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# ENERGY EFFICIENCY (EE) PRACTICES

## Presentation from UGANDA and KAMPALA

**By:** Simon **KALANZI**, Ministry of Energy and Mineral Development  
Edison **MASEREKA**, Kampala Capital City Authority  
Mike **OKUA**, Kampala Capital City Authority  
Steven Jeremy **NTAMBI (PhD)**, Kampala Capital City Authority

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Covenant of Mayors in Africa Workshop, 26-27<sup>th</sup> October, 2015**





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# **NATIONAL LEVEL - UGANDA**

## **Institutional Set Up**

- 1. Ministry of Energy and Mineral Development (MEMD)**
  - UEGCL, UETCL, UEDCL (UMEME), ERA
- 2. The Energy Efficiency and Conservation Department (EECD)**
- 3. Sustainable Energy For All (SE4All) Initiative Secretariat**





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# **Review of current EE strategies and policies (National level)**

- 1. The Energy Policy for Uganda (2002)**
- 2. The Renewable Energy Policy (2007)**
- 3. Uganda's National Development Plan (NDP) II (2015 – 2020)**
- 4. The National Environment Management Act, 1995 and the Kyoto Protocol.**
- 5. Energy Efficiency and Conservation Bill**
- 6. National Climate Change Policy**





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# **Main Sectors for EE - National level**

- 1. Industrial**
- 2. Standards and Labeling of electrical equipment**
- 3. Transport (Transport Policy)**
- 4. Buildings (Households, Commercial and Institutional)**
- 5. Agricultural**
- 6. Urban Planning (Urban design & building codes)**
- 7. Street Lighting in Urban Centres**
- 8. Mining**





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# KAMPALA CAPITAL CITY AUTHORITY

*Kampala Capital City Authority was established by the KCCA Act of 2010 to administer the city on behalf of the Central Government.*

*Its functions include among other;*

*Urban planning and development control, managing and regulating public transport, waste management, primary health & education, trade order and community development.*

*Although its mandate does not explicitly include energy management, KCCA's activities and functions do have implication for the energy.*

***Directly*** – energy management for public buildings and facilities including street lighting

***Indirectly*** - through regulation and management of public transport, enforcement of building codes, management of waste and the landfills and Procurement processes and specifications.





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# **Review of current energy efficiency strategies and policies (City level)**

The City EE Strategy is currently under development. KCCA with support from Expertise France and the French Embassy in Kampala is elaborating its Low Carbon and Climate Resilience Strategy i.e. "Kampala Climate Change Action Strategy"

The Energy & GHG balance for Kampala & the Metropolitan Area has been completed. This will form the baseline for the local EE & GHG ambition and strategy for the City.

The target sectors: public buildings & facilities; city planning, building codes & policies, transport, waste & household energy.

At national level, there various initiatives targeting generation, and distribution including the EE bill soon to be tabled before parliament.



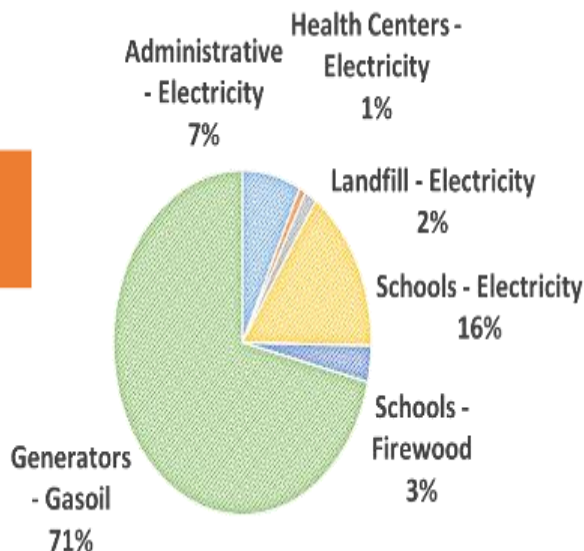
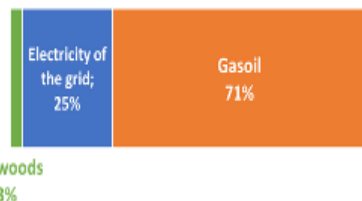


# Energy consumption of KCCA (assets & activities)

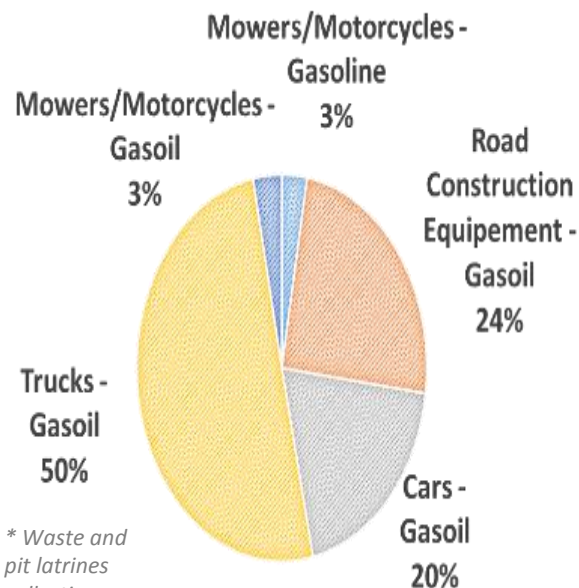


## Buildings and street lighting 3% of energy consumption

Energy mix of KCCA buildings



## Fleet of the Authority 92% of energy consumption



\* Waste and pit latrines collection



### INDICATORS - 2014



- 293 750 kWh of electricity
- 484 kgCO<sub>2</sub>e/kWh of electricity
- Electricity consumption

Consumption of the City Hall:  
42 600 kWh of electricity

Type of building	kWh/year
Administrative	9 465,67
Health Facility	1 932,00
Landfill	17 199,00
Schools	2 300,00



### INDICATORS - 2014



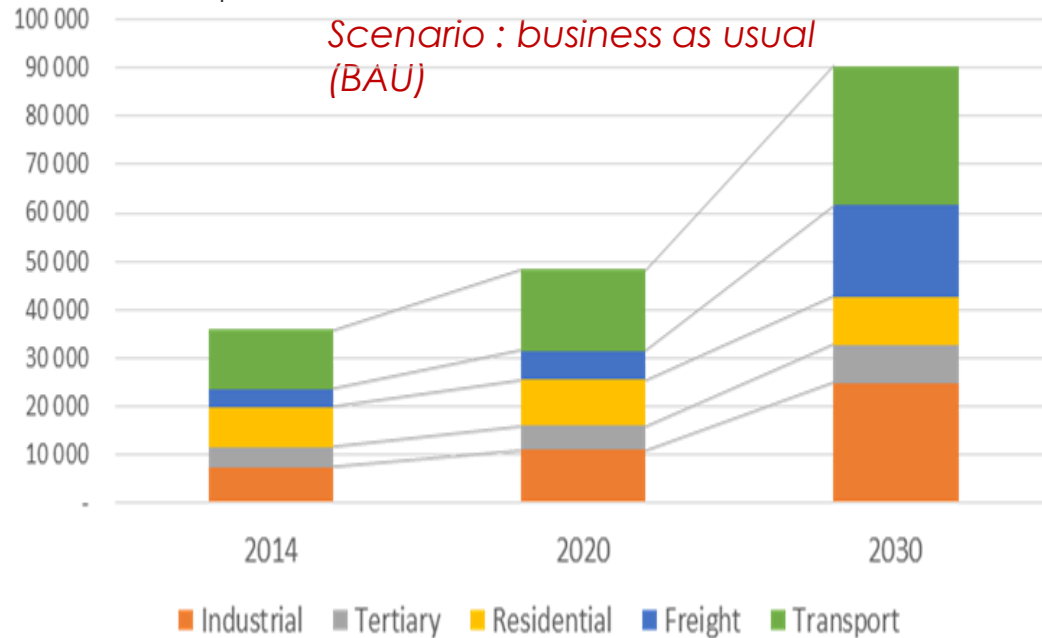
- 1 400 000 liters of gasoil consumed by the fleet
- 40 200 liters of gasoline consumed by the fleet
- 723 000 liters consumed for garbage and pit latrine collection

# Kampala energy profile



## Energy consumption of Kampala by sector (TJ)

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## INDICATORS - 2014



- 1,516,210 inhabitants



- 2.0% per annum of population growth



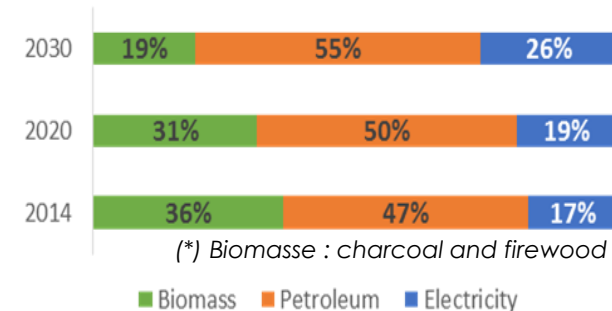
- 418,787 households



- 10 000 GWh of energy consumed

- 47% from fossil fuel

Energy mix of Kampala



## Changing the BAU scenario : Kampala Climate Change IN Action







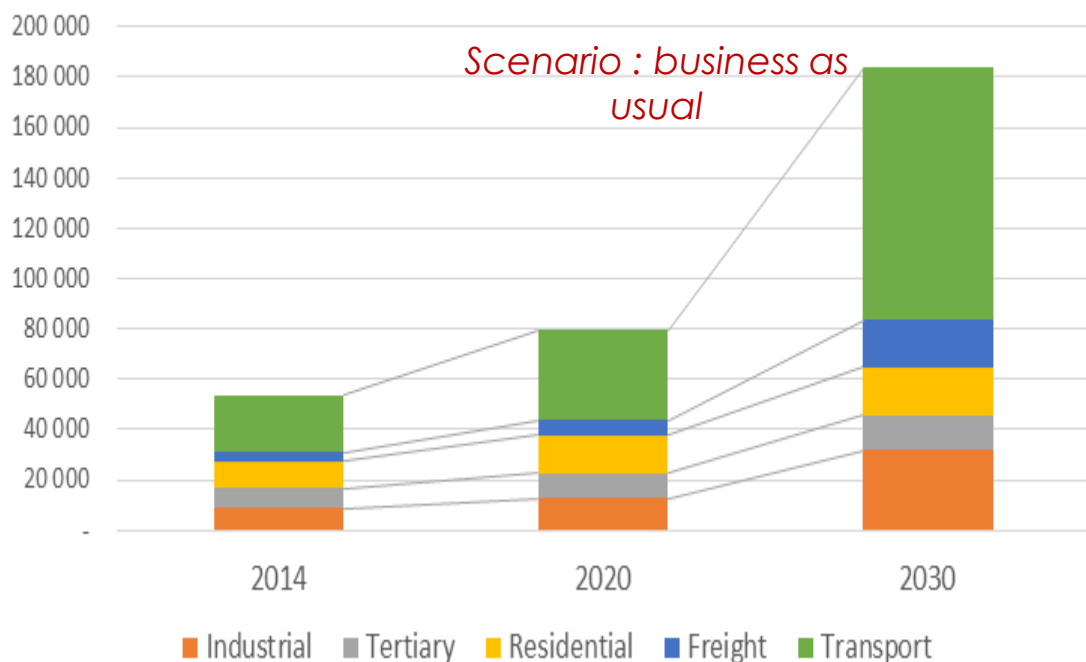
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# Greater Kampala Metropolitan Area

## GKMA energy profile



Energy consumption of GKMA by sector (TJ)



### INDICATORS - 2014



- 3.1m inhabitants



- 10 per annum of population growth (UBOS 2014)



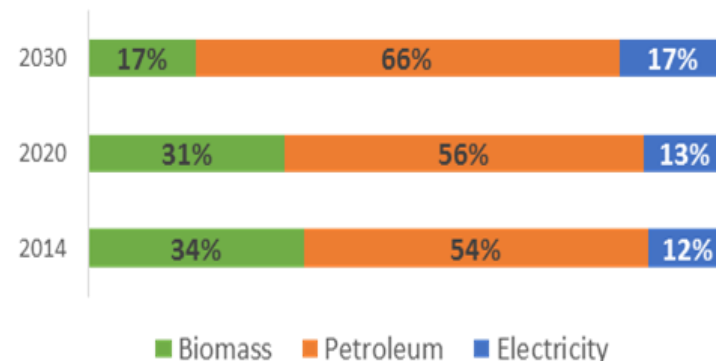
- 1 000 000 households



- 14 920 GWh of energy consumed

- 54% from fossil fuel

### Energy mix of GKMA



(\*) Biomasse : charcoal and firewood

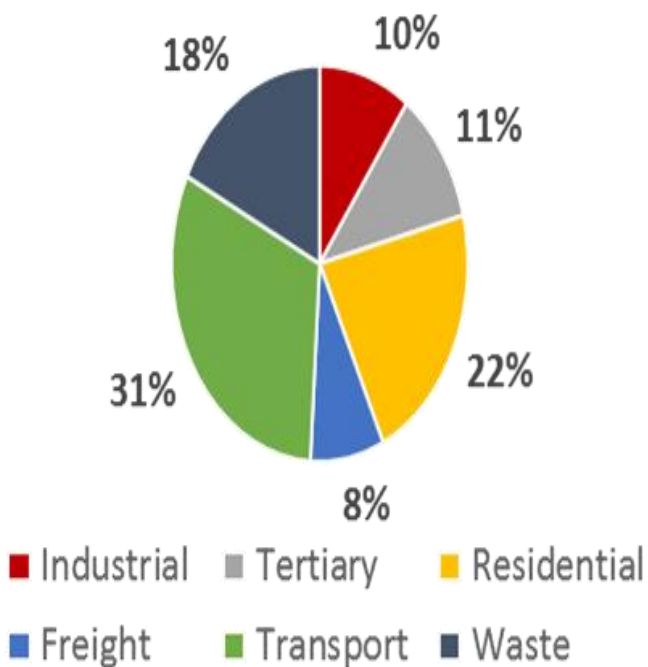


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# GHG profile of Kampala



## Kampala GHG emissions in 2014



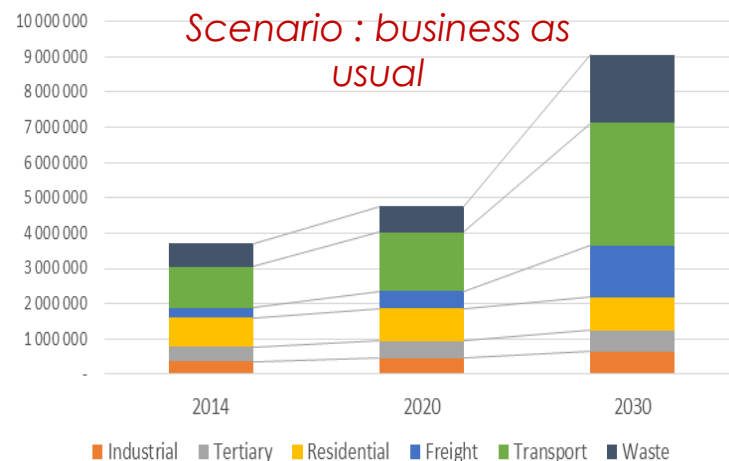
## INDICATORS - 2014



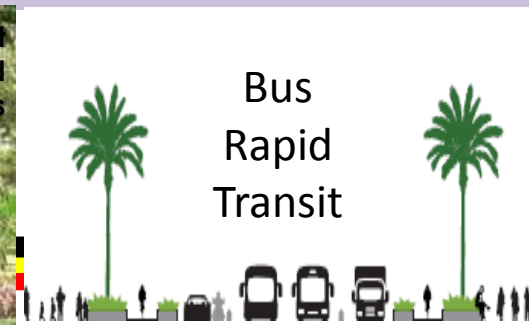
- 3 813 000 tCO<sub>2</sub>e
- 2,4 tCO<sub>2</sub>e/resident

## GHG emissions of Kampala (tCO<sub>2</sub>e)

*Scenario : business as usual*



## Changing the BAU scenario : Kampala Climate Change IN Action





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# Emission by Sector Kampala & GKMA



SECTOR	Emission Sources / ACTIVITY DATA/METHODOLOGY	IMPORTANCE
Energy Industry	Thermal power plants, HFO, charcoal, biomass/ shortfalls	Very important
Industrial sector	Biomass, diesel generator, LPG, grid/growth rates	Significant
Tertiary	Biomass, grid, kerosene/ contribution to GDP/growth rates	Significant
Household	Biomass, grid, kerosene, LPG/per capita / energy intensity	Significant
AFOLU	Animals, biomass coverage, soils, diesel	Significant
Fishing	Gasoline/ average energy consumptions.	Not Significant
Freight	Diesel, gasoline and aviation fuel/ton.km	Very important
Transport	Diesel, gasoline and aviation fuel /veh.km	Very important
Construction	cement production :buildings & road, infrastructure	Significant ?
Food	Meat, cereal, milk...	Not significant
Waste	Solid waste and waste water, treatment method	Very important

# Participation - stakeholders

## **Government MDAs**

1. MEMD
2. KCCA
3. ERA
4. UNBS
5. UECCC
6. MoFPED
7. MoLHU
8. MoWE
9. MoWT

## **Utilities**

1. UMEME
2. ESKOM

## **Development Partners**

1. GIZ
2. EU
3. World Bank
4. UNDP
5. AFD
6. AfDB

## **CSOs**

1. WWF (Energy action Agendas)

## **Energy Auditing, ESCOs & Consulting Firms**

## **Academia**

1. MUK
2. CREEC
3. KYU

## **Private Sector**

1. Solar tech traders
2. Bio mass energy tech producers (improved cook stoves, biogas, briquettes etc)



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# Energy Efficiency initiatives at city level)

## **I. Street Lighting**

1. EE Street Lighting

## **2. Solar Street Lighting**

## **II. Energy Auditing**

1. 6 KCCA Buildings
2. Motion and occupancy sensors for common user places at City Hall
3. Commercial Buildings

## **III. Micro credit financing for EE & RE techs**

Eco stoves at Wandegeya

Pilot biogas installation at Kansanga  
P/s

## **IV. Standards and Labeling for Electrical Appliances**

1. Promotion of voluntary compliance by developers & industrialists
2. Procurement Specifications

## **V. Transport**

1. Mass Transportation (BRT)
2. Promotion of NMT
3. Green-Joule Biofuels Production
- 4. Green-Joule Hybrid Solar-Fuel powered Vehicles (Garbage Trucks)**

## **VI. EE Building Codes (by society of architects & engineers)**





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## **Role of local government to implement EE initiatives**

- EE in public buildings and facilities (offices, schools, HCs, street lighting etc.) – leading by example
- Incorporating EE in building codes
- Promoting EE standards through public procurements
- Collaboration with other stakeholders at national & Local Level (Regulators, Generators, Distributors, Households, CSOs, R&D institutions etc.)
- Promotion on new technologies & technology transfer
- Sharing experiences and best practices including City-to-City twinning opportunities





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# The Kampala Solar Street Lighting (KSSL)

## Mission

The mission of KSSL is to sustainably improve quality of life, functionality and Safety of Kampala during the night by increasing availability and quality of street lighting

## Objectives

1. Conversion of Current Street Lighting Network of 4,000 lights to Solar
2. Increasing the Current Street Lighting from the current 8% (4000) to 100% (45,000) required lighting phased over ten years





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## The Kampala Solar Street Lighting (KSSL)

### Status-Quo

- Currently Kampala has 4,000 street lights of which 250 are solar powered
- This is coverage of 8% of the city
- Most of the Lighting is in the Central Business District
- This has Led to;
  - Congestion of the Central Business District of Commerce and Habitation
  - High Crime and Fear of Crime in most of parts (92%) of Kampala





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## The Kampala Solar Street Lighting (KSSL)

### Opportunity for Partnership

- KCCA current direction on street lighting is on implementation of solar street lighting. Currently installed 250
- Opportunity for installation of 45,000 solar street lights ( USD 113 million)
- Investment planned to be phased over a 10-year period
- Starting with the conversion of current network to Solar





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## The Kampala Solar Street Lighting (KSSL)

### Opportunity for Partnership

- Annual investment of USD 11 million with partners resulting into 4,500 solar street lights per year





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## The KCCA Green-Joule Summit (GJS)

### The Mission

- The mission of the GJS is to create a meta-team of the continent/ world's best teams to solve global problems in the public domain.
- A vast array of systemic challenges face the planet and an incredible number of these are interdependent, with the energy crisis figuring prominently among them





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## **The KCCA Green-Joule Summit (GJS)**

### **Objectives (2015-2020)**

- 1. A fully validated and built/converted 80km per liter waste-collection truck/vehicle with 95% reduction in life cycle costs (embodied global warming potential and hazards to human health cradle-to-grave); as well a factor 20 improvement in materials used.  
(2015-Dec 2016)**





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(2015-Dec 2016)**





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## The KCCA Green-Joule Summit (GJS) Objectives (2015-2020)

2. A business-model which allows the truck to be used at least 18 hours each day, returning added value to suppliers to boost their profit margins, investment for improved public transit and a decrease in congestion (and thus need for expansion) of existing infrastructure. (2015- 2020)





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## The KCCA Green-Joule Summit (GJS) Objectives (2015-2020)

**3. An international consortium comprised of the world's leading universities and corporations that is ready and able to do the breakthrough, interdisciplinary and collaborative research and development. (2015-2020)**







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## The KCCA Green-Joule Summit (GJS)

### Objectives (2015-2020)

- **KCCA to create strong networked teams committed both to energy efficiency and to best practice in sustainability**
- **Setting a powerful precedent for global collaboration and innovation.**





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## The KCCA Green-Joule Summit (GJS)

### Objectives (2015-2020)

- Looking forward: Network poised to tackle sustainability living issues from energy to water, ecological restoration, green and site specific building design, food and, with luck, world peace.
- While our initial focus will be on the developing world, longer term we aim to foster global exchange.





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# The KCCA Green-Joule Summit (GJS) Partnership Invitation

**KCCA invites a partnership with the EU to a  
minimal amount of 10 million Euros to  
achieve the first tangible deliverable of the  
initiative**





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## The KCCA Green-Joule Summit (GJS)

### Meet the Vision

- Driven to develop a new class of automobile, KCCA aims to create a waste (garbage) collection, 80km per liter, high-performance industry-standard truck/vehicle with minimal life cycle costs and wide appeal both in developed and developing countries. This vehicle has been codenamed vision 2040





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## The KCCA Green-Joule Summit (GJS)

### Meet the Vision

- The development shall be done in tandem with academia, industry and governments
- More than engineering, Green-Joule seeks to catalyze energy innovation in a multitude of disciplines and empower the future leaders of global energy initiatives





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## The KCCA Green-Joule Summit (GJS)

### Meet the Team

- **Green-Joule is recruiting and training a diverse and enthusiastic team with expertise in a variety of fields.**
- **The consortium is placing high priority on open communication channels, frequent design reviews, a horizontal management structure, and a commitment to best practice in sustainable design.**





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## The KCCA Green-Joule Summit (GJS)

### Meet the Team

- GJS will develop solutions applicable over a range of materials, industries, and geographic regions ; by repeatedly engaging with questions of infrastructure, incentive programs for zero carbon emissions, and ways to increase total efficiency over product life cycles.





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## The KCCA Green-Joule Summit (GJS)

### Long Term Goals

- **Undertaking of engineering product development with the goal of radical increase in energy efficiency.**
- **After the truck project itself, the consortium will be poised to take on problems of all types ranging from other aspects of transportation (e.g., freight services) to issues in construction, agriculture, and materials flows for industry.**







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## The KCCA Green-Joule Summit (GJS)

### Long Term Goals

- Through Green-Joule, KCCA shall manage and direct such endeavors while guiding the overall vision in a non-profit manner





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## The KCCA Green-Joule Summit (GJS)

### Design in the Public Domain

- **Commitment to Public Domain release : a truly revolutionary proposition of KCCA's GJS.**
- **Just as global warming and resource depletion affect the entire human race, so too should solutions developed to mitigate those challenges.**





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## The KCCA Green-Joule Summit (GJS)

### Design in the Public Domain

- **Computer software evolution benefitted greatly from the Open Source movement:**

- ✓ successfully built a global community of attentive, technically expert, and end-user savvy programmers committed to improving products for universal use.

- **KCCA's GJS is built on the same principles;**

- ✓ Leveraging top talent and enthusiasm from industry and research universities to work on real-world problems in the context of their curricula and operations.





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## The KCCA Green-Joule Summit (GJS)

The Green-Joule Summit- Life Cycle as A critical Design Metric, Factor 20 as a Goal

- **GJS built around a vehicle because cars embody and impact a vast array of industries.**

- ✓ Emissions and environmental pollutants are significant throughout, beginning with raw materials extraction and going through to final recycling and disposal.





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## The KCCA Green-Joule Summit (GJS)

The Green-Joule Summit- Life Cycle as A critical Design Metric, Factor 20 as a Goal

- To meet the life cycle requirements placed on the Vision 2040, development will begin with a Life Cycle Assessment (LCA) indicating allocation of research capabilities, selection of materials and organization of the supply chain.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit- Life Cycle as A critical Design Metric, Factor 20 as a Goal

- Once LCA is complete on the Vision, we will work to develop a freely available LCA tool.
- Critical to sound decision making for both consumers and designers, we believe this to be one of the most significant outcomes from this project.





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## The KCCA Green-Joule Summit (GJS)

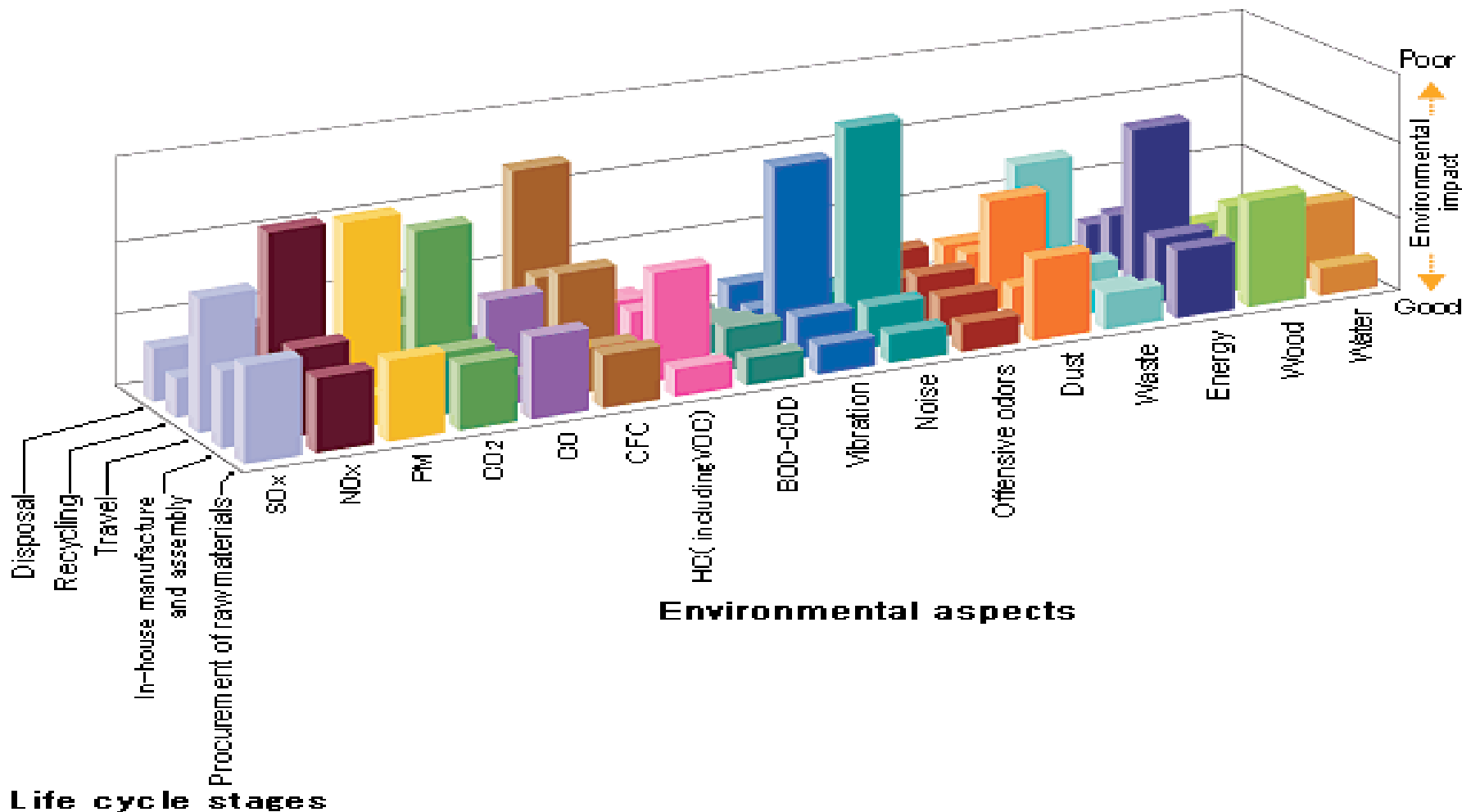
The Green-Joule Summit- Life Cycle as A critical Design  
Metric, Factor 20 as a Goal

- Integration with web based search engines, CAD tools, and product marketing information are all strategic pathways GJS hopes to follow in disseminating the lifecycle analysis tool.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit- Solar Plug-in Architecture

- Vehicles a leverage point for radical & systemic change. 90% Kila commuting activity within 100km.
- GJS Vision: a two-mode vehicle with a design optimized for short and long distance transportation.
- Batteries give the vehicle a 65-70 km range without use of any APU (Auxiliary Power Unit)





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit- Solar Plug-in Architecture

- The solar powered plug-in feature enables easy charging at home/charge stations.
- GJS to develop a model for true cost accounting of electricity as a fuel in cases where clean power is not generated on site.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit- Solar Plug-in Architecture

- Green-Joule Vision design: a potential area of collaboration with partners interested policy options and leverage points associated with the *Vision*.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit: Solar-Biodiesel/Diesel Hybrid Architecture

- The hybrid architecture selected for use in the *Green-Joule Vision* will utilize an electric motor and an APU to maximize fuel efficiency and optimize vehicle performance.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit: Solar-Biodiesel/Diesel Hybrid Architecture

**Increased fuel economy achieved primarily through 3 mechanisms:**

- a) Reducing wasted energy during idle/low output by utilizing the more efficient electric motor and turning off the APU;**
- b) Recapturing waste energy (e.g. regenerative braking); and**





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit: Solar-Biodiesel/Diesel Hybrid Architecture

- c) reducing the size and power of the APU unit, which often has 10x more power than required for nominal cruising conditions in order to meet acceleration requirements.





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## The KCCA Green-Joule Summit (GJS)

### The Green-Joule Summit: Solar-Biodiesel/Diesel Hybrid Architecture

- The combination: Fluid fuels+ Smaller APUs = Significant weight savings in the propulsion system
- Combined with weight savings in other parts, this allows for a smaller, more fuel efficient propulsion system
  - ✓ similar performance to a much larger standalone internal combustion engine.





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## The KCCA Green-Joule Summit (GJS)

### Partnership Invitation-Benefits of Partnership

- A partnership with the KCCA Green-Joule Summit is a unique opportunity with immeasurable benefits:

#### **1) Leverage Your Donation**

KCCA brings a high level of commitment in the form the personnel, time, effort, and monetary levels. KCCA is contributing in research support, labor, and facility use to the project thus maximizing the impact of donations.







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# The KCCA Green-Joule Summit (GJS)

## Partnership Invitation- Benefits of Partnership

### 2) Recruiting Future Leaders

- KCCA GJS is a unique opportunity to strengthen ties with many of the worlds leading industry and academia.
- Partners to access pool of participants including participation in design reviews, testing, and recruiting.





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## The KCCA Green-Joule Summit (GJS)

### Partnership Invitation-Benefits of Partnership

#### 3) Enhance Visibility

GJS is an opportunity for brand association with a cutting-edge, ultra-light vehicle that is likely to receive major coverage across a variety of distribution mediums.





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