Steering Low-Carbon Growth in Emerging African Cities: Insights from Dar es Salaam

Chibulu Luo
IMFG Graduate Fellow
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IMFG Institute on Municipal Finance & Governance at the munk school OF GLOBAL AFFAIRS & PUBLIC POLICY UNIVERSITY OF TORONTO

Steering Low-Carbon Growth in Emerging African Cities: Insights from Dar es Salaam

Chibulu Luo | PhD Candidate
Department of Civil and Mineral Engineering
University of Toronto
Chibulu.Luo@mail.utoronto.ca

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TOPICS FOR TODAY

- Opportunity for a low-carbon infrastructure transition in African cities – why is it relevant?
- Doctoral Research:
  - **Phase 1** – Impacts of population growth and energy access on residential GHG emissions in Dar es Salaam (transport and household energy use)
  - **Phase 2** – Mapping local energy use realities (fieldwork) and policy insights
  - **Phase 3 – Governance and financing structure: institutional leadership and investment opportunities**
- Conclusions

While the largest cities of today are in Asia and Europe, **in 2100 African cities will make up 13 of the top 20 cities worldwide**

World Cities By Population Projected 2100

World Ranking	City	Population (millions)
# 1	**Lagos, Nigeria**	**88**
# 2	**Kinshasa, DRC**	**83**
# 3	**Dar es Salaam, Tanzania**	**74**
# 6	**Khartoum, Sudan**	**57**
# 7	**Niamey, Niger**	**56**
# 12	**Nairobi, Kenya**	**47**
# 13	**Lilongwe, Malawi**	**41**
# 14	**Blantyre City, Malawi**	**41**
# 15	**Cairo, Egypt**	**41**
# 16	**Kampala, Uganda**	**40**
# 18	**Lusaka, Zambia**	**38**
# 19	**Mogadishu, Somalia**	**36**
# 20	**Addis Ababa, Ethiopia**	**36**

Source: Hoornweg, D., and Pope, K., 2017. “Population predictions for the world’s largest cities in the 21st century.” *Environment & Urbanization*, 29(1): 195-216.

Africa Today:

13% of global population

4% of global energy demand and greenhouse gas (GHG) emissions

IEA (2014) ‘Energy in Africa Today’, in *Africa Energy Outlook*

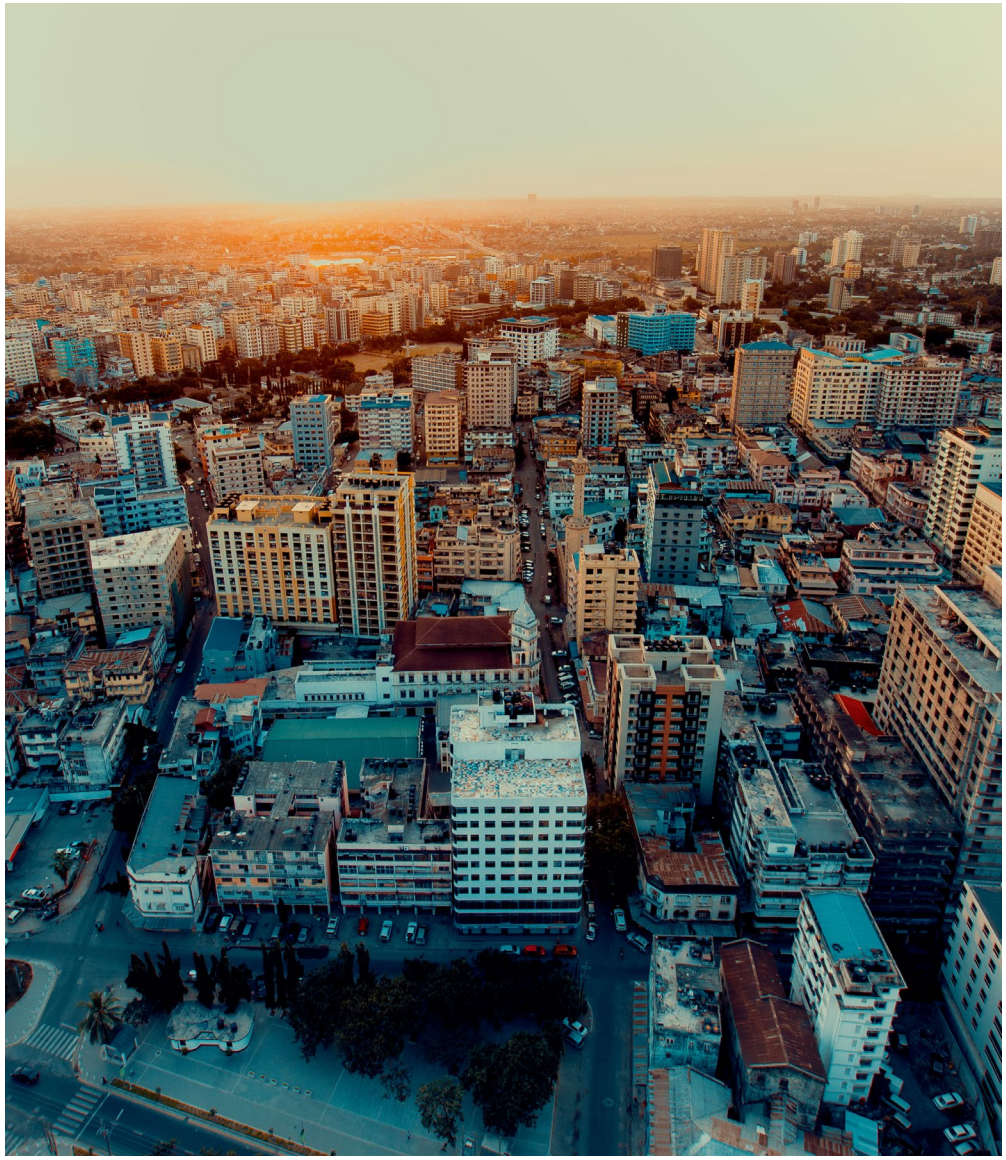
The scale of investments required to build Africa's future infrastructure is between **$130 and $170 billion** a year.

African Development Bank (2018), African Economic Outlook.

Dar es Salaam (night)
Photo credit: Rahim Mngwaya

Significant opportunity for future reductions in carbon emissions in rapidly urbanizing areas where infrastructures are **not yet locked-in...**

IPCC (2014), Chapter on Human Settlements, Infrastructure and Spatial Planning.



Dar es Salaam (dawn)
Photo credit: Adobe Stock Image

1) Decarbonizing power supplies (eliminating the use of fossil fuels for electricity generation and substituting with renewable energy sources)

(2) increasing energy efficiency (promoting the use of fuel efficient vehicles)

(3) scaling-up electrification (substituting fossil-fuel based energy sources, e.g. charcoal used for cooking, or petrol and diesel use in transportation, with electricity).

WHAT DOES "LOW-CARBON INFRASTRUCTURE" MEAN?

Kennedy, C., Stewart, I. D. and Westphal, M. I. (2019) 'Shifting Currents: Opportunity for Low-Carbon Electric Cities in the Global South', (January), pp. 1–36.

STATISTICS

- ~5 million people
- Passenger cars → 68% of annual VKT
- 75% electrification
- ~69% HH charcoal use

Electricity generation:

- 60% natural gas
- 35% hydro-power
- 5% renewable (solar and biomass)

DAR ES SALAAM ("DAR")

Phase 1: What impact will increasing population growth and energy access have on residential GHG emissions in Dar es Salaam?

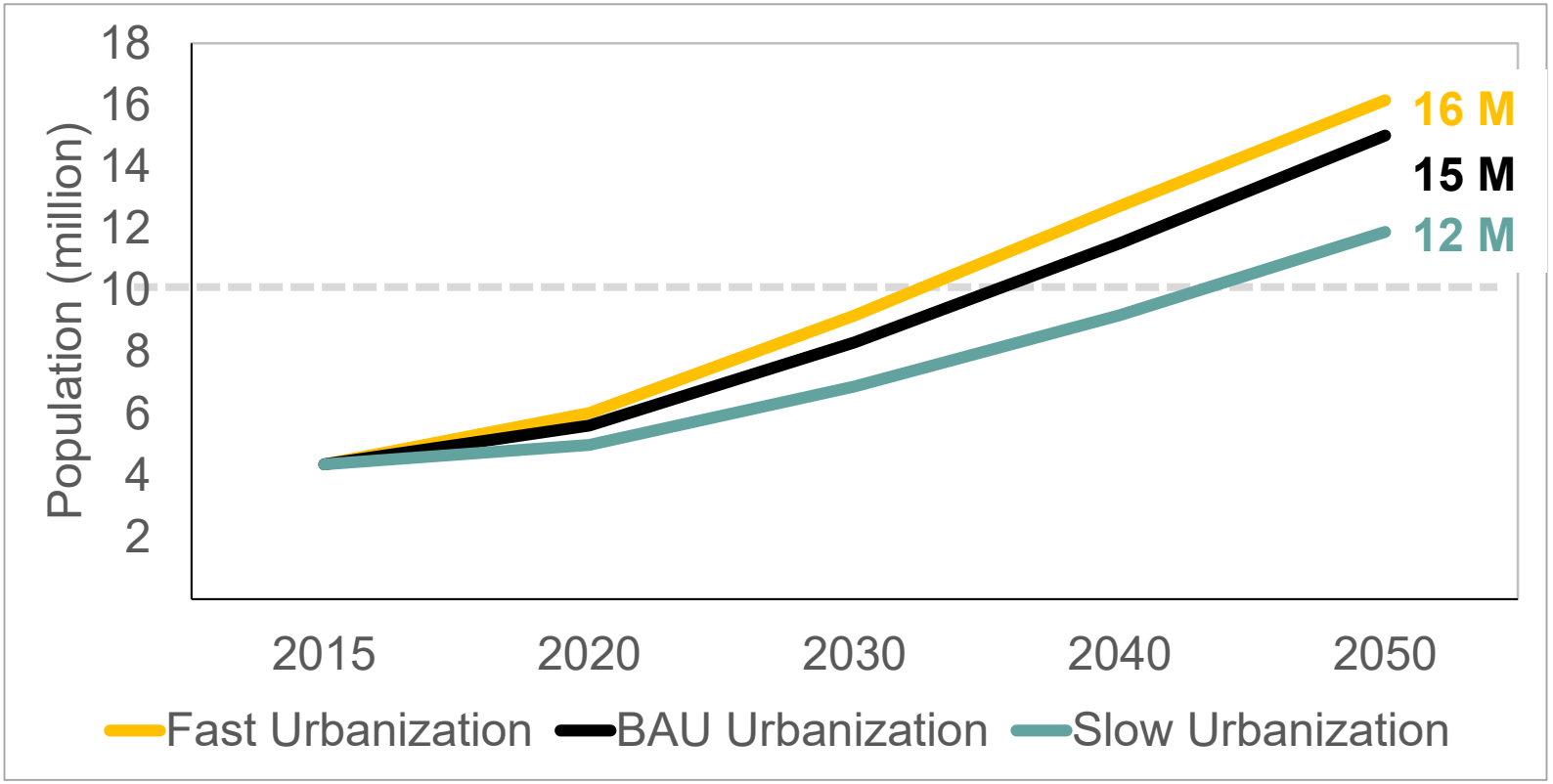
Unit: $ktCO_2eq.$
(Domestic household and transport energy uses)

"Modelling patterns of residential energy use and greenhouse gas (GHG) emissions in Dar es Salaam"

Luo, C., Posen, D., Hoornweg, D., MacLean, H.L. (2019)

(submitted to Energy Policy)

DAR IS SET TO BE ONE OF AFRICA'S LARGEST MEGACITIES BY 2050



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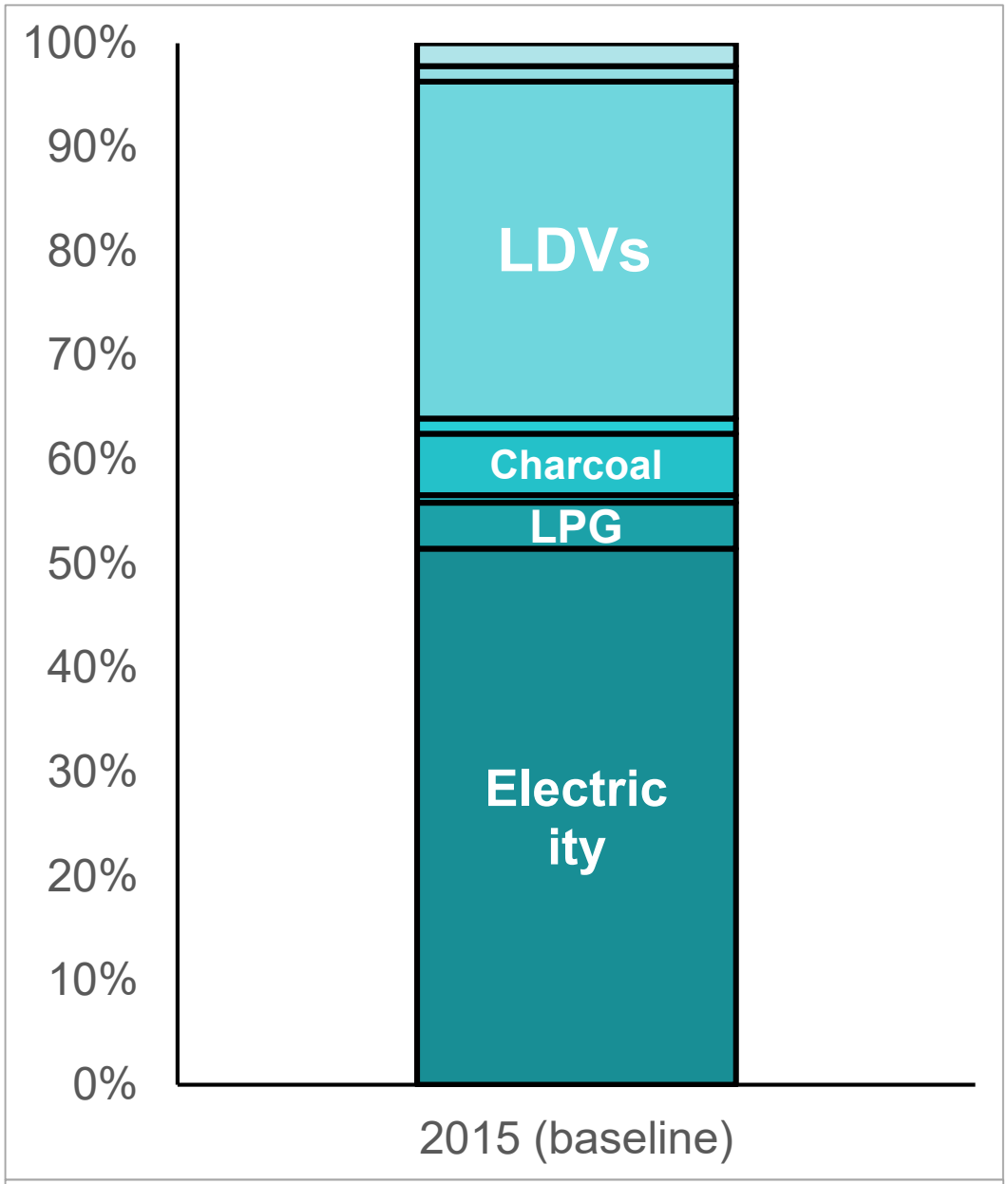
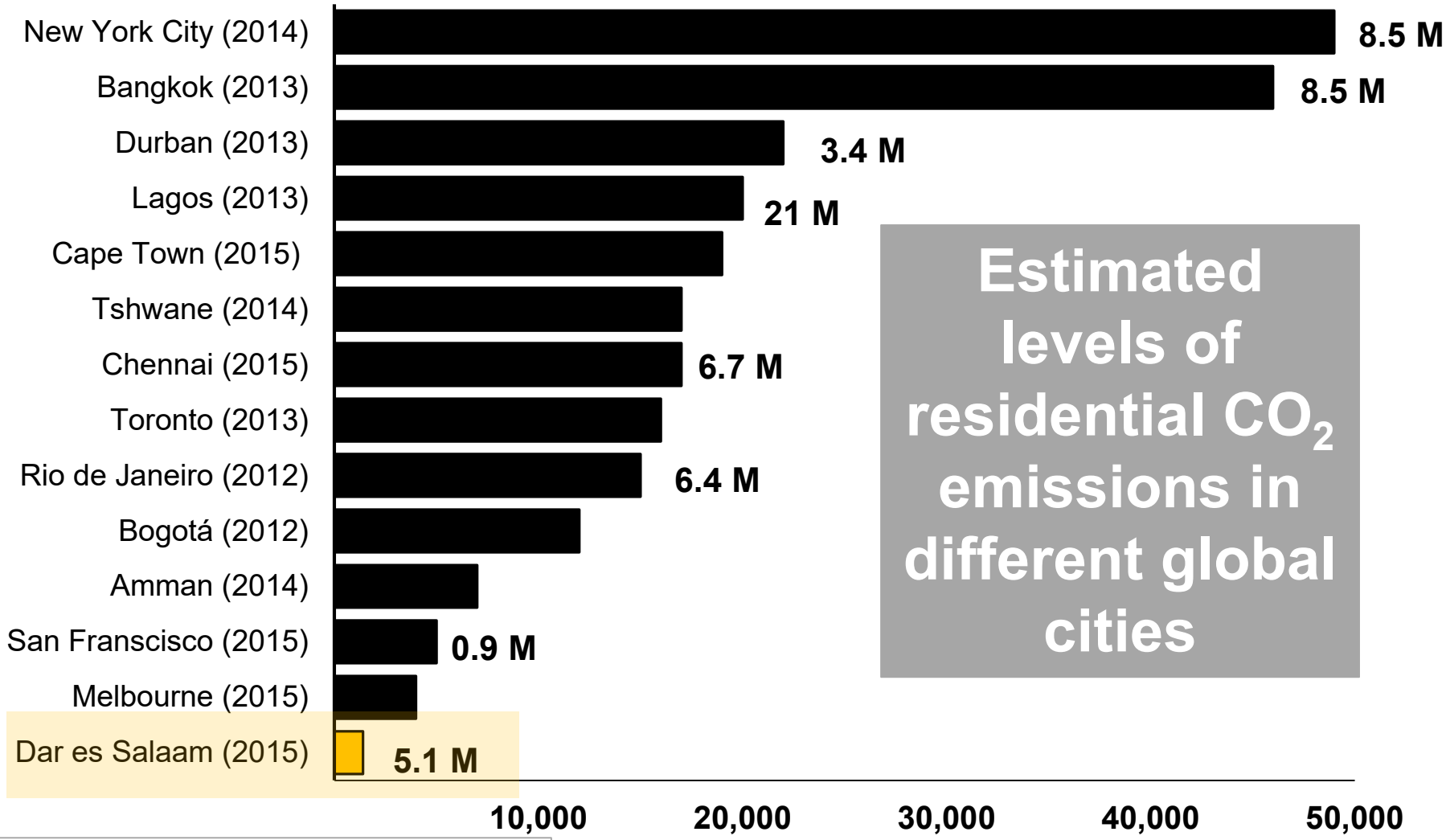
In 2015, absolute residential GHG emissions are estimated at 1,400 $ktCO_2eq$.

~50% due to residential electricity generation

~30% due to Light Duty Vehicle (LDV) or passenger car travel.



LDV – Light Duty Vehicle
LPG – Liquified Petroleum Gas



Estimated levels of residential CO_2 emissions in different global cities

*Note: emissions include Scope 1 and Scope 2: stationary and transport emissions only.

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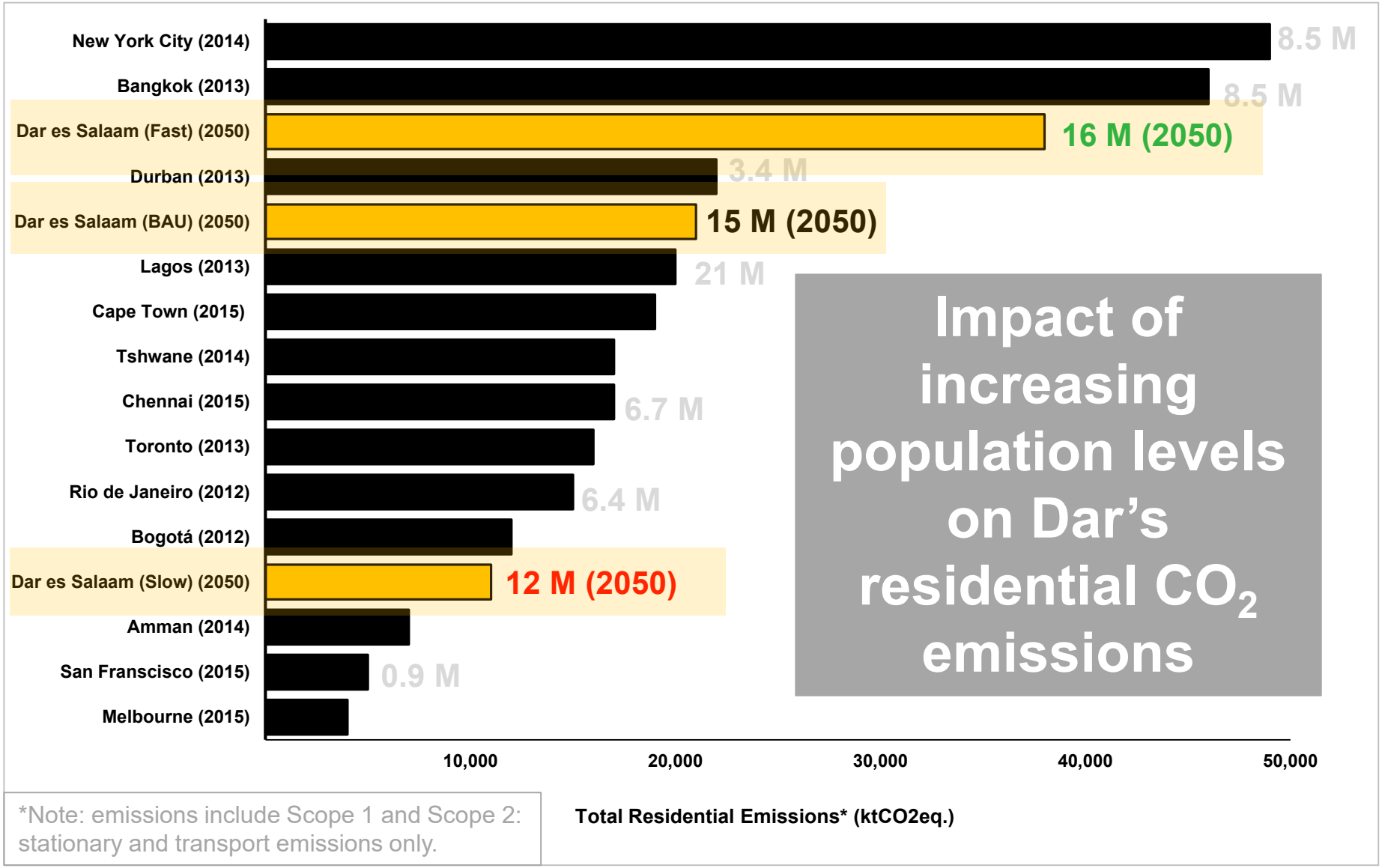

Impact of increasing population levels on Dar's residential CO_2 emissions

*Note: emissions include Scope 1 and Scope 2: stationary and transport emissions only.

Through **aggressive GHG mitigation policies** focused on **decarbonization of the electricity sector** and **sustainable transport**, total emissions can be **reduced by ~66% in 2050**.

"Modelling patterns of residential energy use and greenhouse gas (GHG) emissions in Dar es Salaam" Luo, C., Posen, D., Hoornweg, D., MacLean, H.L. (2019)

Phase 2: How do residential energy uses differ at the neighborhood or ward level?

[Fieldwork (Sept. - Oct. 2018)]

- ~ 1,400 surveys in 8 wards
- 09/18 – 10/18

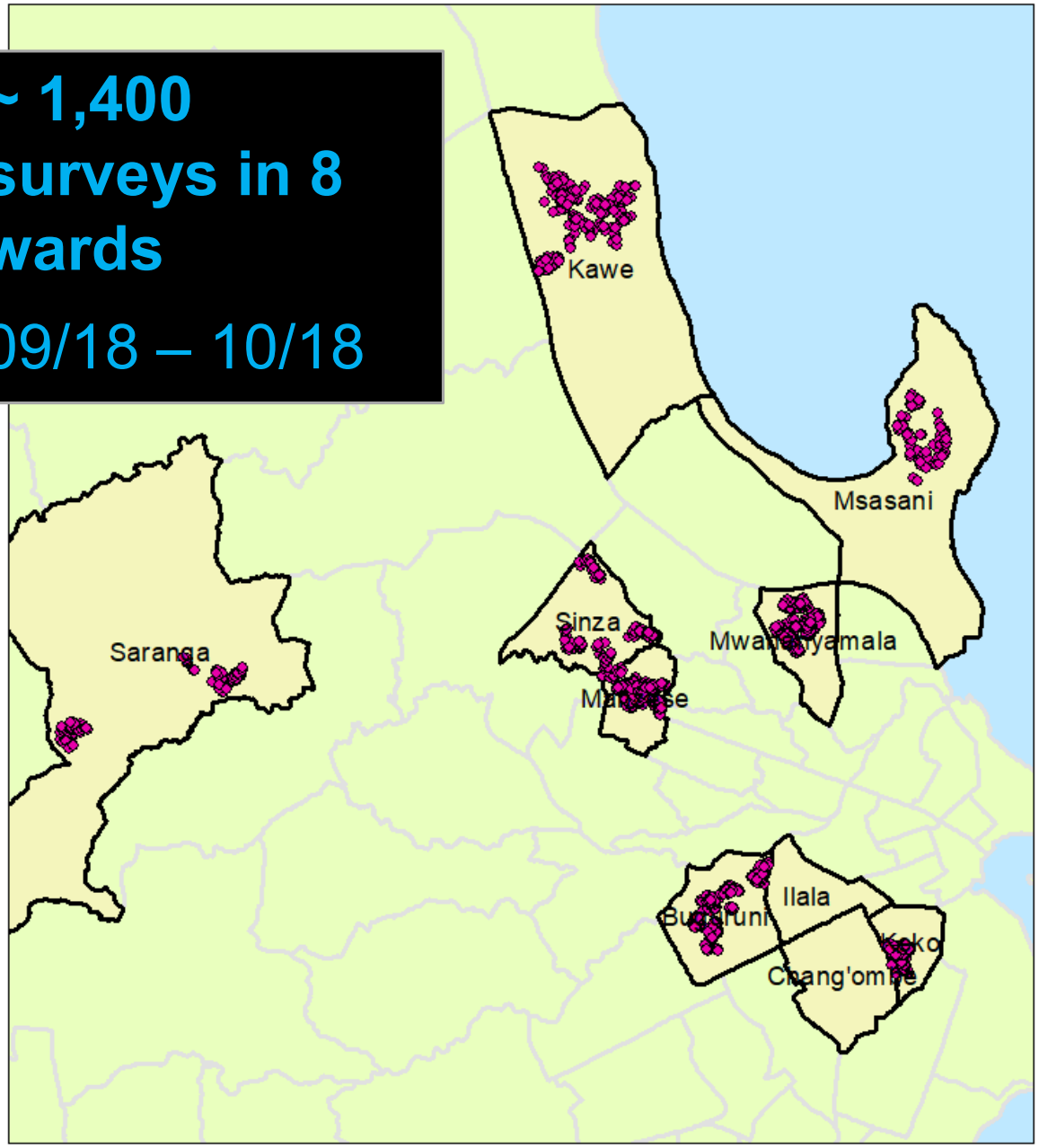

Photo credit: K15 Photos (2018)

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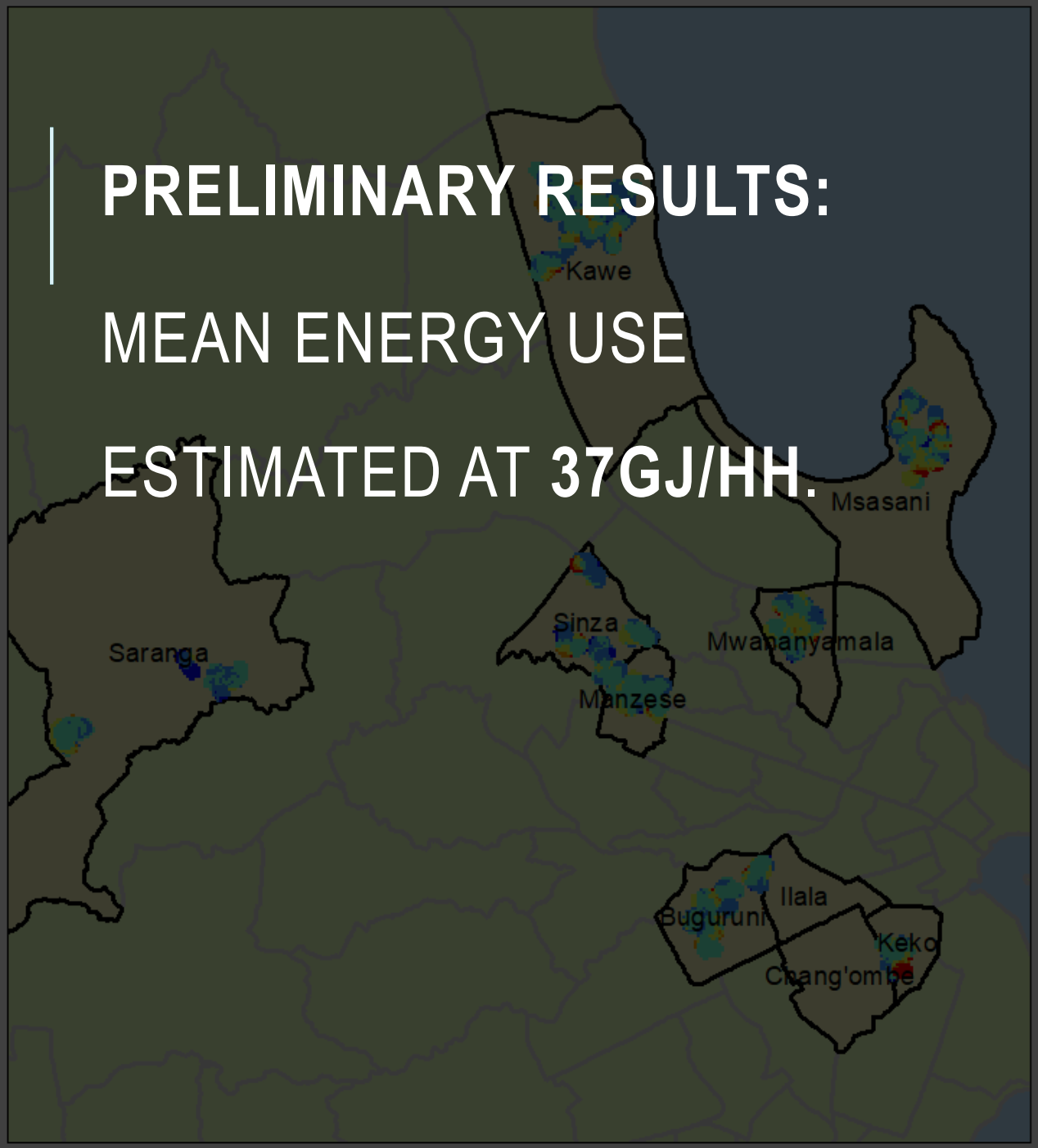
Household Questionnaire

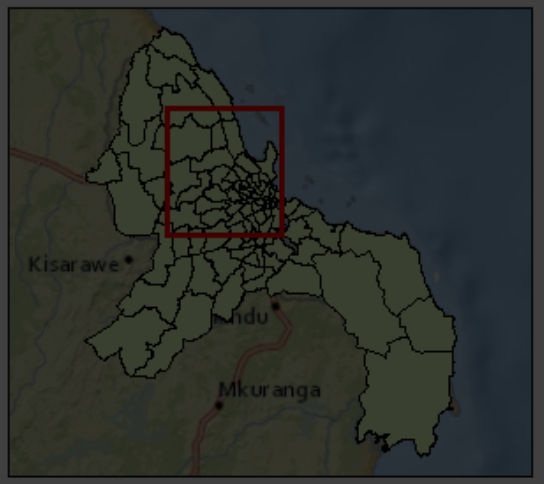
- Household socio-economics
- Location of building and structural design
- Building electrification
- Level of electricity use
- Charcoal use
- Vehicle ownership
- Type of fuel used (i.e. petrol or diesel)
- Use of public transport
- Number of trips (per day), routes and reason

Photo credit: K15 Photos (2018)

PRELIMINARY RESULTS:

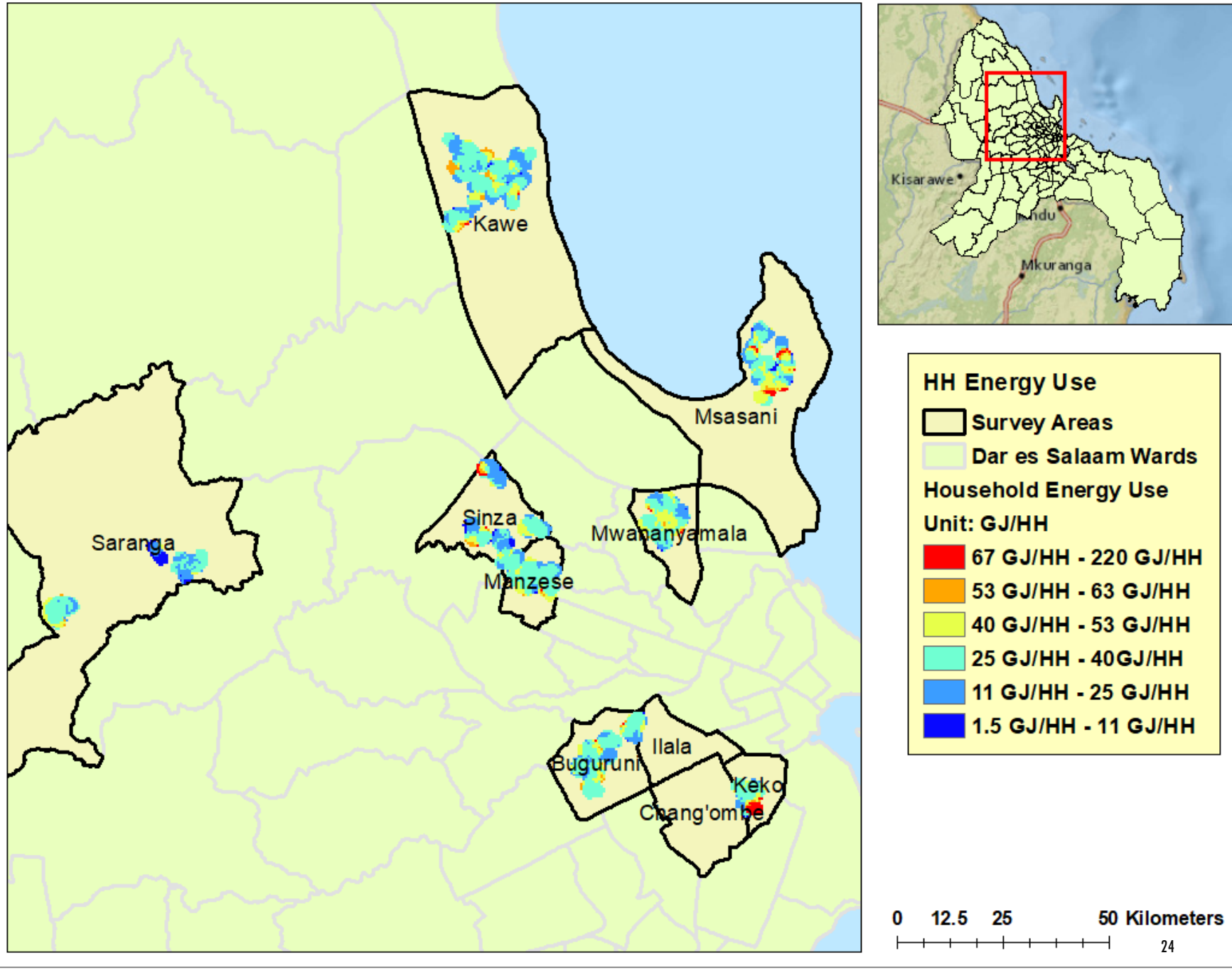
MEAN ENERGY USE ESTIMATED AT **37GJ/HH.**





HH Energy Use
Survey Areas
Dar es Salaam Wards
Household Energy Use
Unit: GJ/HH
67 GJ/HH - 220 GJ/HH
53 GJ/HH - 63 GJ/HH
40 GJ/HH - 53 GJ/HH
25 GJ/HH - 40GJ/HH
11 GJ/HH - 25 GJ/HH
1.5 GJ/HH - 11 GJ/HH

0 12.5 25 50 Kilometers


Kawe
Msasani
Sinza
Mwananyamala
Manzese
Saranga
Ilala
Buguruni
Keko
Chang'ombe
Kisarawe
Mkuranga
HH Energy Use
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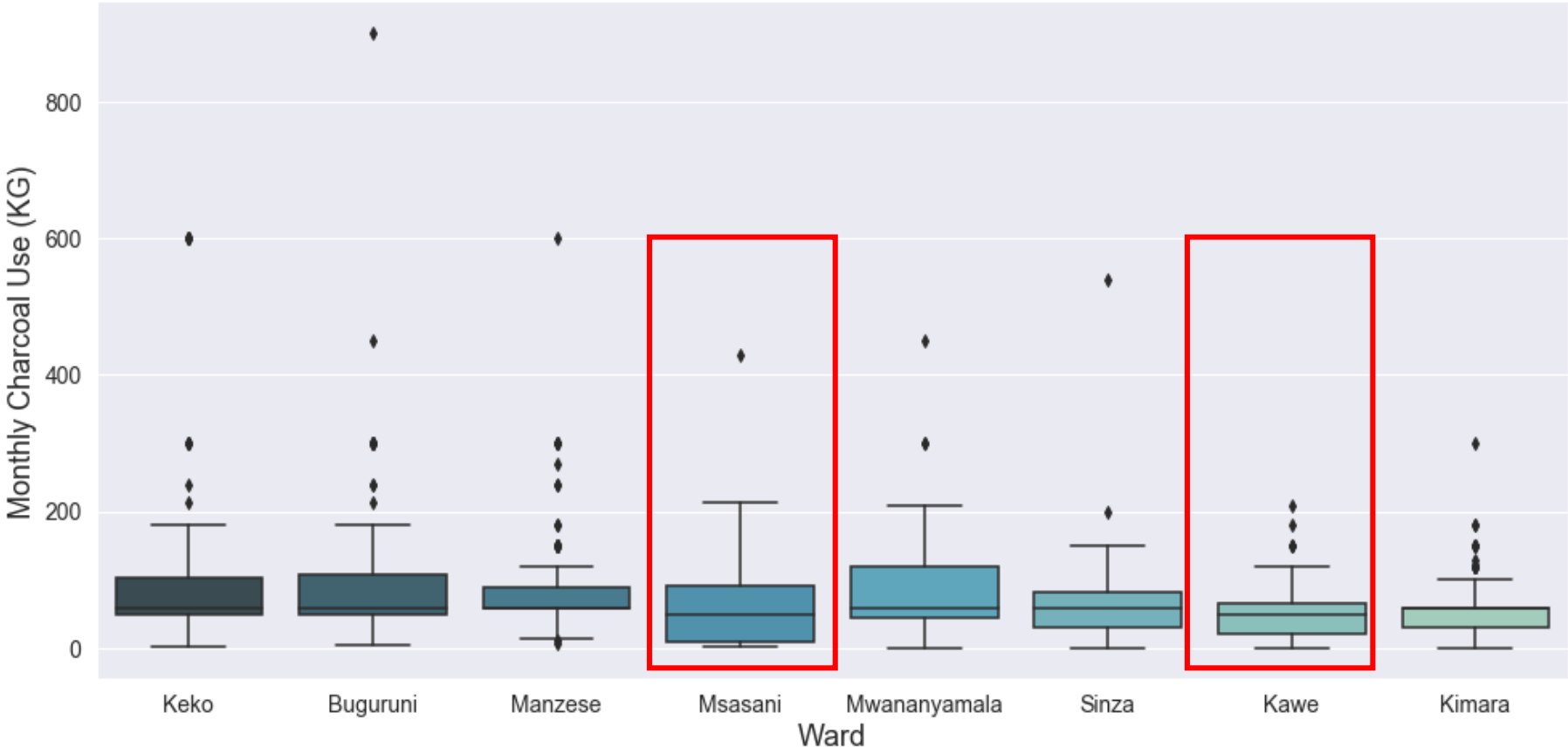
1.5 GJ/HH - 11 GJ/HH
0 12.5 25 50 Kilometers

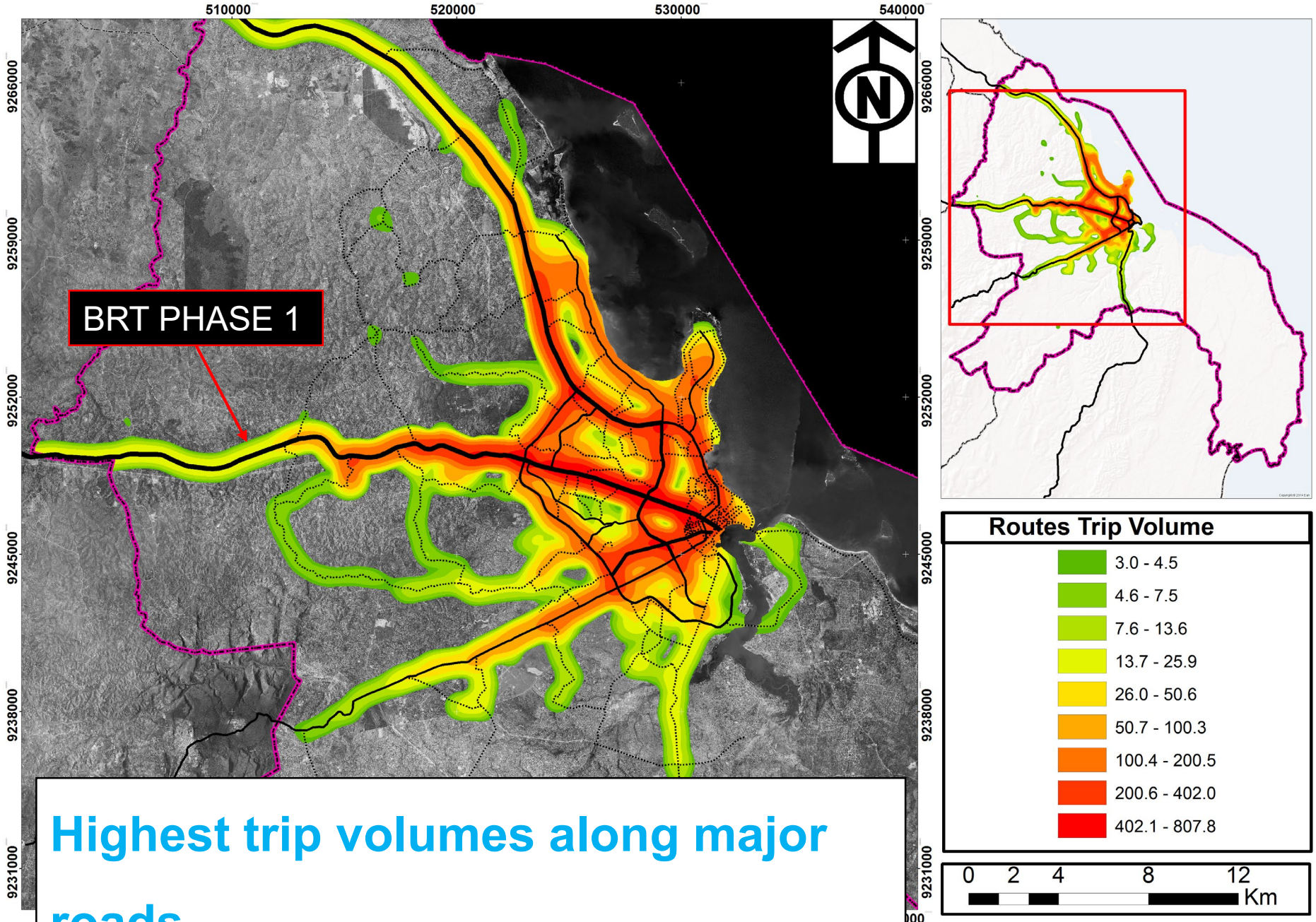
While most HHs in the sample are electrified (~88% of sample), only 11% of HHs are using it for cooking.

High levels of charcoal use for cooking at a median level of 60kg per household per month across all HHs, with the highest levels in low- and middle-income HHs.

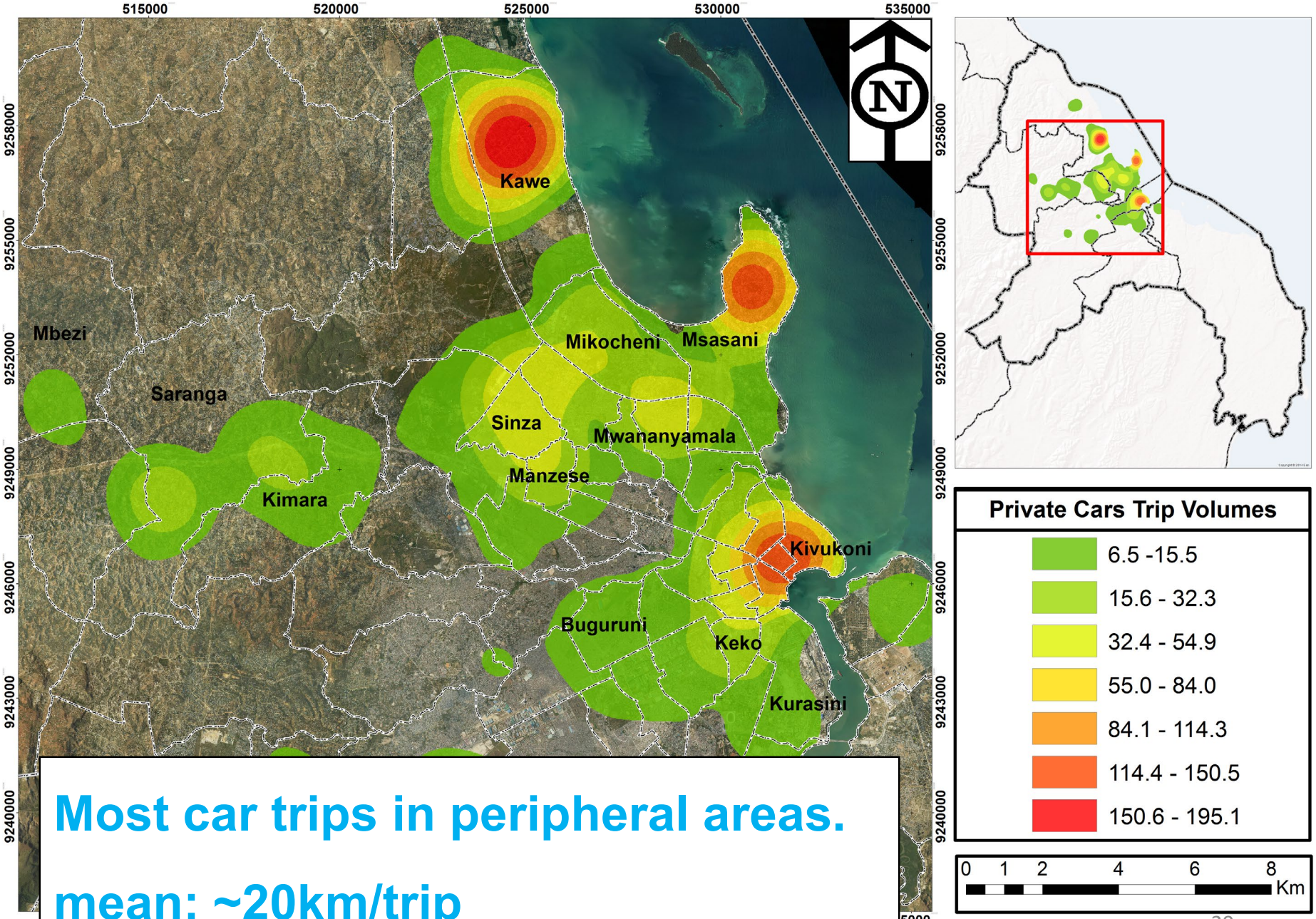


~80% of public transport trips are by “dala-dala” mini-buses.

Dar es Salaam, Tanzania
Photo by Chibulu Luo ©



Highest trip volumes along major roads.

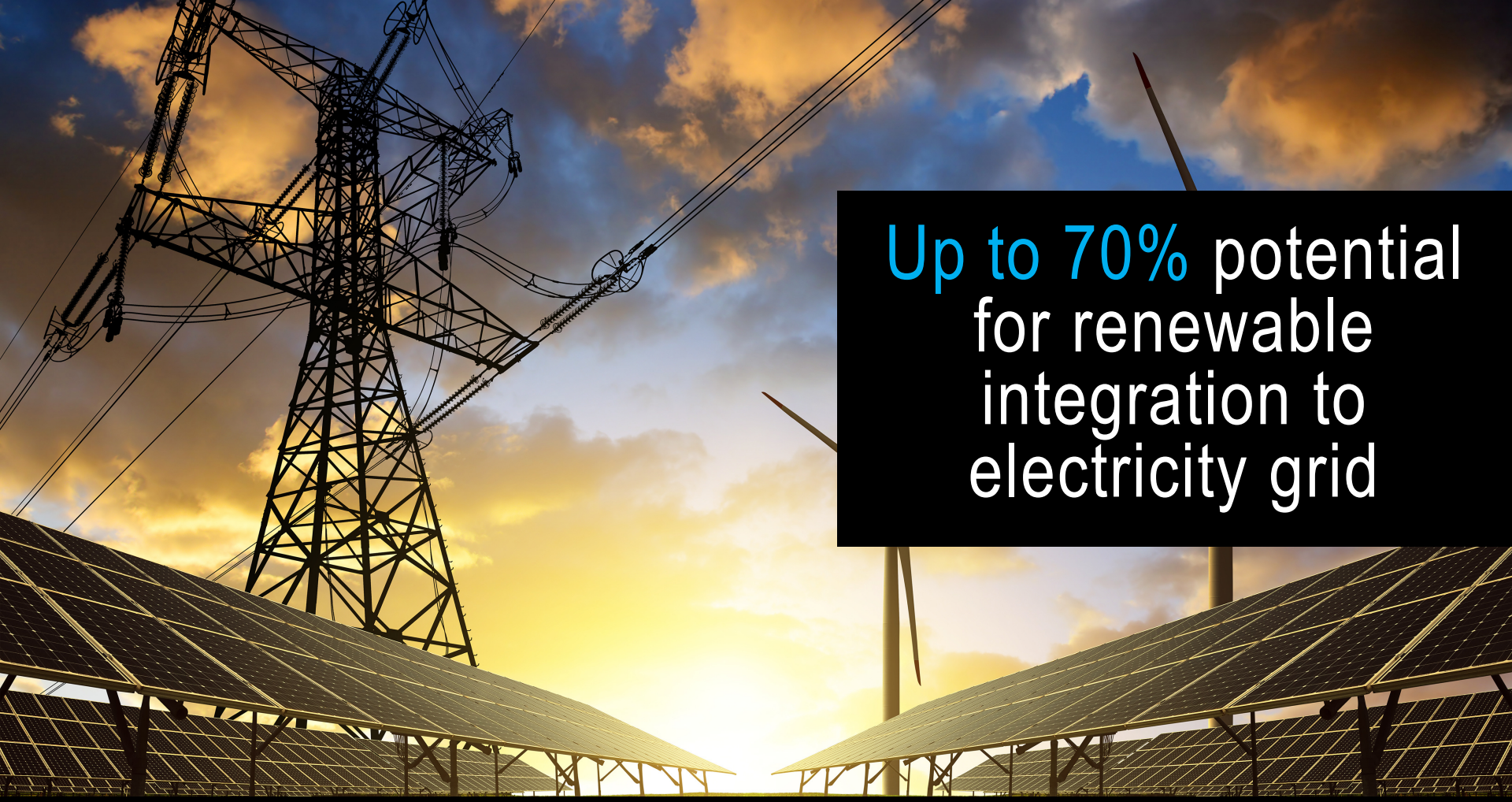


Most car trips in peripheral areas.

mean: ~20km/trip

POLICY INSIGHTS…

Manage use of traditional fuels



De-carbonize electricity

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Promote use of low-carbon transit

Phase 3: Governance and financing landscape?

- Which institution has the capacity to coordinate?
- How can investments be scaled-up?

[Key informant interviews and Workshop (Nov. 2018)]

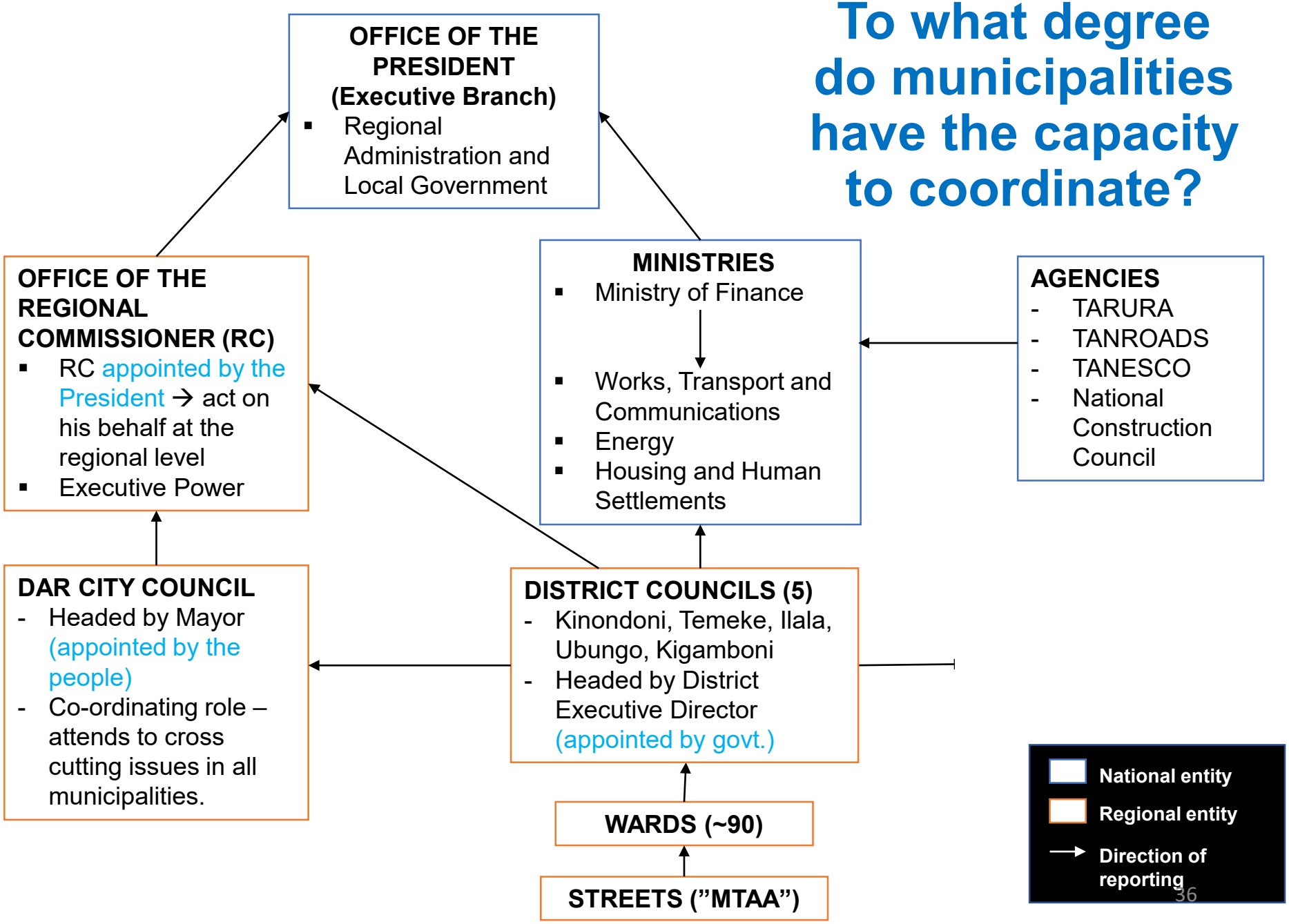
D-BY-D POLICY

In 1998, Tanzania put in place **decentralization-by-devolution (D-by-D) policy** which gives Local Government Authorities (LGAs) fiscal and administrative autonomy on the management and use of central government funds to their District.

"Local government authorities are given powers to implement their own projects — it is at their discretion to decide which areas of investment they want (depending on their need). So even if the central government provides a large portion of their resources, there is a a devolution of funds from the central government, in a way that there is some kind of semi-autonomy in the expenditure"

Director, President's Office (2018)

To what degree do municipalities have the capacity to coordinate?



Low-carbon growth in Dar es Salaam, Tanzania | A workshop on governance and finance strategies: http://civmin.utoronto.ca/low-carbon-growth-in-dar-es-salaam-tanzania-a-workshop-on-governance-and-finance-strategies-organized-by-phd-candidate-chibulu-luo/ (November 29th 2018)

Which institution should **coordinate** the low-carbon agenda?

3. District and City Councils

D-by-D policy gives them autonomy to communicate priorities areas of funding to central government.

Ability to coordinate across sectors is moderate

Communicate sector-specific priorities to ministries, to ensure that service delivery reflects local needs.

Which institution should **coordinate** the low-carbon agenda?

2. Ministries

Coordinate policies and actions around renewable technology integration and scale-up (e.g. MoE).

Ability to coordinate across sectors is moderate

Collaborate with LGAs to develop local policies that promote and incentivize investments in low carbon infrastructure

Which institution should **coordinate** the low-carbon agenda?

1. President's Office (PO-RALG)

Mandated by President

(requires political leadership)

Ability to coordinate across sectors is high

"Trickle-down" effect to strategies at the national and municipal level

What are the options for **finance**?

Funding options

- Dedicated budget line from central government
- Own source revenues **(limited)**
- Private sector (e.g. PPPs), "need to build a strong pipeline of projects"
- Tax-based mechanisms

CONCLUSION

The transition needs to have **political leadership directly from the central government** (President's Office). Only then will implementation occur at lower levels of governance. **"Out-of-the-box"** thinking is required to scale-up investments, particularly, establishing more effective mechanisms for engaging with the Private Sector.

"The process needs to be led by the President's Office, with the inclusion of all sectors and District Councils. Even though the implementation of low-carbon investments will be done at the sector level, it needs to include all stakeholders. But currently, every sector is planning on its own."

Professor, Ardhi University (2018)

Chibulu Luo | PhD Candidate
Department of Civil and Mineral Engineering
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