Potential and Challenges for Large Scale Introduction of Electric Buses in South Africa

SABOA
September 2023

Golden Arrow Bus Services

Agenda

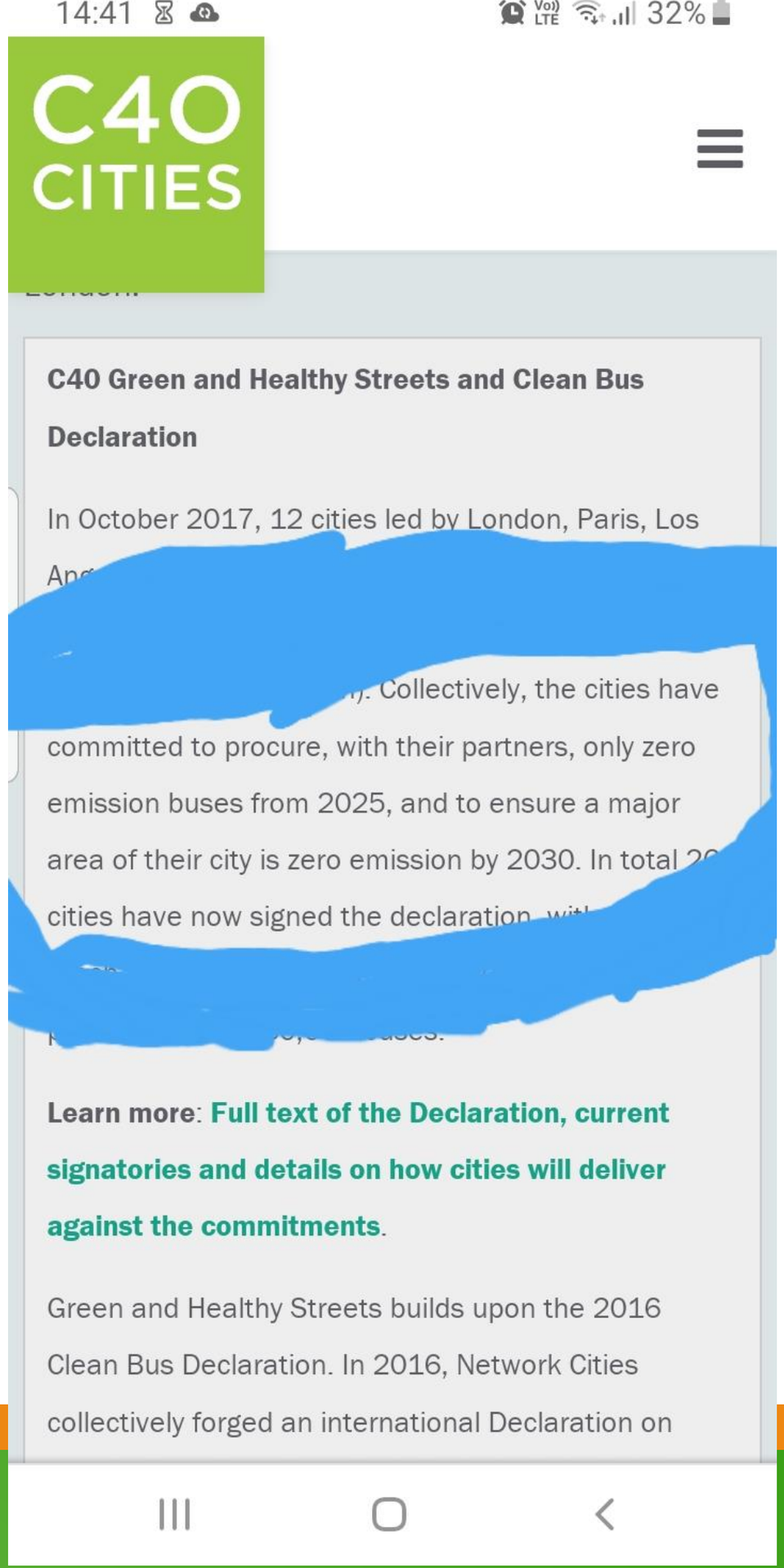
- Golden Arrow Background
- C40 Cities
- Dirty Electricity Argument
- Electric Bus Testing
- Potential Savings
- Charging and Electricity Demand Profiles
- Solar PV and Battery Storage
- Diesel Bus Conversions?
- Financial Institutions

Golden Arrow

- Age 162 Years → Since 1861
- Buses >1 100
- Employees >2 500
- Distance ±65 000 000 Km per year
- Diesel >25 000 000 Lt per year

C40 Cities

- Cape Town
- Durban
- Johannesburg
- Tshwane



Source: C40 website

Dirty Electricity Argument?

- *"Better to localise energy production, via dirty electricity, than using imported dirty fuel in South Africa"*

- Electric vehicle introduction
  - No subsidies in South Africa to "go green"
  - Step 1 = must be a commercial solution
  - Step 2 = utilise renewables to reduce costs and carbon footprint

Test Results

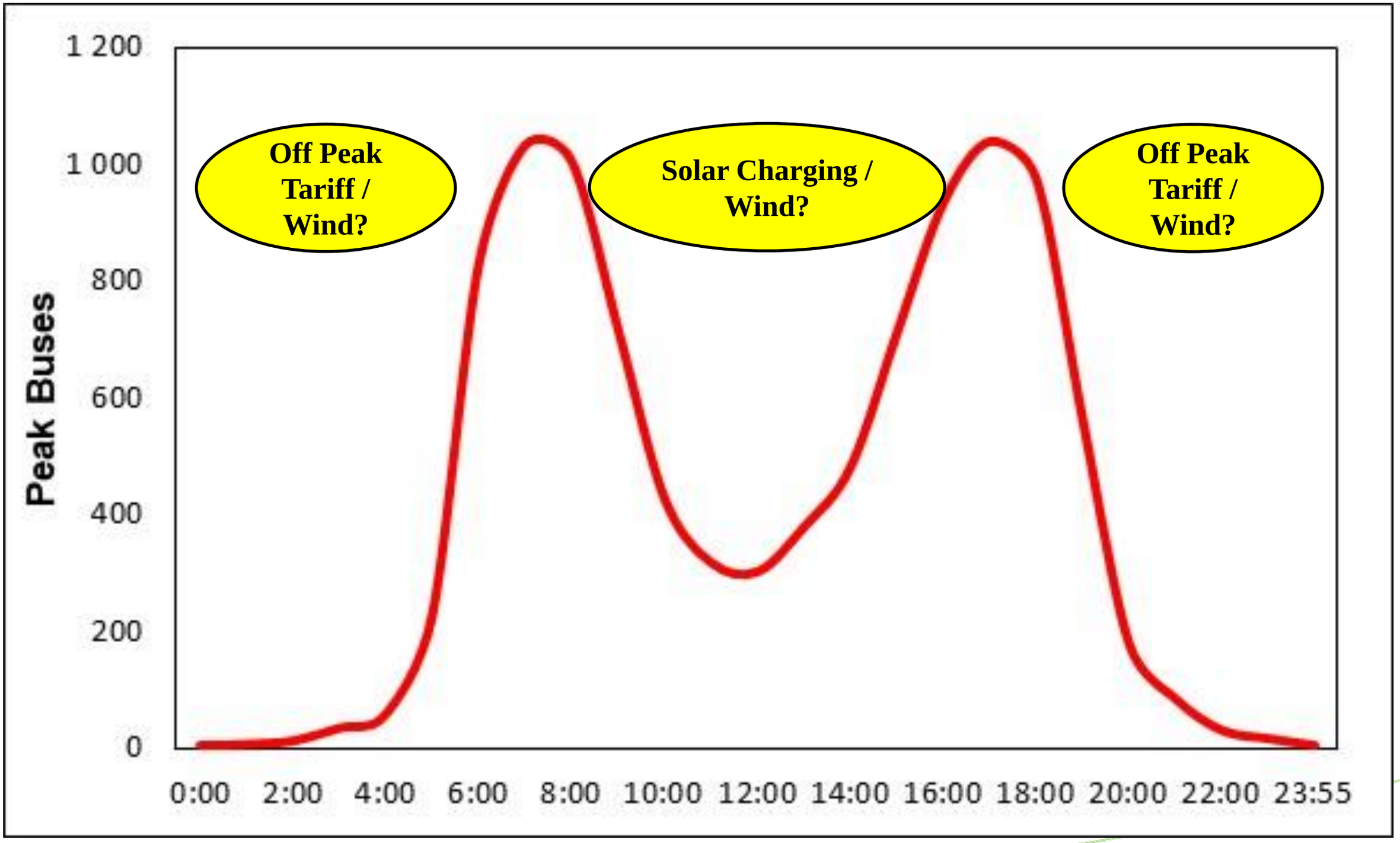
- > 100 000km completed

- Energy
  - 1.05 kWh/km → 37 seater buses
  - 1.10 kWh/km → 65 seater bus

Potential Savings

- Energy
  - 1.10kWh per Km → 65 seater
  - Energy costs → -70% [ytd June 2023 Diesel]
- Spare parts → -50% estimate
- Oil & lubes → -80% estimate
- Tyres → no impact
- Labour → -30% estimate

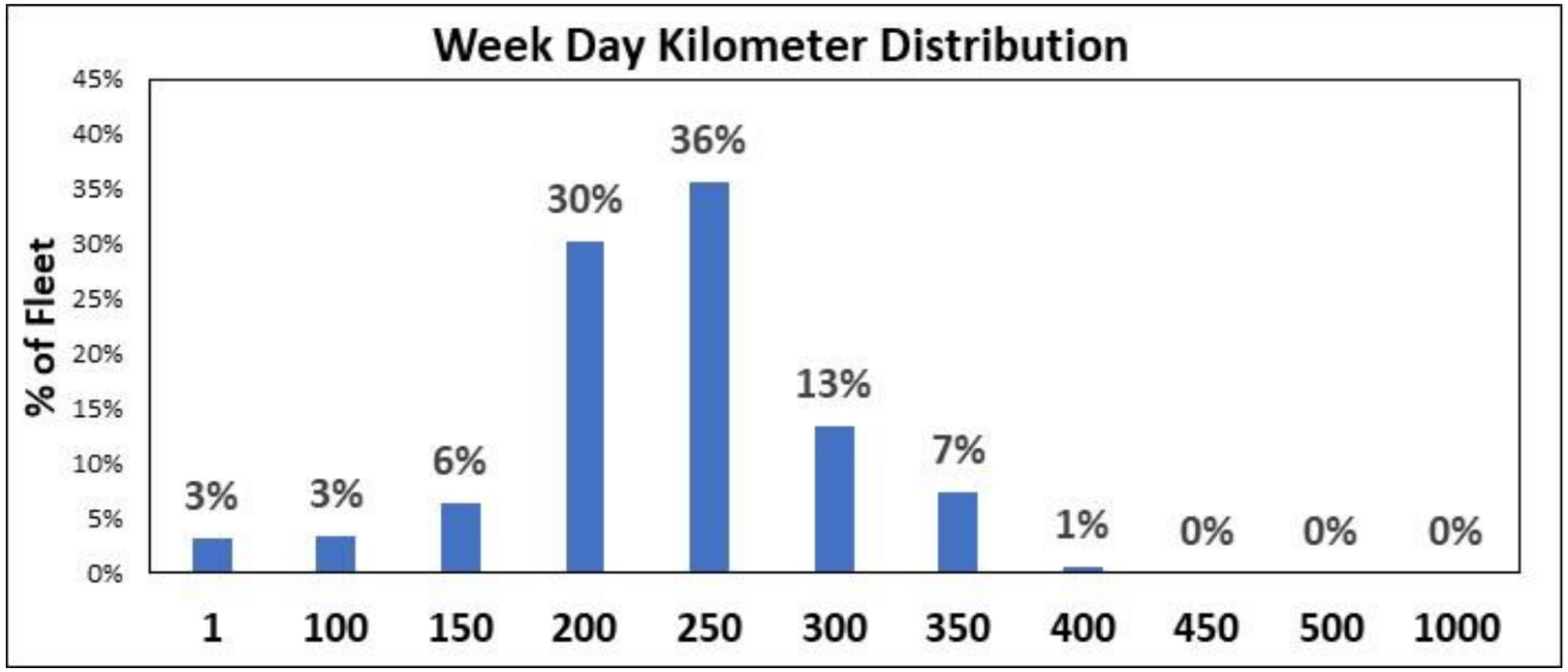
Charging Potential

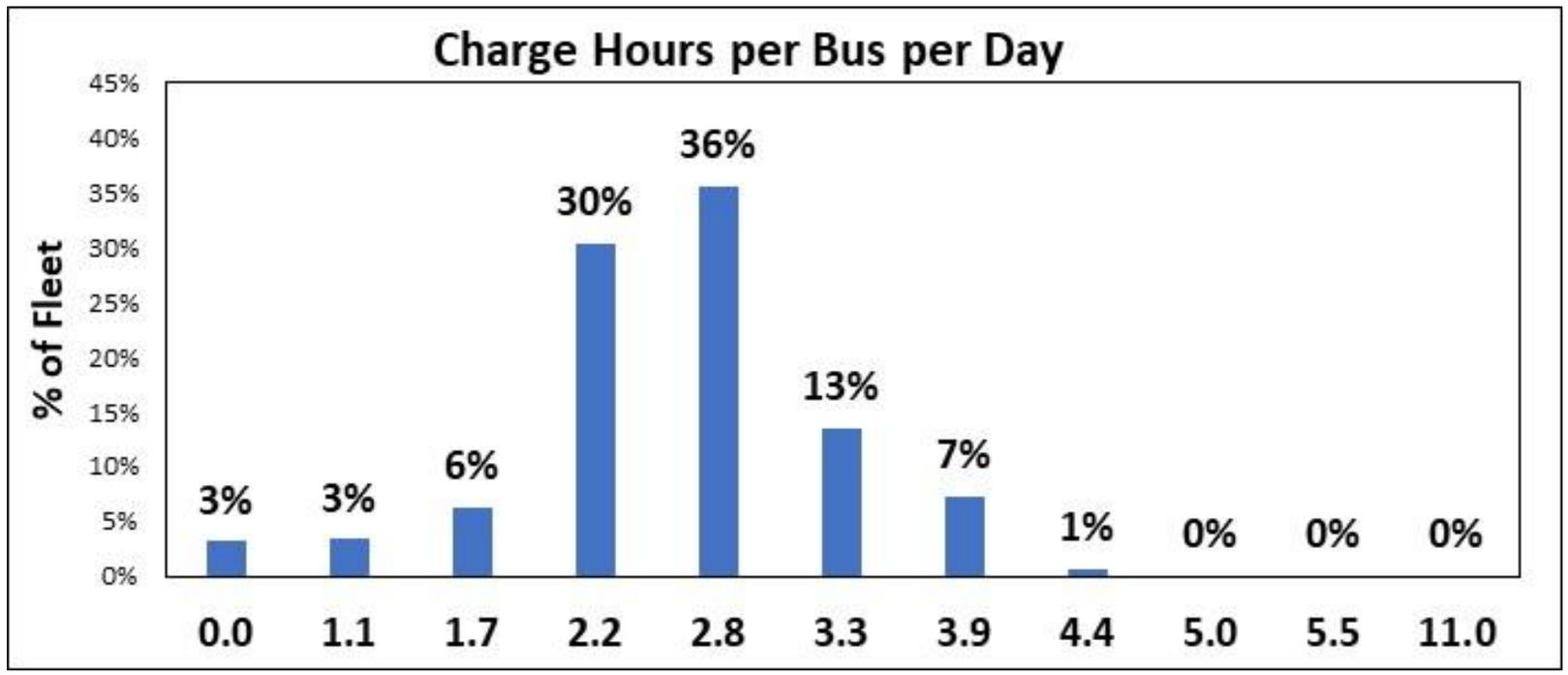


Electricity Demand Profiles

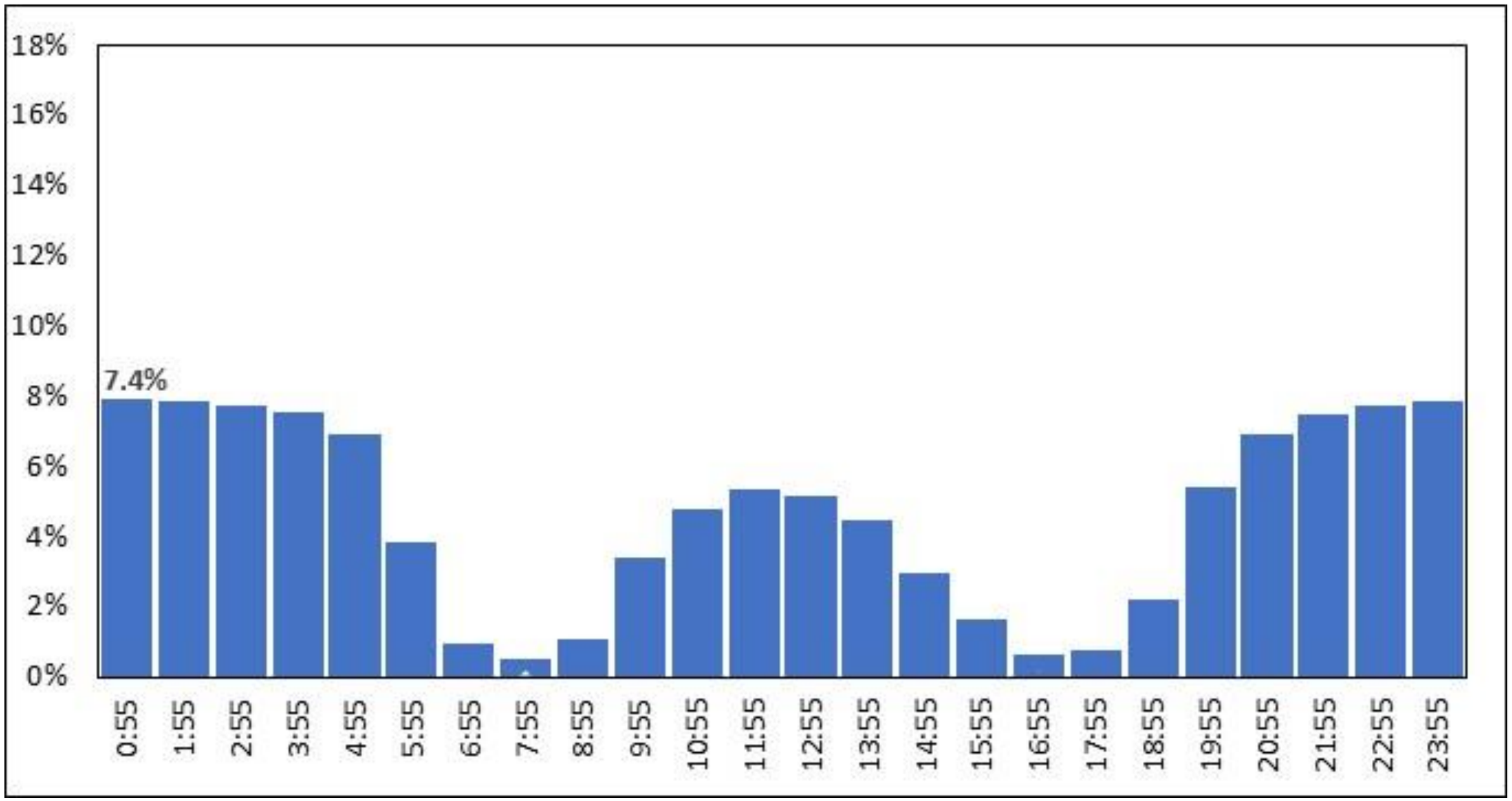
- Linked to operating profile and potential load shedding
- Maximum electricity demand scenarios
  - No load shedding
  - Load shedding between 2 and 8 hours per day
  - Off peak charging
    - Demand balancing
    - Special rates
- Linked to each scenario
  - Maximum kW required
  - Number of chargers required

Kilometers vs Charge Hours





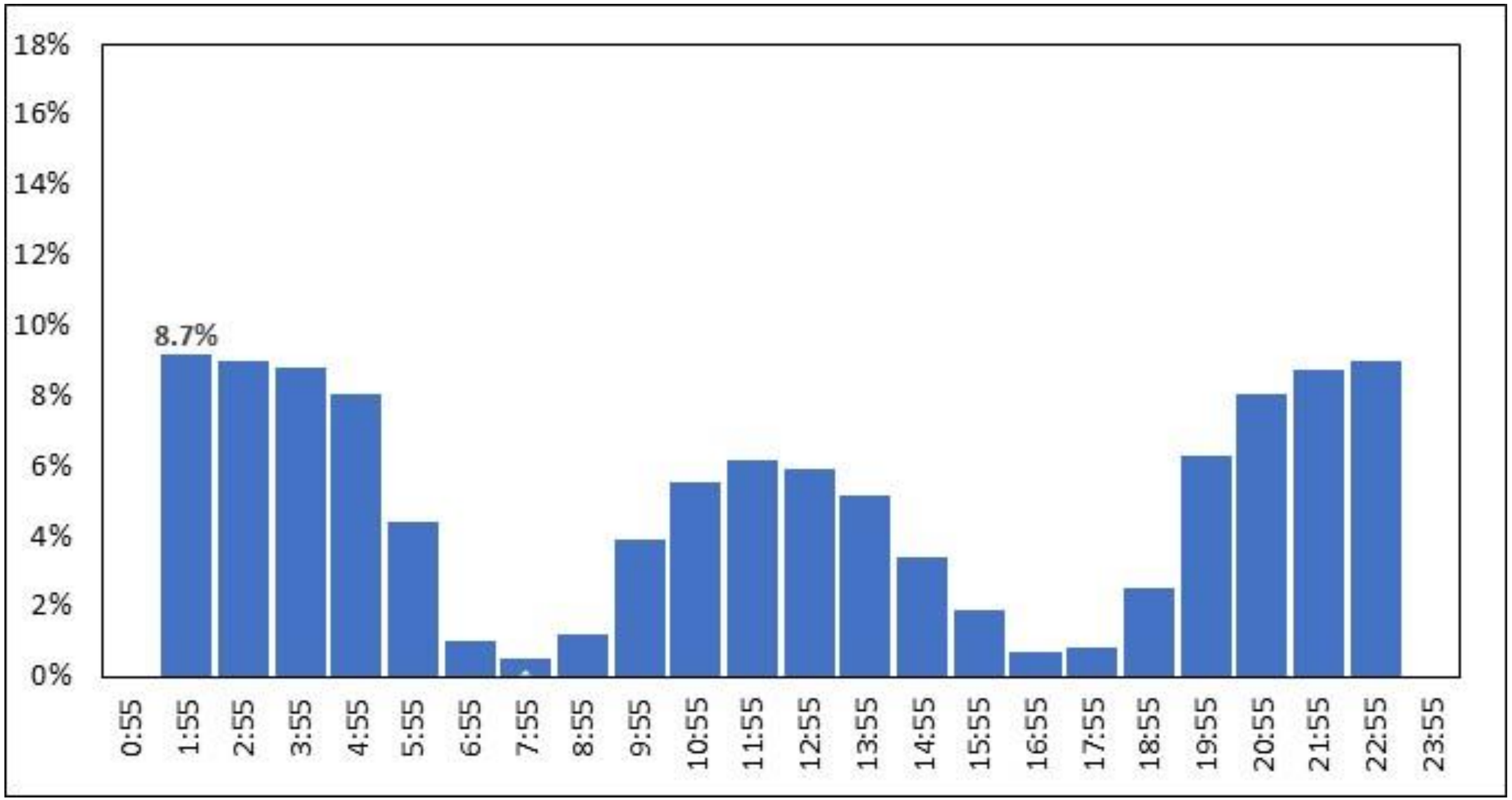
No Load Shedding



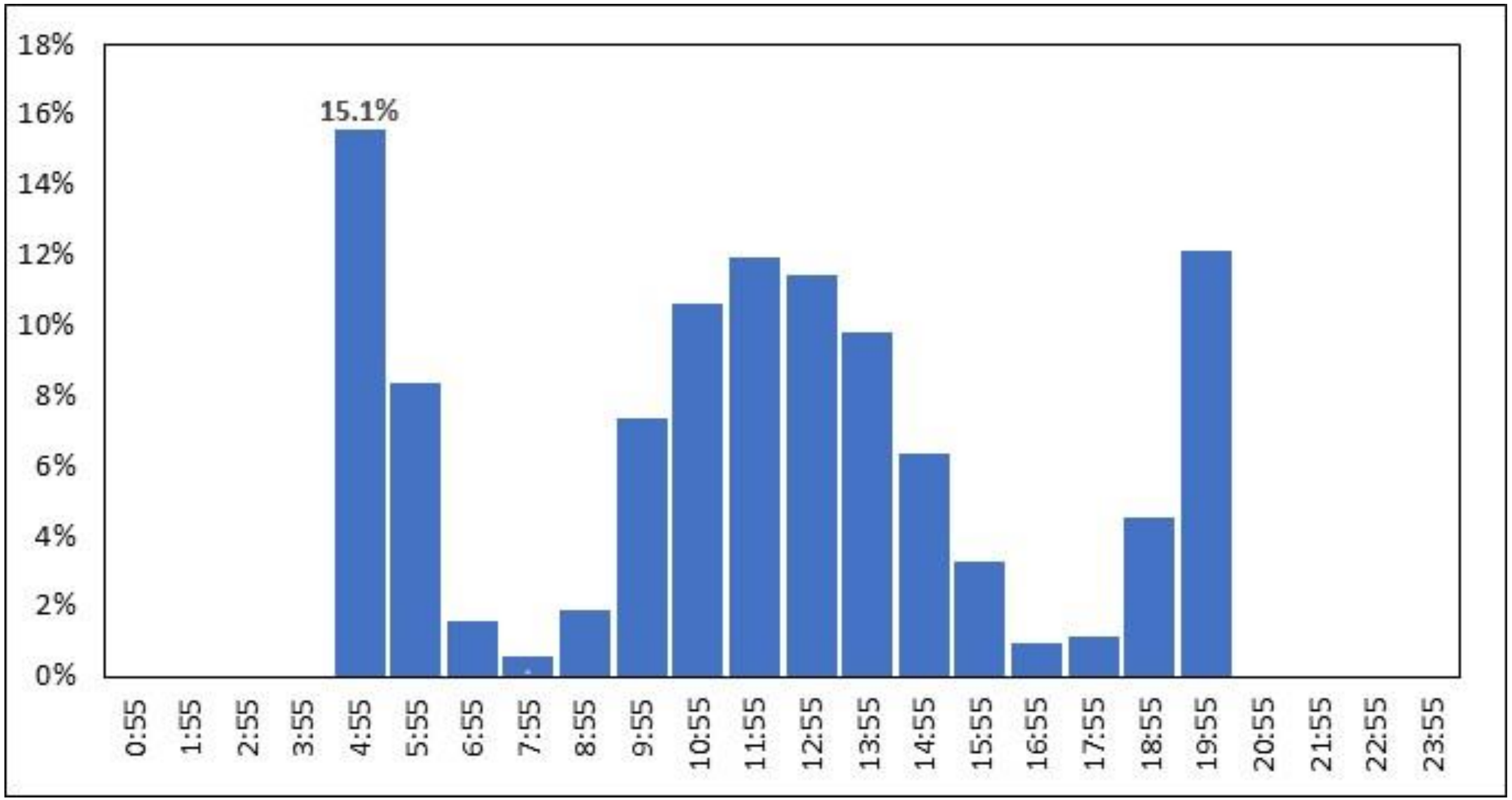
No Load Shedding

	No Load Shedding			
Buses	60	120	180	463
Km / Day	12 000	24 000	36 000	92 600
kWh / Day	13 200	26 400	39 600	101 860
kVA	1 500	2 500	4 000	9 500
Chargers	15	25	40	95

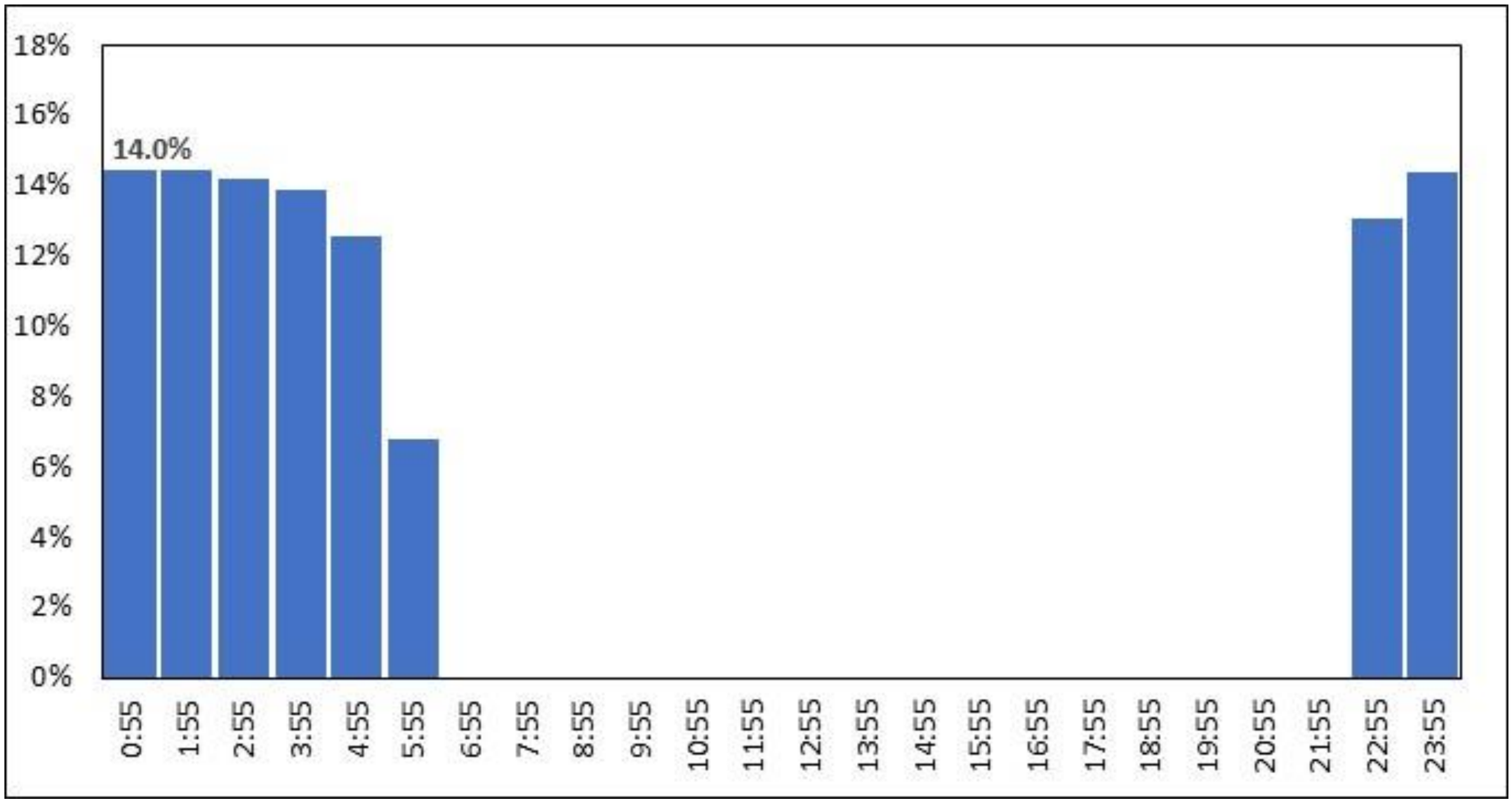
2 Hours Load Shedding



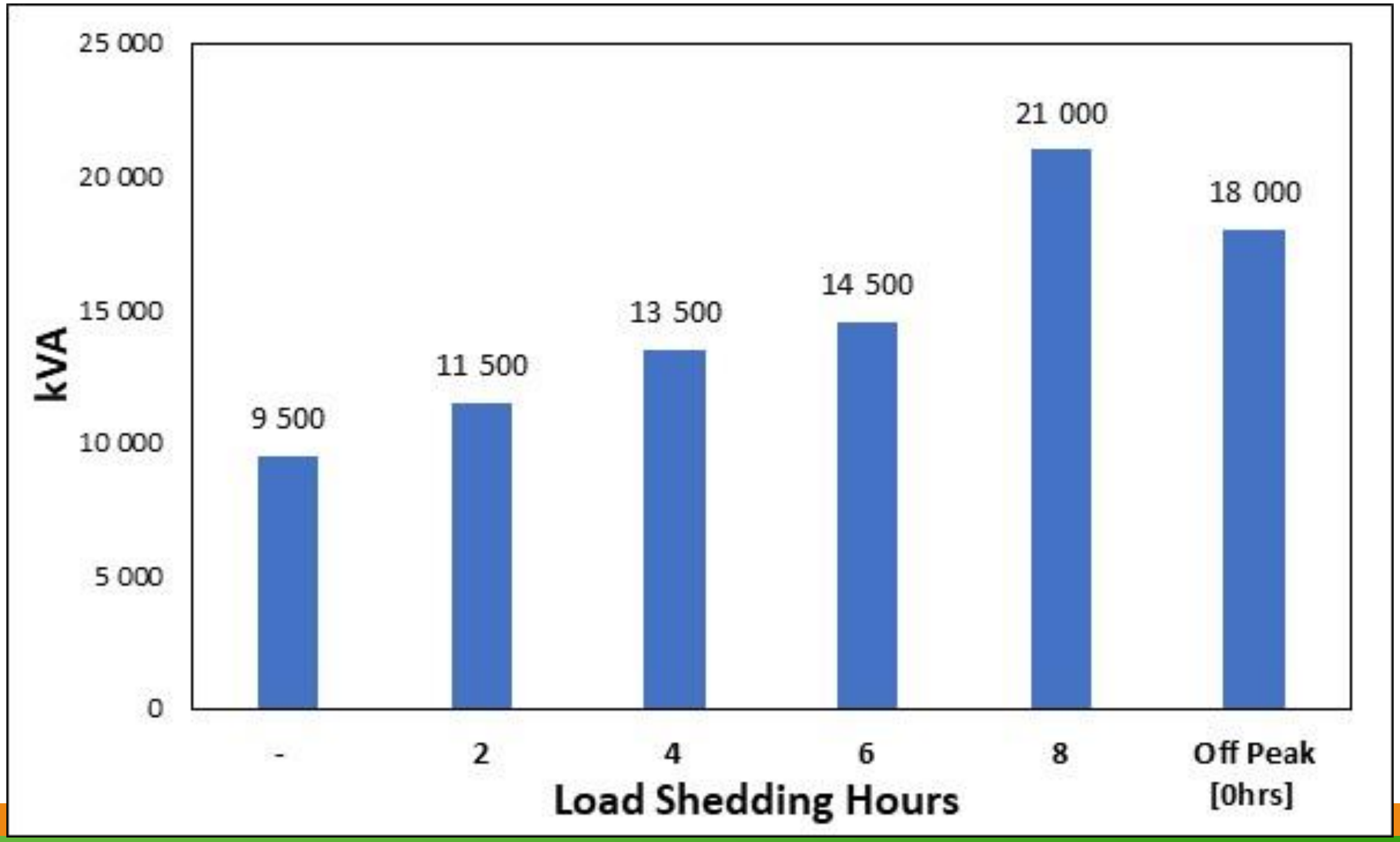
8 Hours Load Shedding



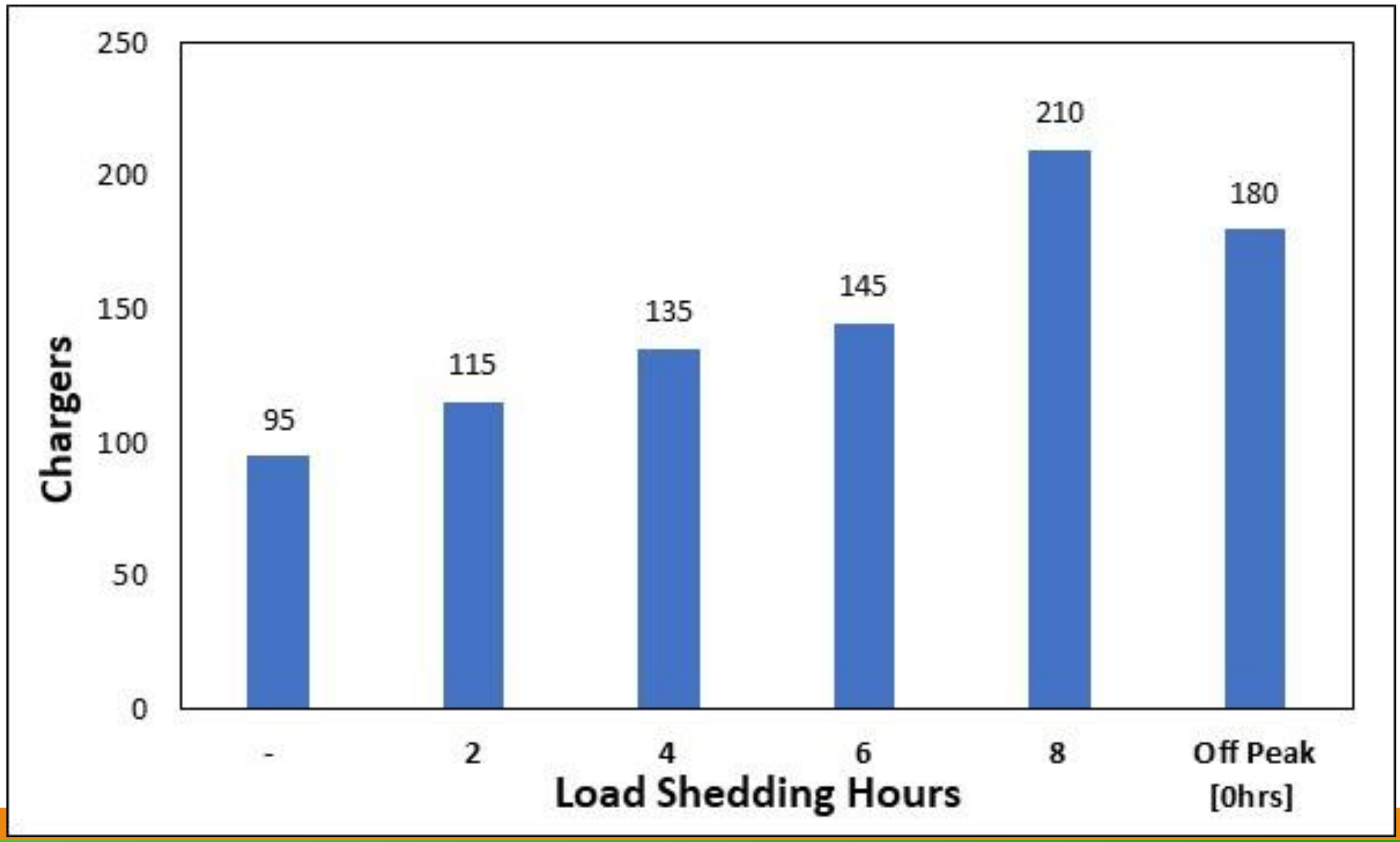
Off Peak Charging



Electricity Supply



Chargers Required

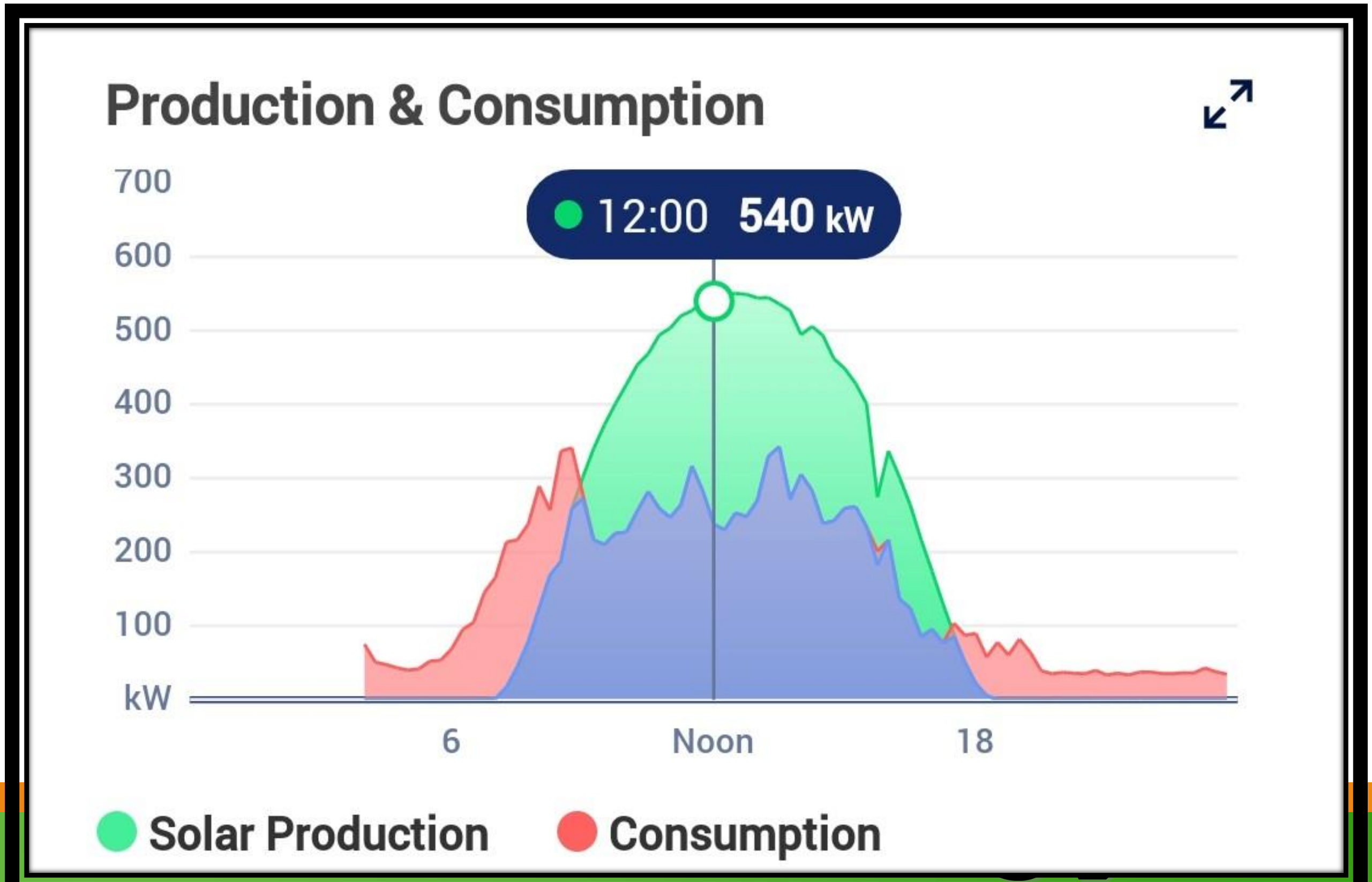


Battery Size and Range Anxiety

- Detailed operating profile
  - Accurate utilisation hours, with time of day, required
  - Non-utilisation hours = charging opportunities
- Smallest battery for your operation profile
  - Smaller = less cost
  - Smaller = less weight

- Most people overestimate their utilisation hours

Solar Production



Car Port Type Bus Parking?

- Golden Arrow owns 22 hectares ~ 10% to 15% of required production

Battery Storage?

- Still an expensive alternative
- Battery efficiencies and ESKOM price escalations will probably accelerate the progress towards storage being a feasible solution

Electric Conversions?

- Partner with University of Stellenbosch
- Prototype target completion late September 2023

Golden Arrow Next Steps

- 2023
  - Board approval for 60 locally build or assembled electric buses
  - Start testing converted electric bus
  - Homologation challenges for converted buses?
- Late 2024 / Early 2025
  - Start introducing 5 electric buses per month in Cape Town
  - Complete e-bus conversion feasibility
  - Convert diesel buses to electric buses?

Financial Institutions

- Many banks advertise “green finance”
- Risk of “green washing” exist
- Banks should advertise “green” vs “normal” rates

Thank You!


Golden Arrow
BYD
100% ELECTRIC / ZERO EXHAUST EMISSIONS
2040
Golden Arrow
ELECTRIC
Golden Arrow
ELECTRIC
STOP