Global EV Pilot City Forum 2019
November 15th 2019

From Pilots to Scale: The Experience of Santiago de Chile with Electric Public Buses

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Research + Development + Innovation

Air quality and Climate change

We include advanced research on the formation of aerosols and their distribution of sources, as well as external and internal air pollution processes.

Topics Urban aerosol characterisation / Atmospheric emissions and toxicity / New atmospheric monitoring systems.



Energy and Transports

Also, we include research on efficient technology in transportation and its ramifications, in addition to heavy machinery. Furthermore we work on energy efficiency.

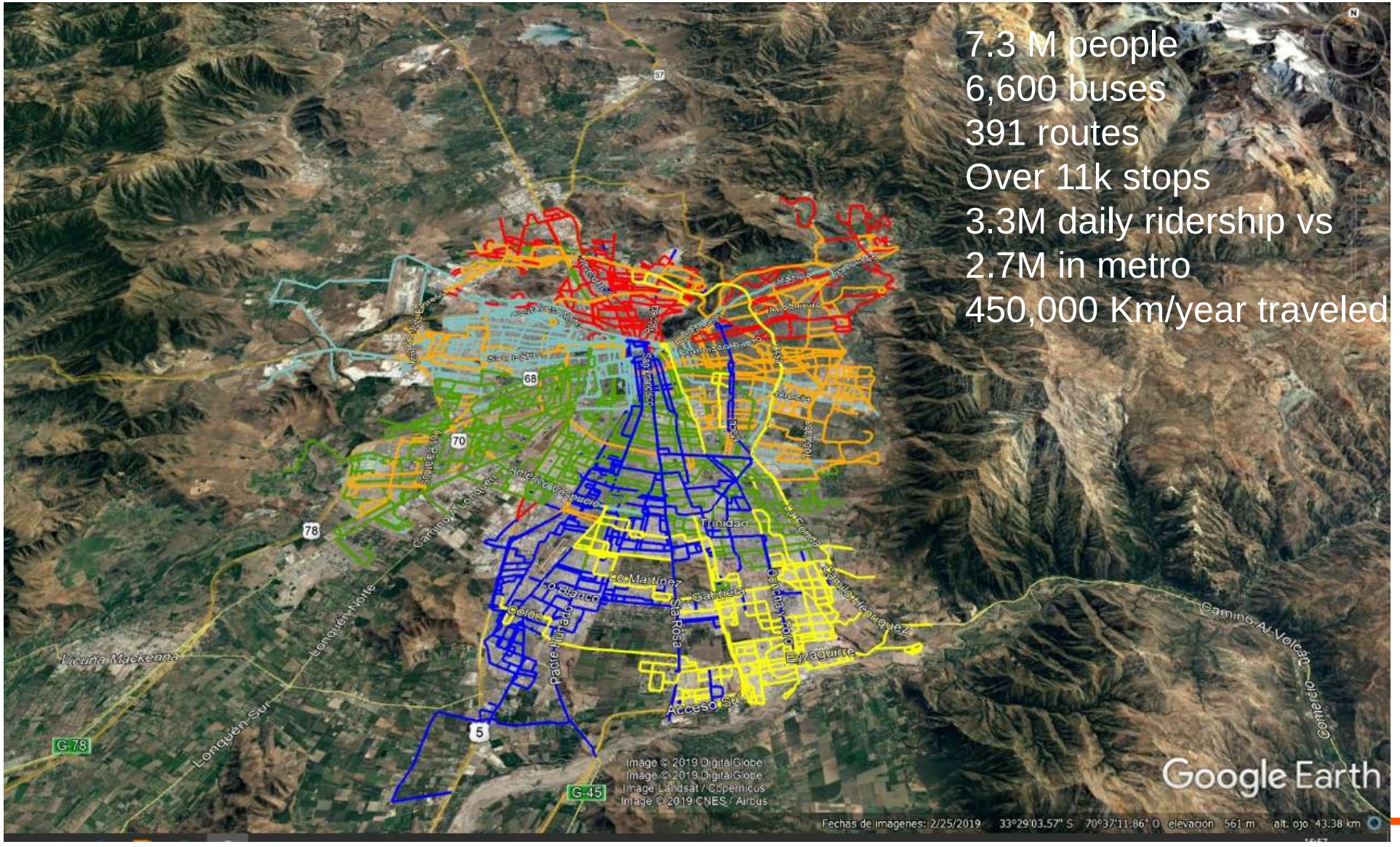
Topics Base line / Emissions inventories / Electromobility / Public transport.



Our work is focused on Latin America and the Caribbean but developed in-conjunction with global partners



CONTEXT


7.3 M people
6,600 buses
391 routes
Over 11k stops
3.3M daily ridership vs
2.7M in metro
450,000 Km/year traveled
Image © 2019 DigitalGlobe
Image © 2019 DigitalGlobe
Image Landsat / Copernicus
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Google Earth
Fechas de imágenes: 2/25/2019 33°29'03.57" S 70°37'11.86" O elevación 561 m alt. ojo 43.38 km

Chile has had a historical focus on improving vehicle technology by focusing on public transportation



Year	Diesel Sulfur Content (PPM)	Emission Standard (Norm D.S.130/94 MTT)
1990	5000	N/A
1994	3000	N/A
1997	1000	N/A
2002	300	Euro III/EPA 98
2006	50	Euro III Advanced / EPA 98
2010	50	Euro III Advanced + DPF / EPA 98 + DPF
2012	15	Euro V / EPA 2004 + DPF
2016	15	Euro V / EPA 2007 + DPF
2018	15	Euro VI / EPA 2010

ELECTRIC BUS PILOTS

Electric bus pilots began in 2013 and have swiftly expanded – Santiago has become an entry point for e-buses to the region













Innovative financing models have allowed electric bus pilots to quickly scale to 100+ bus operations



ENGIE

stp SANTIAGO

BUSESVULES.A.

YUTONG

Innovative financing models have allowed electric bus pilots to quickly scale to 100+ bus operations



METBUS

enel x

BYD

Including the first “electric corridor” operated exclusively with BEBs in Latin America (10/2019)



- CAPEX has dropped from $450k to $295k USD from 2014 to 2019
- Buses achieving 76% reduction in energy costs
- 40% reduction in maintenance costs

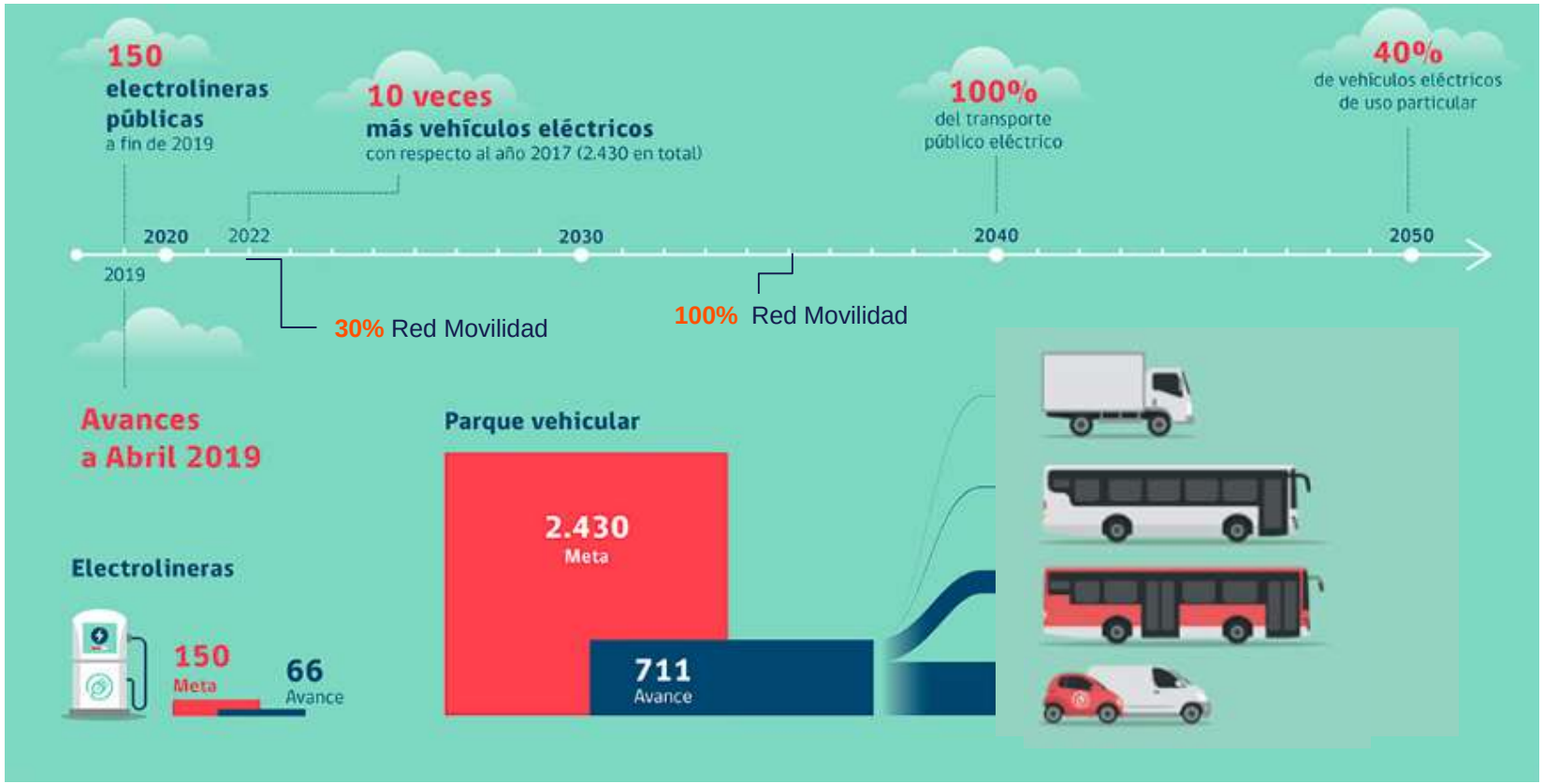
By end of 2019, 411 BEBs in regular operation – hoping to reach 800 by mid 2020 - full electrification by 2035 (6,650+ buses)





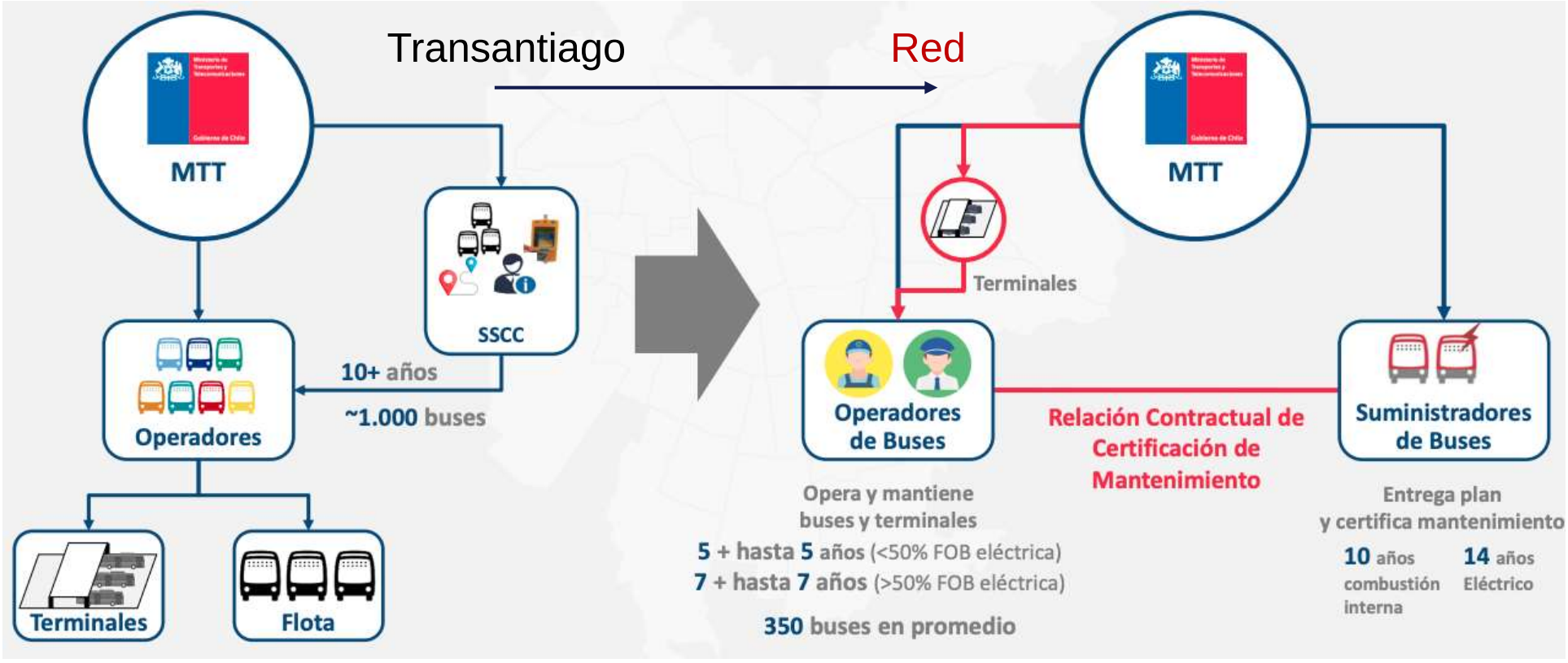


Current electric vehicle targets by the Ministry of Energy include full electrification of public transport by 2040



SCALING BEBs THROUGH COMPETITIVE PUBLIC TENDERS

Fleet renewal tender will change public transit model for the city and also include incentives for BEBs



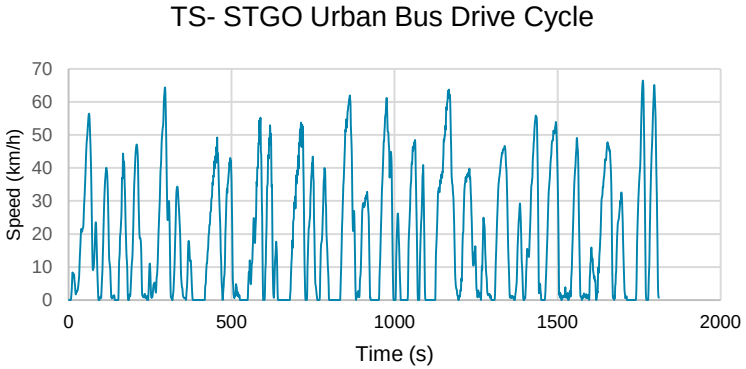
Upcoming competitive public tenders for fleet renewal in Santiago de Chile (2020 - 2024)

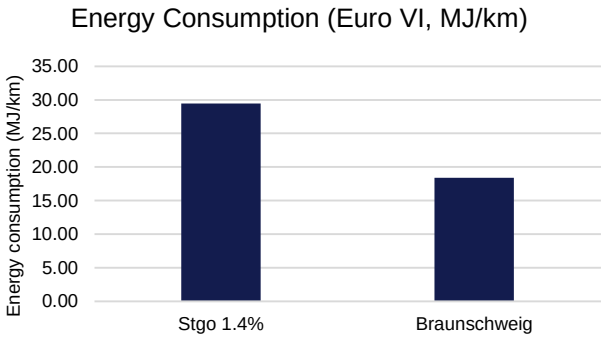


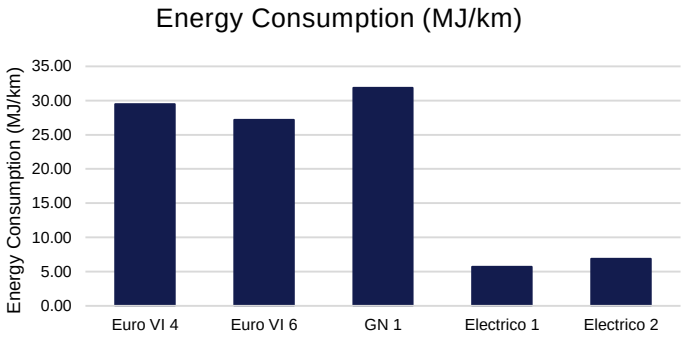
- Fleet renewal will likely be more concentrated in the first phase (70-80% by 2022)
- First public tender will look to include at least 30% BEBs

EXAMPLES OF REDUCING BARRIERS TO SCALE BEBs OPERATIONS

Chile has focused on improving public transportation performance and energy efficiency







- TS-STGO simulates representative (+ stringent) conditions for urban buses in Santiago
- **BEBs still outperform (x4) conventional buses** in more stringent test cycle
- City specific drive cycles give **regulators insight into vehicle performance** and **allow OEMs to adapt performance**
- Despite caveats, this **provides a comparable measure to distinguish performance based on energy consumption** in fleet renewal processes
- **Implemented in 2018 - Resolución MTT No 2.243 (Junio 2018)**

CMM Investigación & desarrollo

ADVANCED MOTOR FUELS
IEA-AMF

Determining the potential for route electrification helps reduce operational and financial risks

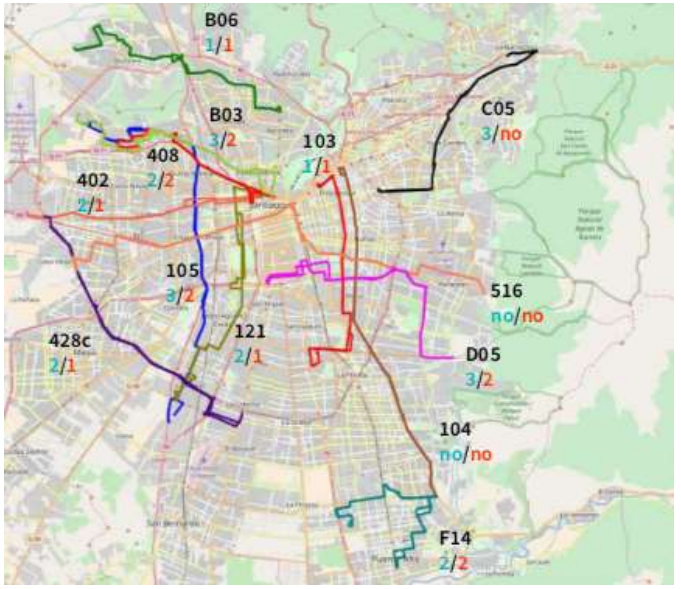
Desarrollo de modelos de operación de rutas eléctricas

- Desarrollo de un ciclo de conducción (3CV/CMM), medición en laboratorio (3CV/VTT)
- Desarrollo de modelos de buses en herramientas de simulación (CMM/ITBA)
- Validación de los modelos en Laboratorio (3CV/CMM/VTT)

+

Identificación de recorridos con potencial a ser electrificados

- Identificación de rutas (CMM)
- Simulación de consumos de energía y autonomía (CMM)
- Simulación VTT, específicos para e-buses + recarga (3CV/CMM/VTT)



DTP Metropolitano

BID Banco Interamericano de Desarrollo

GFEI Global Fuel Economy Initiative

P4G Partnering for Green Growth and the Global Goals 2030

UN environment

VTT

Average range for different scenarios (by route) allow for planning BEB deployment potential

Scenarios	Average Range (km/charge)	
	Bus 1 (277 kWh)	Bus 2 (324 kWh)
30% passenger load without AC	211	233
50% passenger load without AC	195	219
30% passenger load with AC	154	175
100% passenger load without AC	161	185
100% passenger load with AC	132	152

- Range scenarios vary by as much as ± 36%
- Auxiliary systems (AC/Heating) can reduce range in up to 19%
- Most favorable performance meet 200km per charge in 85% of routes
- Most stringent performance meet 160km per charge in 85% of routes
- Implications for BEB deployment, route priorities, charging strategies, vehicle technology et al

CONCLUSIONS

BEBs have great potential in emerging cities but require strong planning and enabling environments

- **Policy Innovation:** Well designed policies can reduce technological, operational and financial risks
- **Improve Performance:** Meet operational requirements improve environmental performance
- **Business Model Innovation:** New business ecosystem require multi-stakeholder cooperation
- **Data & Compliance**: Data is key to reduce asymmetries of information between stakeholders
- **Focus on Public Transportation:** Increases positive externalities that can lead to replication
- **Enabling Environment**: Goals have to be accompanied by strong planning and enabling environment

Thank You!

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