwater harvesting potential in relation to water consumption per month



ITEM	Unit	Value
Catchment/roof area (A) (30% from the available total rooftop area)	m ²	4,284
Average annual rainfall (R)	mm	1,197
Annual available rain water	m ³ /a	2,051



Ideas & Strategy: Rain Water Harvesting



Reservoir for 680 m³ of
rainwater
(Approx 4 months of rainwater)



ITEM	UNIT	VALUE
Total construction cost	UGX	51,060,749
Operating cost	UGX/a	1,021,215
Monetary saving	UGX/a	7,734,385
Payback period	a	9.2
Levelized cost of service unit (LCoS)	UGX/m ³	3,699

Wastewater

Status Quo: Wastewater

Total water consumption at university: 13,080.67 m³/a

Wastewater generation capacity: **11,772.60 m³/a**
(90% of the FW input. per capita per day: (6.65 L))

BOD/COD content

BOD: incoming: 450mg/L outgoing =47mg/L

COD: incoming: 500mg/L outgoing =70mg/L

 Emissions: 21 tCO_{2e}/a



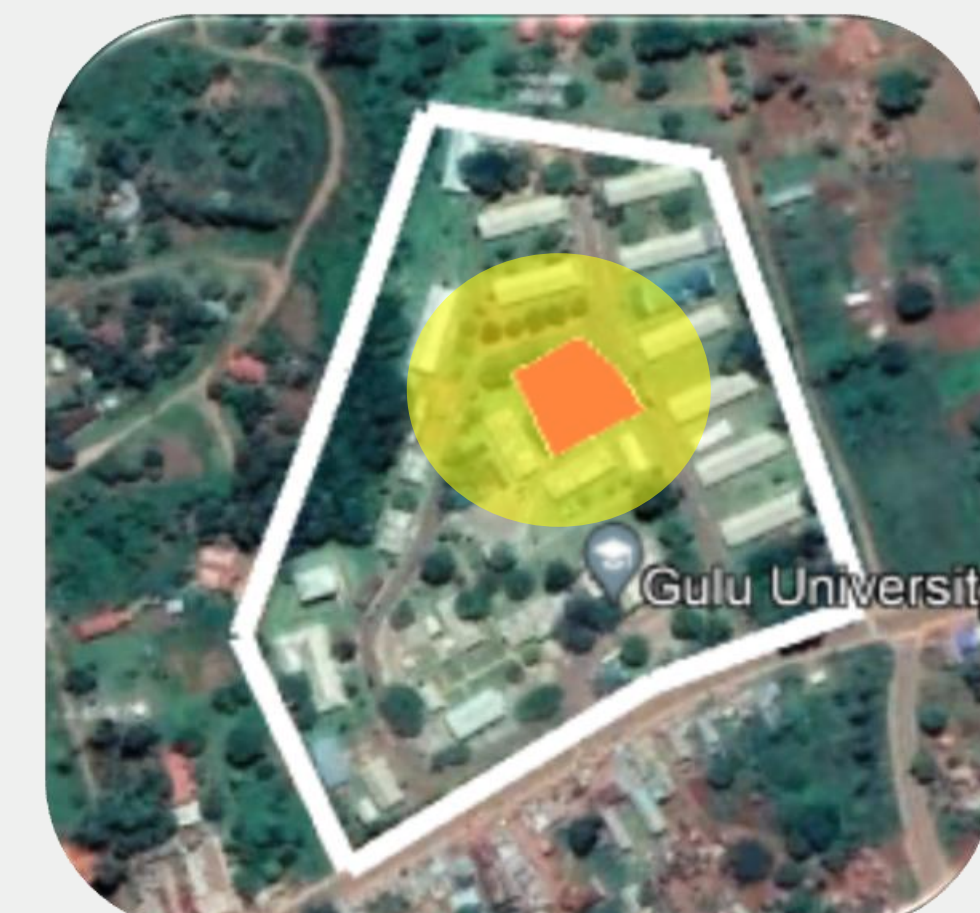
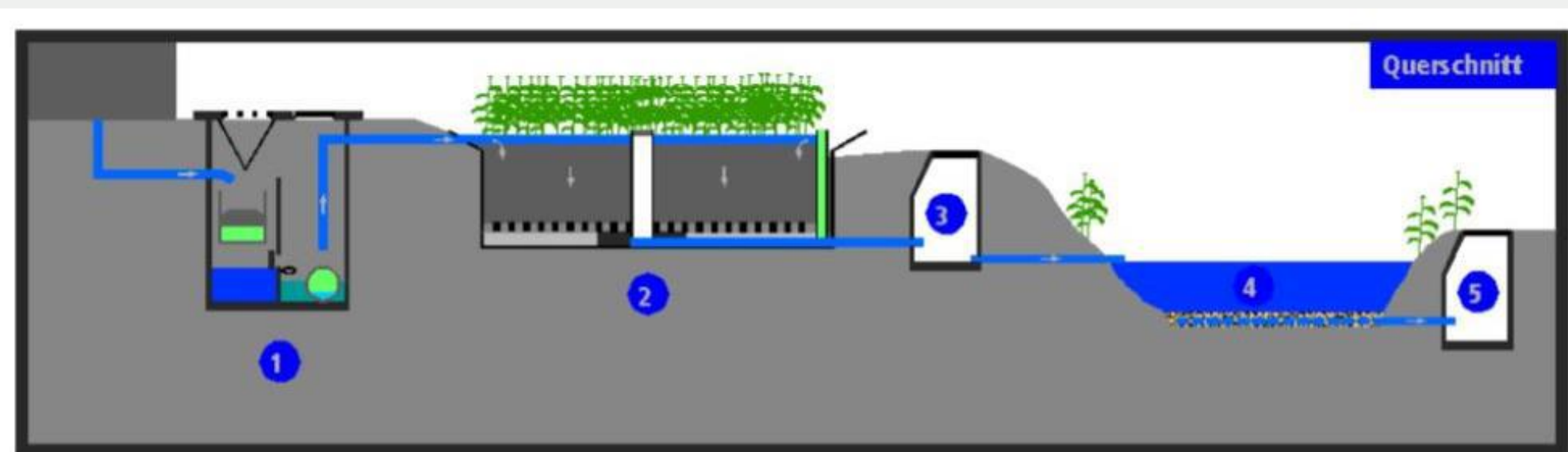
Ideas & Strategy: Reed Bed Filter

Sustainable water management: treated by nature

The proposal considers the construction of separate RBF at each campus. The design and the drainage system of each campus and the topography are considered

Volume (2021): 11,772.60 m³/a

Area requirement: 537 m²



Ideas & Strategy: Sustainable Land-Use



- Fuel wood production
- High-value crops
- Carbon sequestration
- Food Production
- Sink of fertigation water
- Shading

Ideas & Strategy: Irrigation

Reed Bed Filter		
	Input volume (m ³ /day)	Output volume (m ³ /day)
Total	32,28	29,05

Crop selection for treated sewage effluent

ITEM	UNIT	BANANA	GUAVA	MAIZE
Spacing	Meter	2,4x2,4	3x3	0,75x0,75
Crop water requirement	mm/month	240	16	150
Yield	kg/tree/a	40	35	0,4



SOURCE: flawlessconsultantsug.org

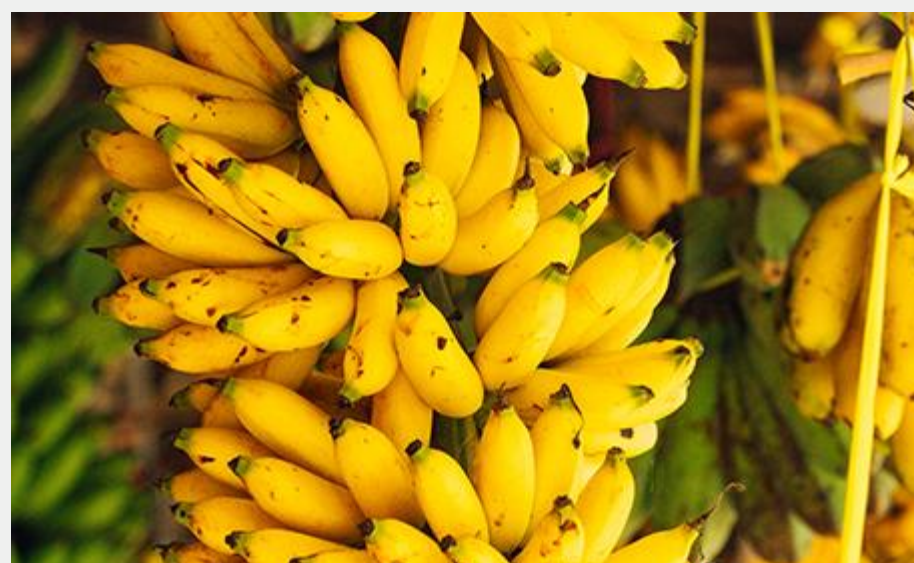


SOURCE: agrifarming.in



SOURCE: bussinessfocus.co.ug

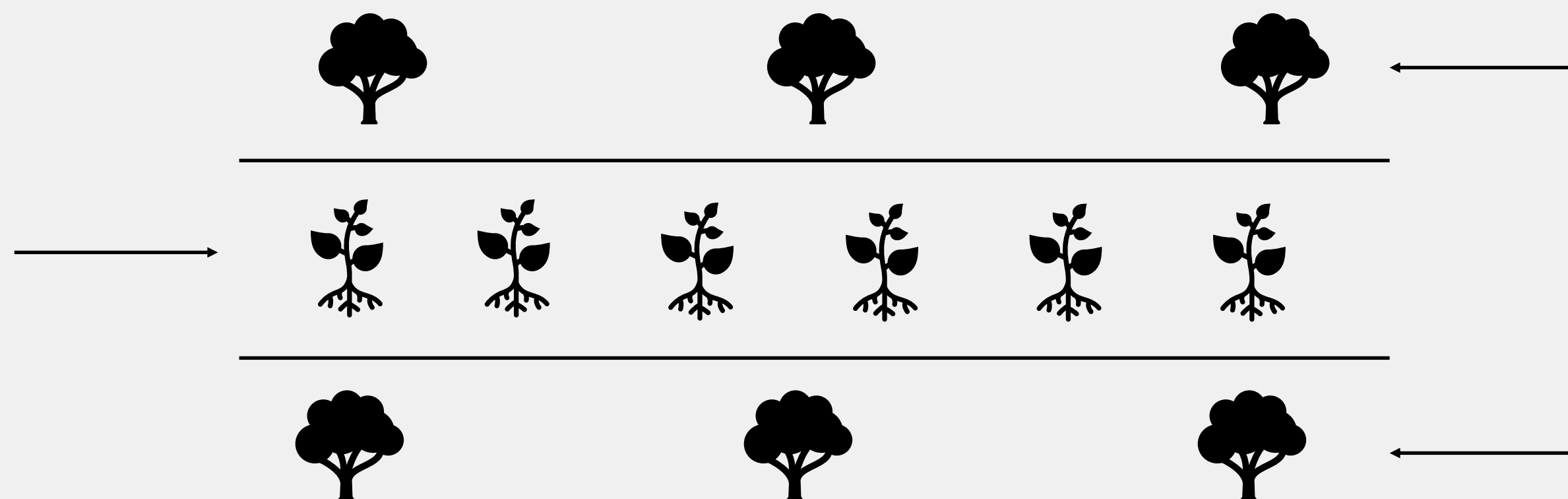
Ideas & Strategy: Cashcrops



ITEM	UNIT	BANANA	GUAVAS	MAIZE
Number of plants		377	194	1,356
Yield	kg/a	15,063	6,778	542
Price	UGX/kg	2,000	2,500	2,100
Income	UGX/a	30,125,926	16,945,833	1,138,760

Total potential income = 48,201,519 UGX (35,847.11 Euros)

Ideas & Strategy: Green Fence



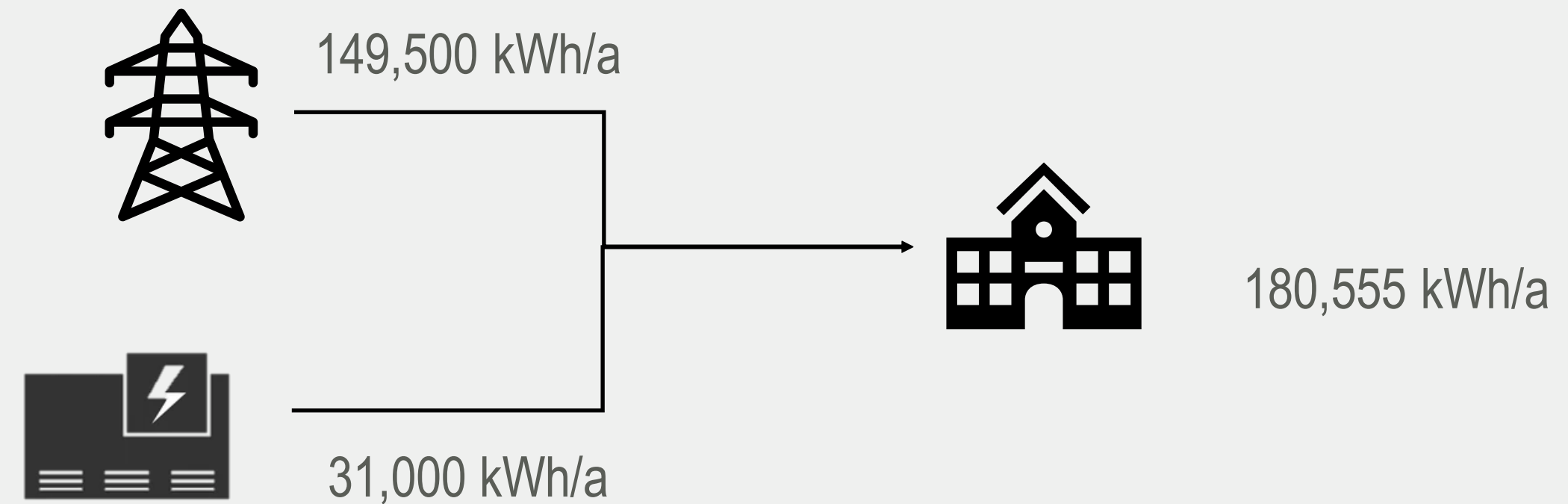
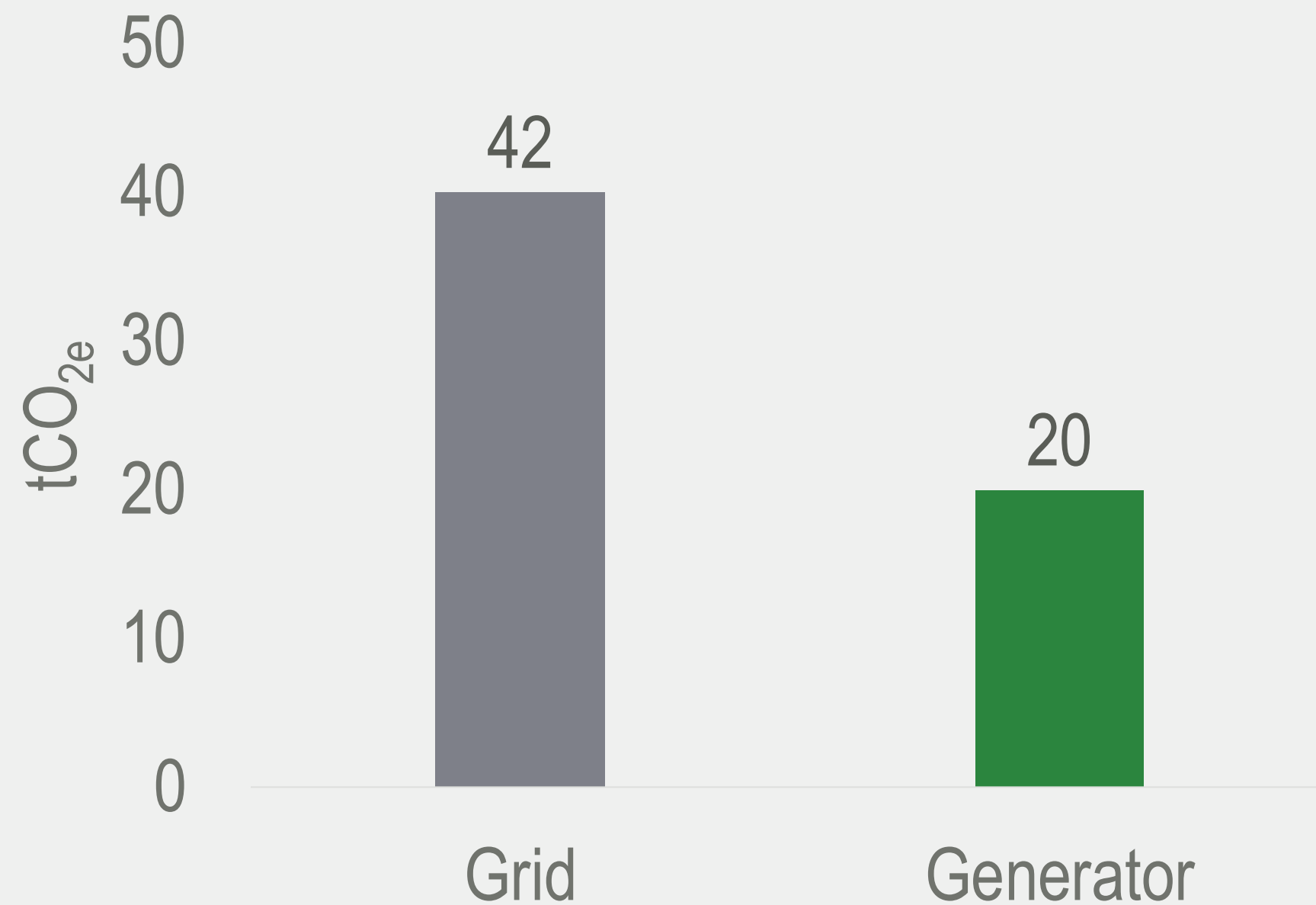
Sustainability Benefits of Gliricidia		
ITEM	UNIT	VALUE
Estimated Total length of Green Fence	m	4,000
Total biomass production	t/a	484
Total energy potential	MWh/a	906
Total carbon sequestration potential	t/a	218

Sustainability benefits of Teak		
ITEM	UNIT	VALUE
Total number of teak trees		640
Total economic value of final product	UGX	691,200,000
Total carbon sequestration potential (25 years)	t	21,327

Energy system

Status Quo: Energy

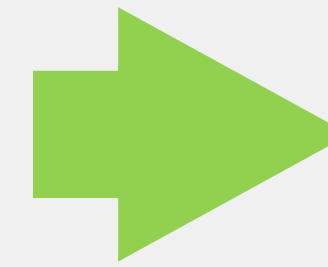
GHG Emissions



ITEM	UNIT	AMOUNT
Electricity consumption from the Grid	kWh/a	149,500
GHG emissions	tCO _{2e} /a	42
Fuel input demand	l/a	7,764
Energy from Generator	kWh/a	31,055
GHG emissions	tCO _{2e} /a	20
Total Energy Supply	kWh/a	180,555
Electricity costs	UGX/a	109,579,086.00
Total Emissions	tCO _{2e} /a	62

Ideas & Strategy : Pump Replacement

ITEM	UNIT	AMOUNT
Operating hours	h/a	3650
Total dynamic head	m	20
Flow rate	m ³ /s	0.003
Nominal installed capacity	kW	4
Calculated efficiency rate (η)	%	19%
Energy consumption	kWh/a	8,687
Annual costs	UGX/a	5,003,712
New power absorption	kW	1
New efficiency rate (η)	%	66%
Equipment Cost	UGX	10,526,400
Energy Savings	kWh/a	6,520
Cost Savings	UGX/a	3,755,967
CO _{2e} Savings	t/a	1.8
Payback time	a	2.8
IRR	%	40%



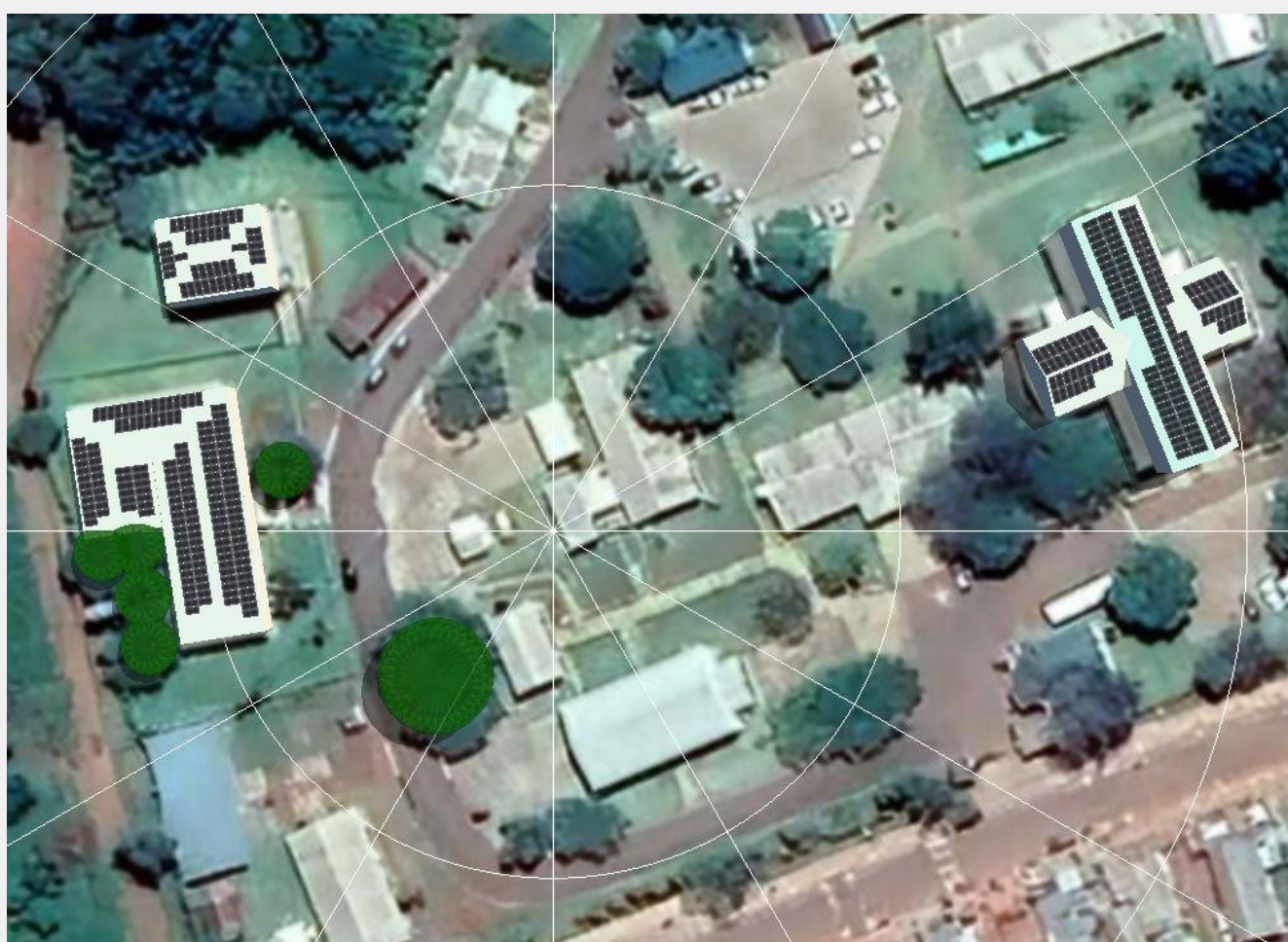
$$\eta = \frac{Q \left(\frac{m^3}{s} \right) * H(m) * \left(\frac{kg}{m^3} \right) * 9.81 \left(\frac{m}{s^2} \right)}{EC_p(w)}$$

Ideas & Strategy : Light Replacement analysis

ITEM	UNIT	FTL	LED - Low Tech	LED - High Tech
Approximate cost per bulb	UGX	800	1,355	1,355
Average lifespan	h	5,000	20,000	50,000
Watts used	W	36	18	16
No. of bulbs needed for 50,000 hours of use	x	10	3	1
Operating hours	h	10	10	10
Operating hours of the year	h/a	2,450	2,450	2,450
Total purchase price of bulbs over 50000 hrs	UGX	360,000	216,000	144,000
Total cost of electricity used (50,000 hours at 580 UGX/kWh)	UGX	1,044,000	522,000	464,000
Total cost over 50,000 hours	UGX	1,404,000	738,000	608,000
Cost per operational year	UGX/a	68,796	36,162	29,792



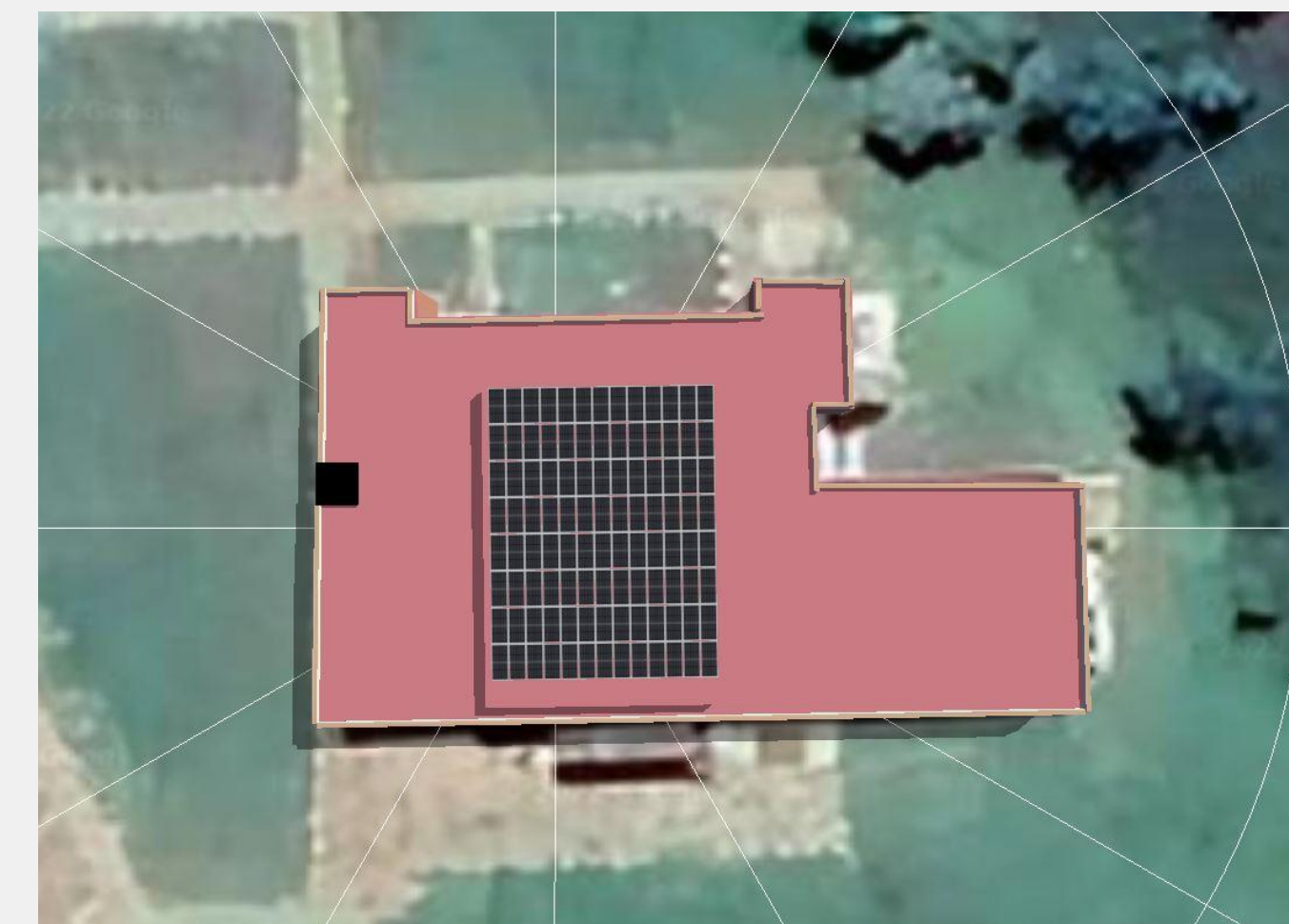
Ideas & Strategy: Photovoltaic system for Gulu University



Main Campus



Faculty of Agriculture



Forest Campus

ITEM	UNIT	AMOUNT
Installed Capacity	kWp	179
Generation	kWh/a	362,235
Annual Yield	kWh/kWp	1,824
Solar Fraction		70%

ITEM	UNIT	AMOUNT
Installed Capacity	kWp	73
Generation	kWh/a	147,031
Annual Yield	kWh/kWp	2,005
Solar Fraction		69%

ITEM	UNIT	AMOUNT
Installed Capacity	kWp	49
Generation	kWh/a	95,973
Annual Yield	kWh/kWp	1,927
Solar Fraction		75%

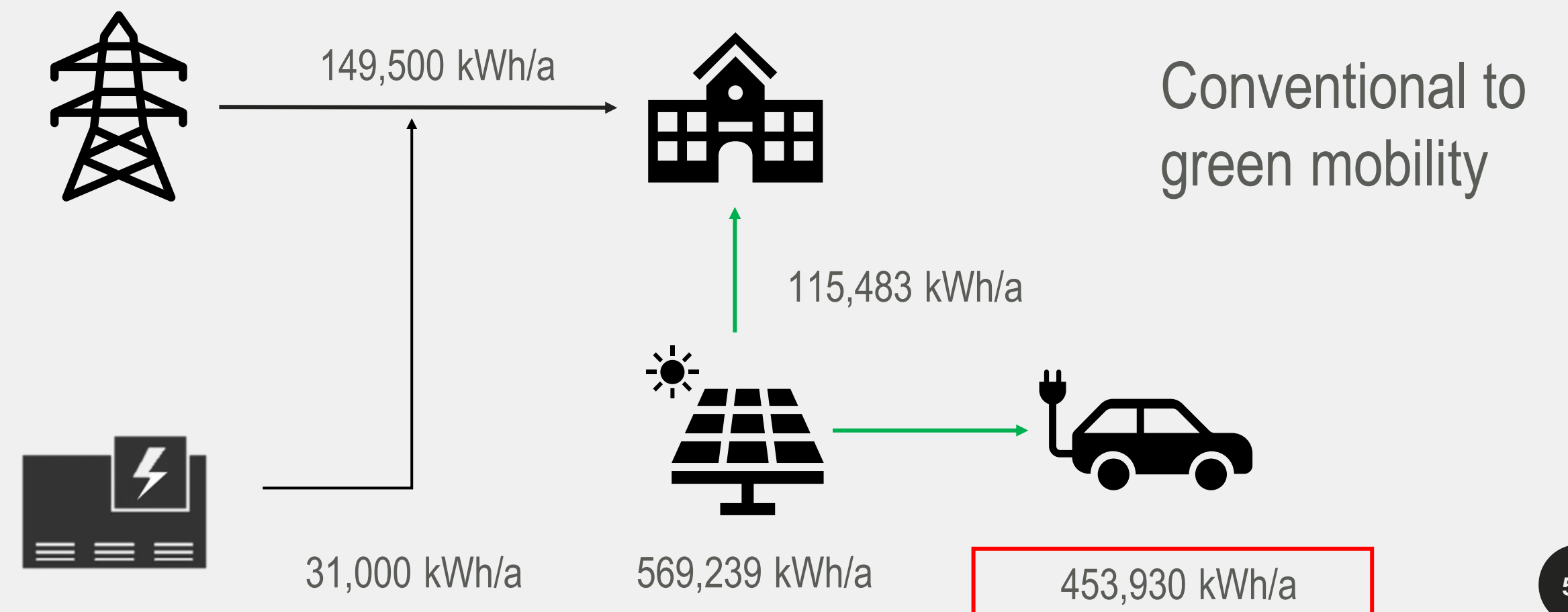
Ideas & Strategy: Photovoltaic system for Gulu University

Location	Consumption by Grid (2021)	Installed capacity	Specific Annual Yield	Annual generation	Self consumption	Solar fraction (annual)	LCoE	LCoE (With Loan)	GHG Savings
	kWh/a	kWp	kWh/kWp	kWh/a	%	%	UGX/kWh	UGX/kWh	t CO _{2e} /a
Forest Campus	35,484	49	1,927	95,973	28%	75%	126	242	7
Main Campus	53,392	179	1,824	326,235	11%	70%	134	257	10
Faculty of Agriculture	29,624	73	2,005	147,031	14%	69%	123	235	6

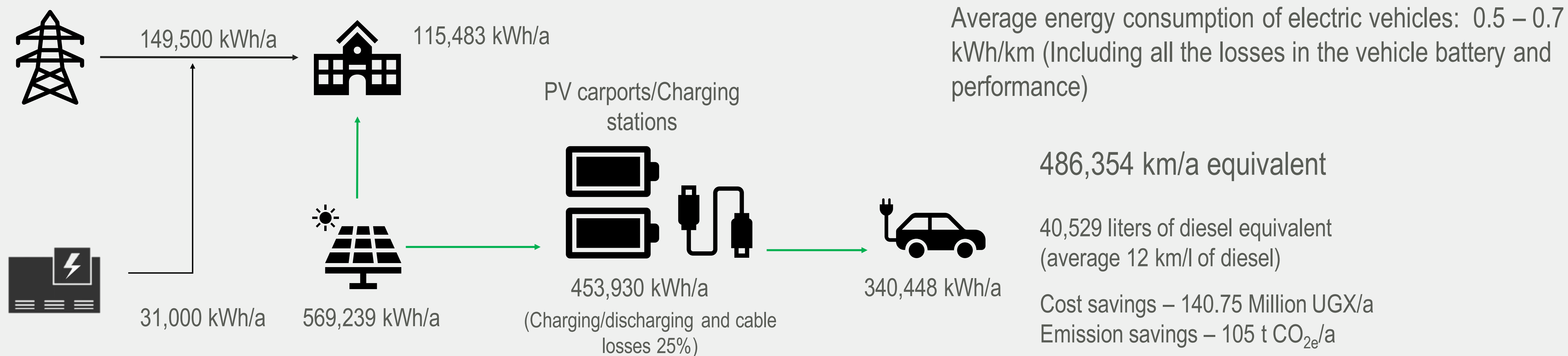
Consumption is based on the simulated load profile for PV

Energy supplied by Generators -	31,000	kWh/a
Total electricity supply covered by PV -	115,493	kWh/a
Total GHG emission abatement -	52	tCO _{2e} /a
Total cost savings -	76 mil	UGX/a
Available excess generation -	453,930	kWh/a

Unitary turnkey price – 1,000 USD/kWp
Current electricity price - 581 UGX/kWh



Ideas & Strategy: Photovoltaic for green mobility



Photovoltaic system KPIs



Energy & fuel price inflation (4-5%/year)

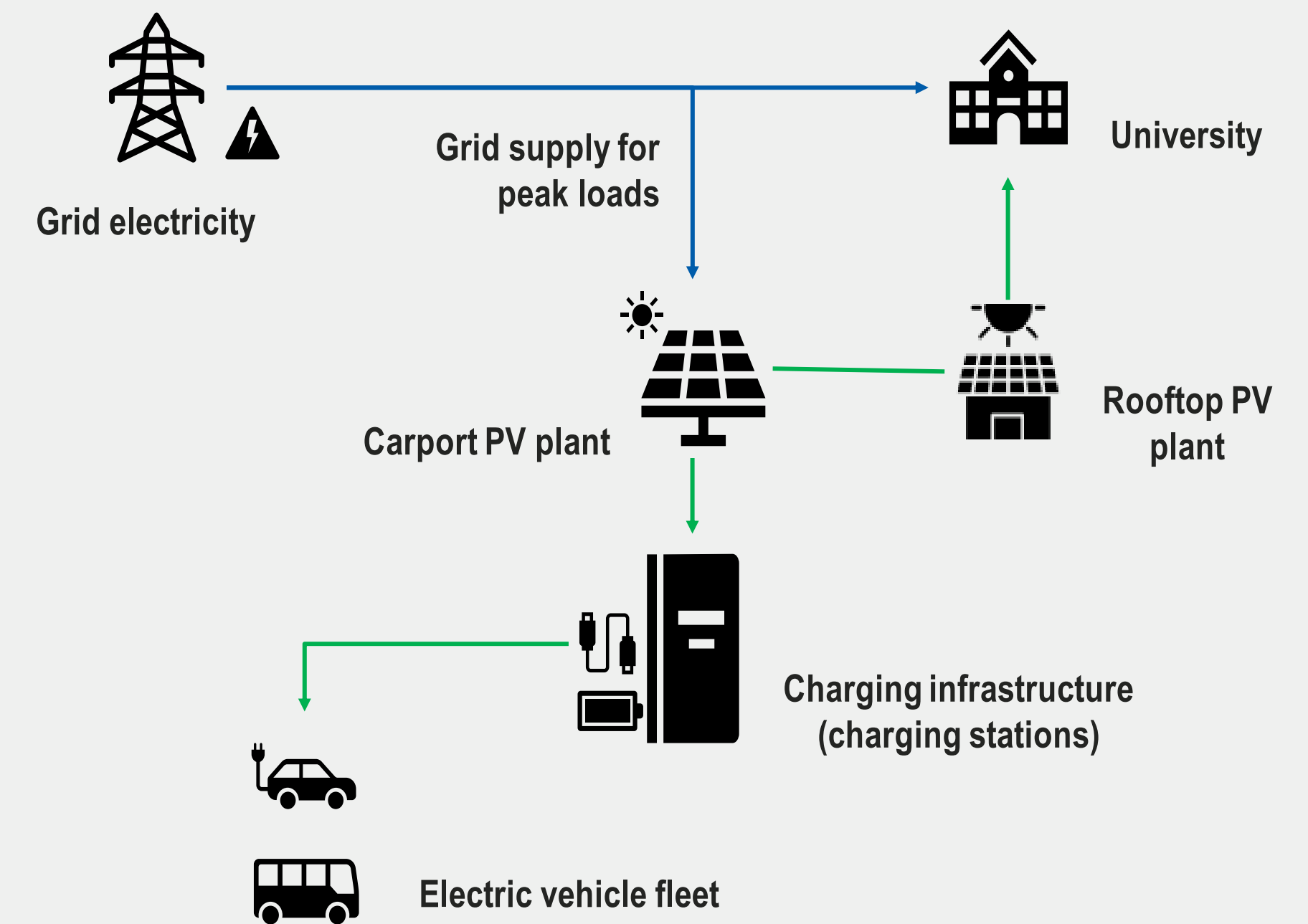
ITEM	UNIT	AMOUNT
Total installed capacity	kWp	301
Specific Annual Yield	kWh/kWp	1,893
Estimated investment	UGX	3.23 tril
LCoE	UGX/kWh	129.9
LCoE (With 16% loan)	UGX/kWh	248.6
Total GHG savings	tCO _{2e} /a	157.7
Payback period	Years	11

Future: Solar Carports – Use of parking spaces



Aspects:

- Enough space
- Shading for vehicles
- Solution for rising energy prices
- Promotion of Green mobility



Mobility

Ideas & Strategies: GU Electric Vehicle Fleet



ITEM	UNIT	AMOUNT
Average mileage	km/a	496,594
Total energy requirement	kWh/a	347,615.8
Required PV space for mobility	m ²	789.4
Cost savings (approx.)	UGX/a	54,352,495
GHG savings (Based on fuel consumption data)	tCO _{2e} /a	201

Status Quo: Transport



BUSES 03



BIKES 05



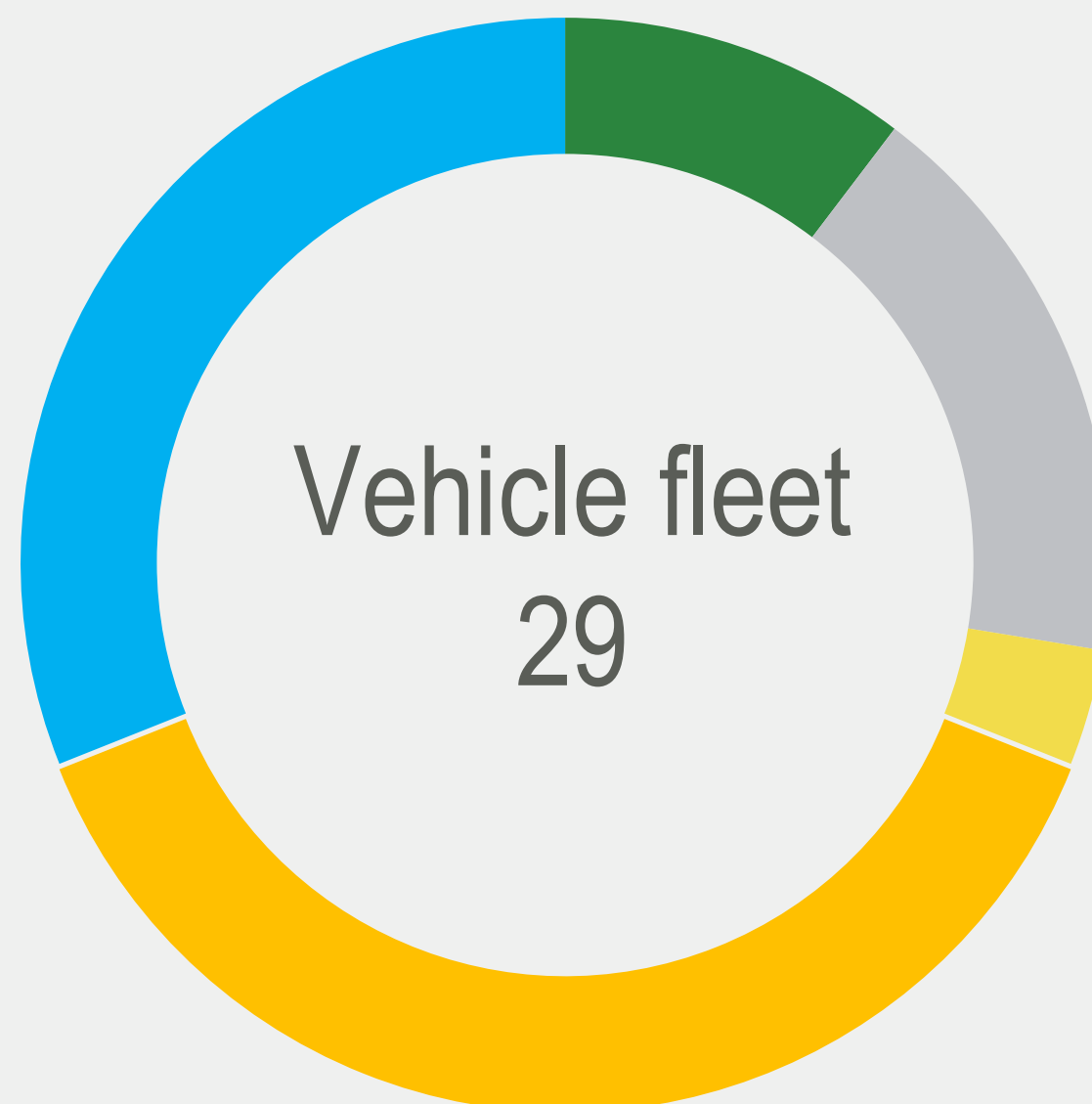
AMBULANCE 01



PICK UP 11



STW 09



ITEM	UNIT	AMOUNT
Distance travelled	km/a	496,595
Fuel consumption	l/a	75,759
Fuel costs	UGX/a	488,460,776
GHG emissions	tCO _{2e} /a	201

Ideas & Strategies: Electric Mobility



Electric vehicles:
Efficient and sustainable with low
maintenance costs

Perform regular maintenance
e-Boda Boda Station
Bike Rentals

Ideas & Strategies: The City Boda Boda

Swapping Center

*E-Boda Boda Charging
Station*

Rental Services

What to achieve:

Capacity building: Awareness of the systems

Repair and maintenance support: providing jobs to non-educated workers

Establishing a circular economy: within the university energy circuit



Ideas & Strategies: Life Cycle Cost Analysis

ITEM	UNIT	CURRENT VEHICLE	E-VEHICLE
Parameter	Units	Current vehicle	E-Vehicle
Model		NISSAN PICK-UP	FORD F-150 LIGHTNING
Capex	UGX	100,800,000	111,600,000
Fuel Consumption per 100 km	l or kWh	10	26
Annual Mileage	km/a	27,649	27,649
Fuel Costs	UGX/l or UGX/kWh	6,270	249
Total Fuel Costs Per year	UGX/a	16,637,253	1,820,811
Maintenance Cost	UGX/a	10,080,000	2,232,000
Emissions Per Year	tCO _{2e} /a	7	0
Life Cycle cost (Over 10 years)	UGX/a	36,797,253	15,212,811



Ideas & Strategies: Life Cycle Cost Analysis

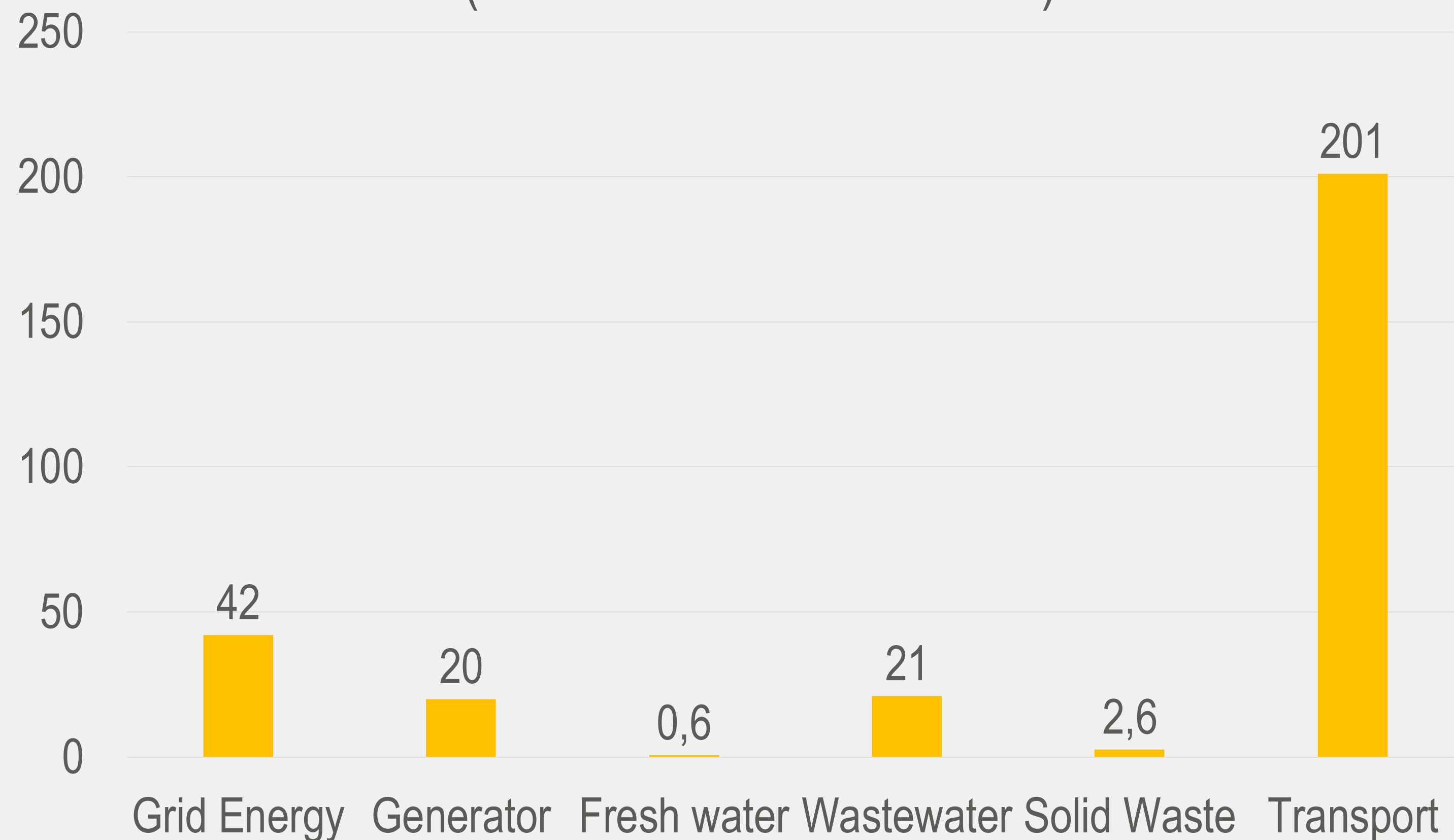
ITEM	UNIT	CURRENT VEHICLE	E-BUS
Model		SCANIA BUS	KAYOOLA EV
Capex	UGX	150,000,000	900,000,000
Fuel Consumption per 100 km	l or kWh	18	250
Annual Mileage	km/a	38,710	38,710
Fuel Costs	UGX/l or UGX/kWh	6,270	249
Total Fuel Costs Per year	UGX/a	44,129,032	24,058,065
Maintenance Cost	UGX/a	7,500,000	18,000,000
Emissions Per Year	tCO _{2e} /a	52	0
Life Cycle cost (over 10 years)	UGX/a	66,629,032	132,058,065



Conclusion

Status Quo - GHG Balance of GULU University

Total CO_{2e} Emissions (tCO_{2e}/a)
(Based on 2019–2021 data)



Total GHG emissions

287.2 tCO_{2e}/a

Average GHG Emission (Gulu University)

0.05 tCO_{2e}/ca/a

Average GHG Emission (Uganda)

0.1 t CO_{2e}/ca/a

Total Investments & Savings (cont.)

	ITEM	UNIT	AMOUNT	Payback (in years)
MSW	Balling Press			
	Regional Added Value Potential - PET	UGX/a	162,861,970	
	Total Cost	UGX	47,116,800	3.5
	Faucetts			
	Monetary Savings	UGX/a	564,330	
	Estimated CAPEX	UGX	1,080,000.00	1.9
Fresh Water	Replacing Cistern			
	Monetary Savings	UGX/a	550,566	
	Estimated CAPEX	UGX	1,728,000.00	3.6
	Urinals			
	Monetary Savings	UGX/a	539,128	
	Estimated CAPEX	UGX	3,420,000	6.6
	Rain Water Harvesting			
	Monetary saving	UGX/a	7,734,385	
	Estimated CAPEX & OPEX	UGX	52,081,964	6.7

Total Investments & Savings (cont.)

	ITEM	UNIT	AMOUNT	Payback (in years)
Wastewater	Reed Bed Filter			
	Total Potential Income	UGX/a	48,201,519	
	Total Cost	UGX	51,232,644	1.06
Energy	Light Replacement			
	Annual energy cost savings	UGX/a	1,089,936	
	Estimated investment cost	UGX	4,320,000	3.9
	Photovoltaic System			
Mobility	Monetary Savings	UGX/a	0.29 tril	
	Estimated Investment	UGX	3.23 tril	11
	E-Vehicle			
	Fuel Savings (UGX/kWh)	UGX/a	14,816,442	
	Estimated CAPEX	UGX	111,600,000	7.53
	E-Bus			
	Fuel Savings (UGX/kWh)	UGX/a	20,070,967	
	Estimated CAPEX	UGX	900,000,000	40
	TOTAL BENEFITS	UGX/a	290,256,429,243	
	TOTAL INVESTMENTS	UGX	3,231,172,579,408	11.1
		EUR	847,516,230.58	

Challenges on The Road to Zero Emissions

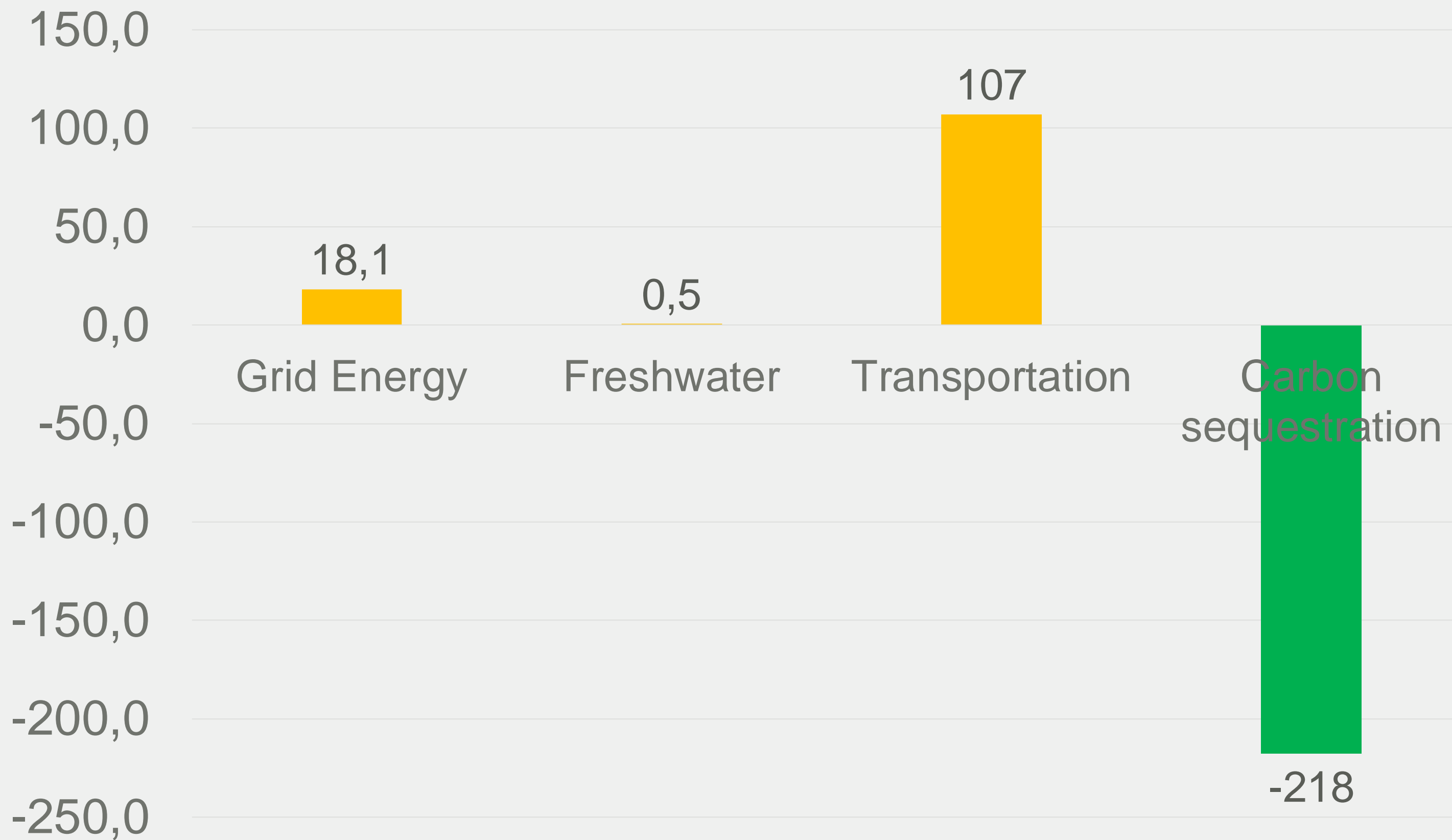
- Organise the necessary investments
- Ensure participatory multistakeholder engagement
- Identify knowledge and technology gaps
- Asset management and maintenance
- Institutional capacity and policy framework(s)

Opportunities on The Road to Zero Emissions

- Empowerment: from donations to investments
- Participatory multistakeholder engagement
- Capitalise on carbon mitigation and sequestration potential
- Job and skills creation
- Development nucleus for resilience GMC-2040 & GU-2071
- New (non) academic research & curriculum

GHG Balance: Potential Results

GHG Balance - Potential Results (tCO_{2e}/a)



Total GHG emissions

-92.4 tCO_{2e}/a

(Excluding the Teak carbon stock)

Gulu University emissions can be reduced to **-0.02 tCO_{2e}/ca/a**

Average GHG Emission (Uganda)
0.1 t CO_{2e}/ca/a

...the complete picture



Thank you!
