



a world class African city

LOOKING AT THE FUTURE OF ENERGY IN THE CITY TODAY



AMEU SEPTEMBER 2016

The World's Problems

and The energy Trilemma

Google - "I know everything", Facebook - "I know everybody", Internet - "Without me, u
r nothing", Electricity - "keep on talking fools"

A WORLD IN CRISIS

State of the World

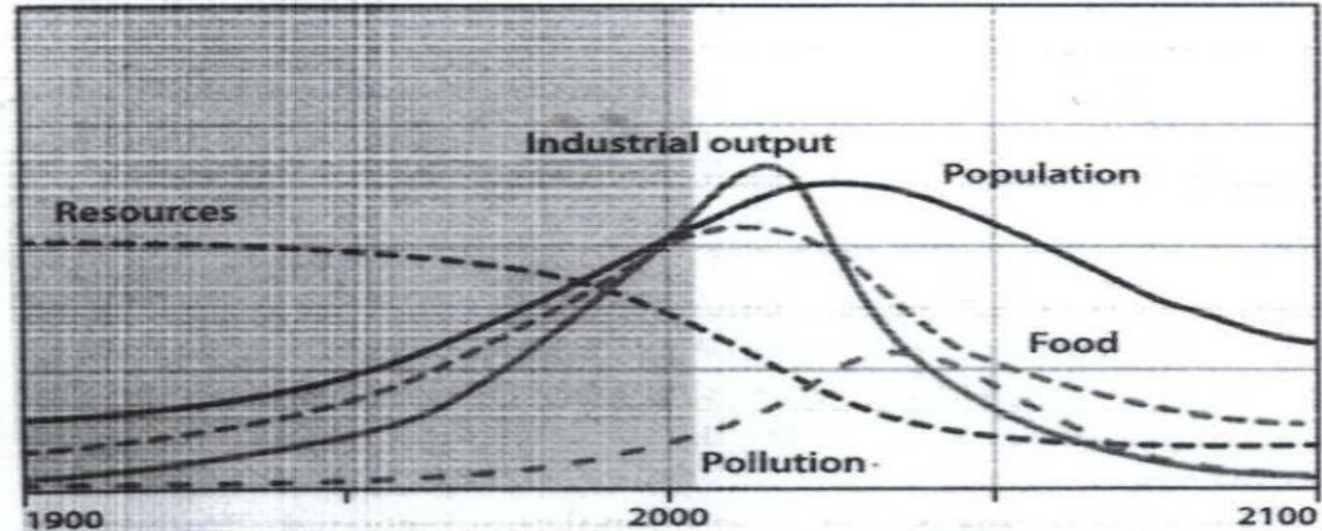


FIGURE 1. Limits to Growth Scenario. Source: *The Limits to Growth: The 30-Year Update*

	2013	2014	2015e	2016f	2017f	2018
Sub-Saharan Africa	4.8	4.5	3.0	2.5	3.9	4.4
South Africa	2.2	1.5	1.3	0.6	1.1	2.0
Nigeria	5.4	6.3	2.7	0.8	3.5	4.0
Angola	6.8	3.9	2.8	0.9	3.1	3.4

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS – SEPTEMBER 2015

Table 11. Sustainable Development Goals

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

THE GLOBAL ENERGY PROBLEM

Balancing the 'Energy Trilemma'

Energy Security

The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

Energy Equity

Accessibility and affordability of energy supply across the population.

Environmental Sustainability

Encompasses the achievement of supply and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.



ENERGY
EQUITY



ENERGY
SECURITY



ENVIRONMENTAL
SUSTAINABILITY



HOW TO MEET THE ENERGY TRILEMMA: FOLLOWING THE LAWS OF DEVELOPMENT OF SOCIETY

The negation of the negation

Quantitative changes to qualitative changes

Unity in diversity



QUANTIFICATION OF WASTE



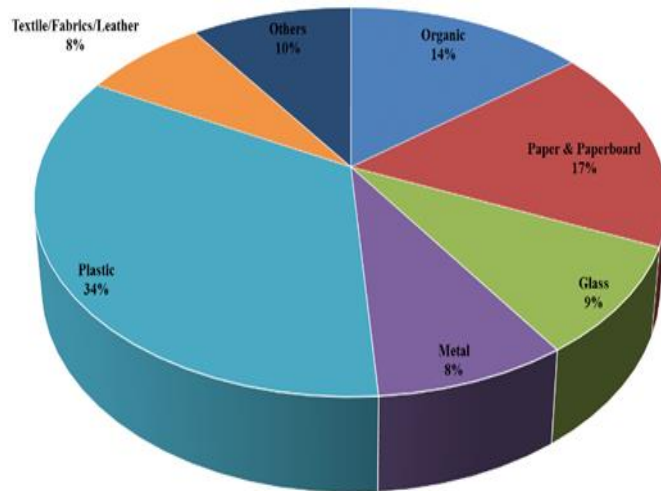
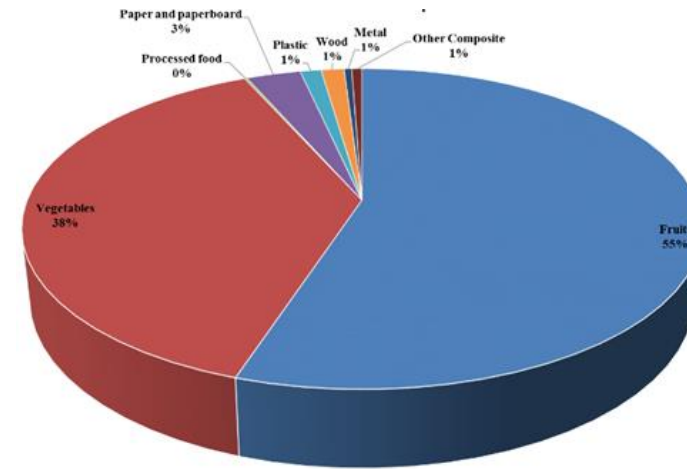
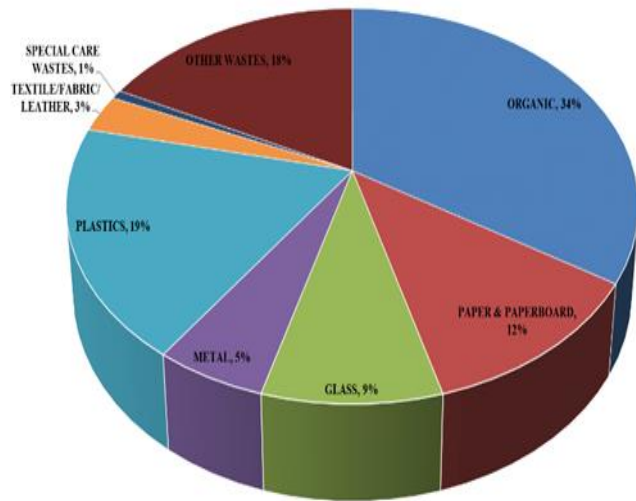
Assess the waste dumped at Robinson deep

Quantify the waste in terms of the hierarchy

This process not only helped the City understand but also constituted a research for UJ

This became a practical academic exercise involving research students and serving municipal needs as well

CHARACTERIZATION OF WASTE



Energy potential	Quantity organic (tons/yr)	Biogas (1000 m ³ /yr)	Energy (TJ/yr)
RCR	101,426	7,100	140
Diesel	1,252	97	2
Fruit & Veg.	16,936	1,319	8,457,634
Natural gas (m ³ /yr)			28
Gas (l/yr)			8,006,842
Waste (l/yr)	61,345	5,580	9,024,296
Electricity (MWh)	180,959	14,096	2906
CO ₂ equivalent reduction (tCO _{2eq} /yr)			124,327.22

CONCLUSION

	TS = 15%		
	78%	80%	85%
VS			
Biogas yield (1000 m ³ /year)	1,135	1,164	1,237
Net biogas (m ³ /year)	598,707	625,816	700,589
Biomethane (m ³ /year)	347,250	364,133	406,341
Diesel (l/year)	326,415	342,285	381,961
Metro bus fuelled/year (100%)	8	8	9
Buses fuelled/year (30-70%)	20	21	23

Initially a 10 tonne per day bio digester was envisaged as a pilot project. However it was recommended that a 50t/d capacity should be pursued

Techno-economic analysis of the latter showed that at 15% TS and VS ranging between 78% to 85% there is potential to fuel 8-9 dedicated bio methane buses or 20-23 bio fuel buses (30% bio methane and 70% diesel).

Project will be a research facility for skills acquisition, academic work and technology learning

Project is currently at design phase and system integrated approach i.e. design the plant for a future capacity which includes upscaling, heat generation, electricity, bio fertilizer etc