Rules of Engagement

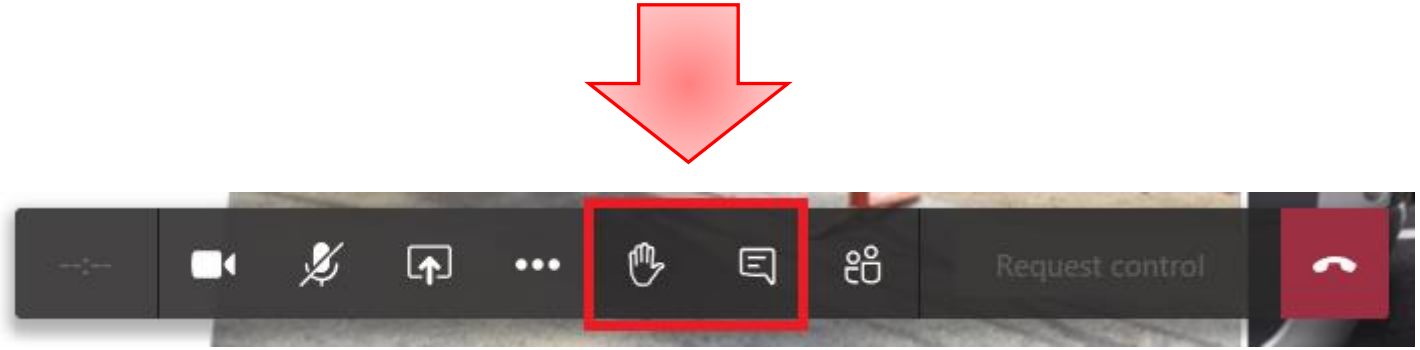
Low Carbon Vehicle Partnership
Connect
Collaborate
Influence

1. **The webinar will be recorded** and uploaded to view after with the **meeting slides shared with participants.**

2. **All participants will be muted throughout the webinar**.

3. **Keep video turned off and microphones muted**

4. **Please raise your hand and use the chat section to submit questions**. If you cannot use the chat please email your question to Daniel.hayes@lowcvp.org.uk



Developing an “EV Culture” with good data

LowCVP
Low Carbon Vehicle Partnership
Connect | Collaborate | Influence

25th November 2020

Part of Electrification of Bus Fleets Webinar Series

Webinar Panel

LowCVP Low Carbon Vehicle Partnership
Connect Collaborate Influence

Tony Oldham, Operations Director, CT4N

Sandra Radecka, Account Manager, ViriCiti

Lawrence Govender, Aftermarket Director, Optare

Topics summary

1. **Key differences between diesel and electric operation – not quite "plug and play"**
   i.e. reasons why you need an EV culture and how to get the most out of your EV

2. **Vehicle / Infrastructure Operation:**
   Where is the vehicle/ where is the charger?
   Is the vehicle being charged/is the charger working?
   How much power, for how long?
   How much does it need to be charged?

3. **Drivers**: driving style/training, breaking & acceleration, in-service management
   Does it have enough charge to complete the service?
   Can I move it onto another service to support elsewhere?

4. **Vehicle Maintenance/Warranty:**
   What is actually wrong on the vehicle, when did things go wrong and where?
   Is the vehicle behaving correctly?
   Does it have enough charge to get to the garage for maintenance?

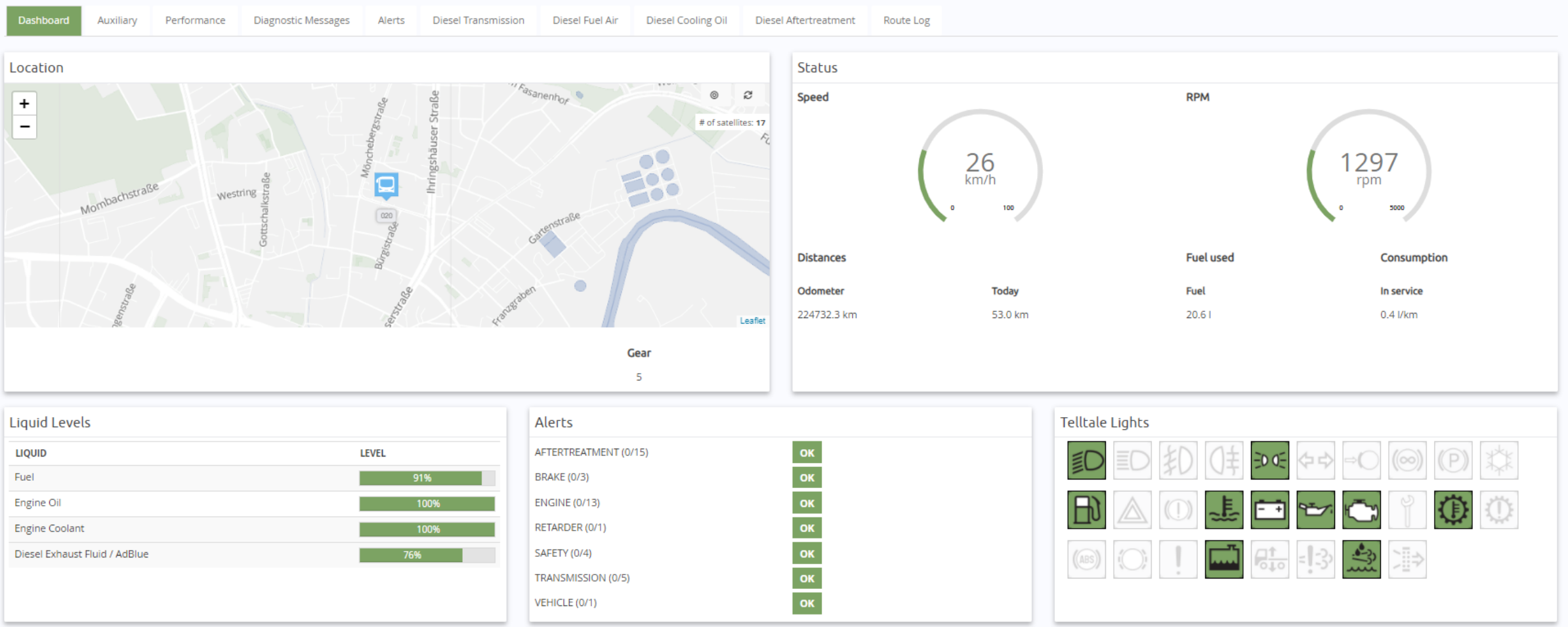
5. **Summer/Winter Effects:**
   What is the impact of cold on battery capacity and range?
   What is the impact of heating?
   What can operators do to mitigate these challenges?

Introduction to CT4N

- Private operator based in Nottingham
- One of the UK's oldest and largest EV fleets
- Operating from Queens Drive Park and Ride
- 45 Optare Solo EVs & Versa EVs (2012)
- 22kW & 50 kW chargers
- Power Supply: 420kVA (0.42MW)
- 13 BYD K9 – up to 80kW chargers (2016)
- Power Supply: 960kVA (0.96MW)
- 11 Routes on locallink network & Medilink

Key differences between diesel and electric operation

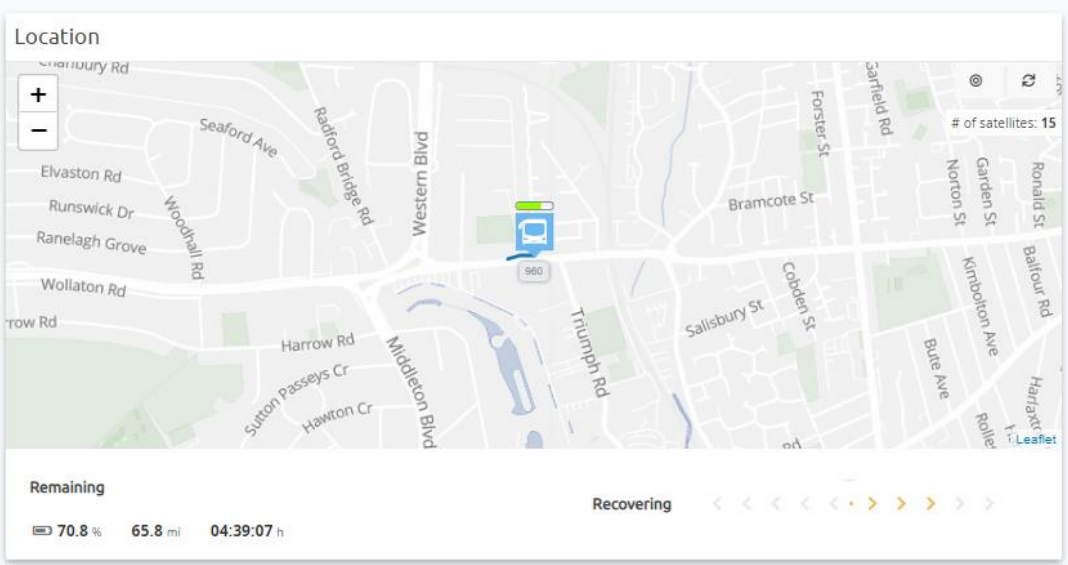
Diesel key indicators: liquid fuel, engine oil, coolant, aftertreatment system/ adblue etc.

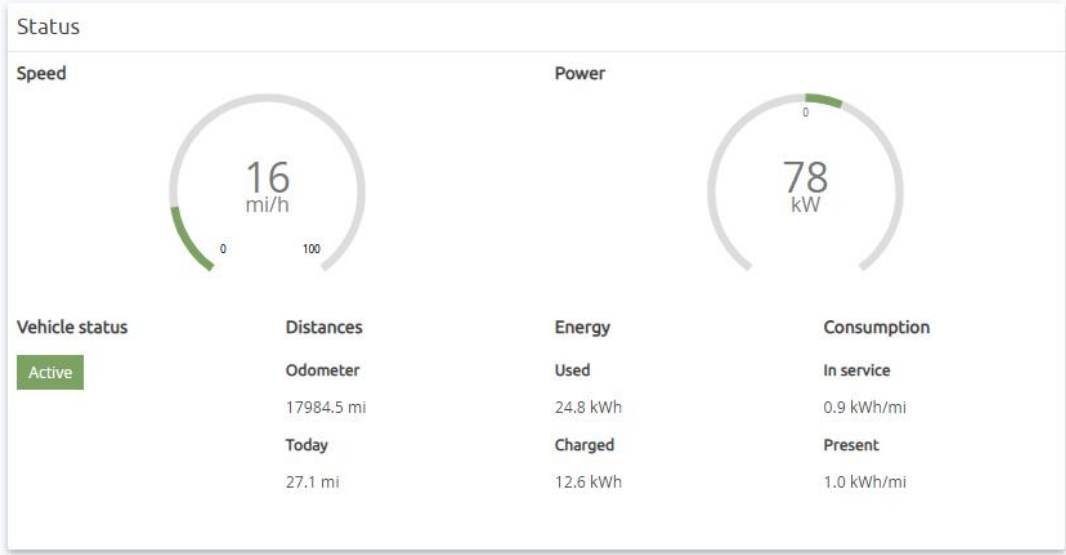


1

Key differences between diesel and electric operation

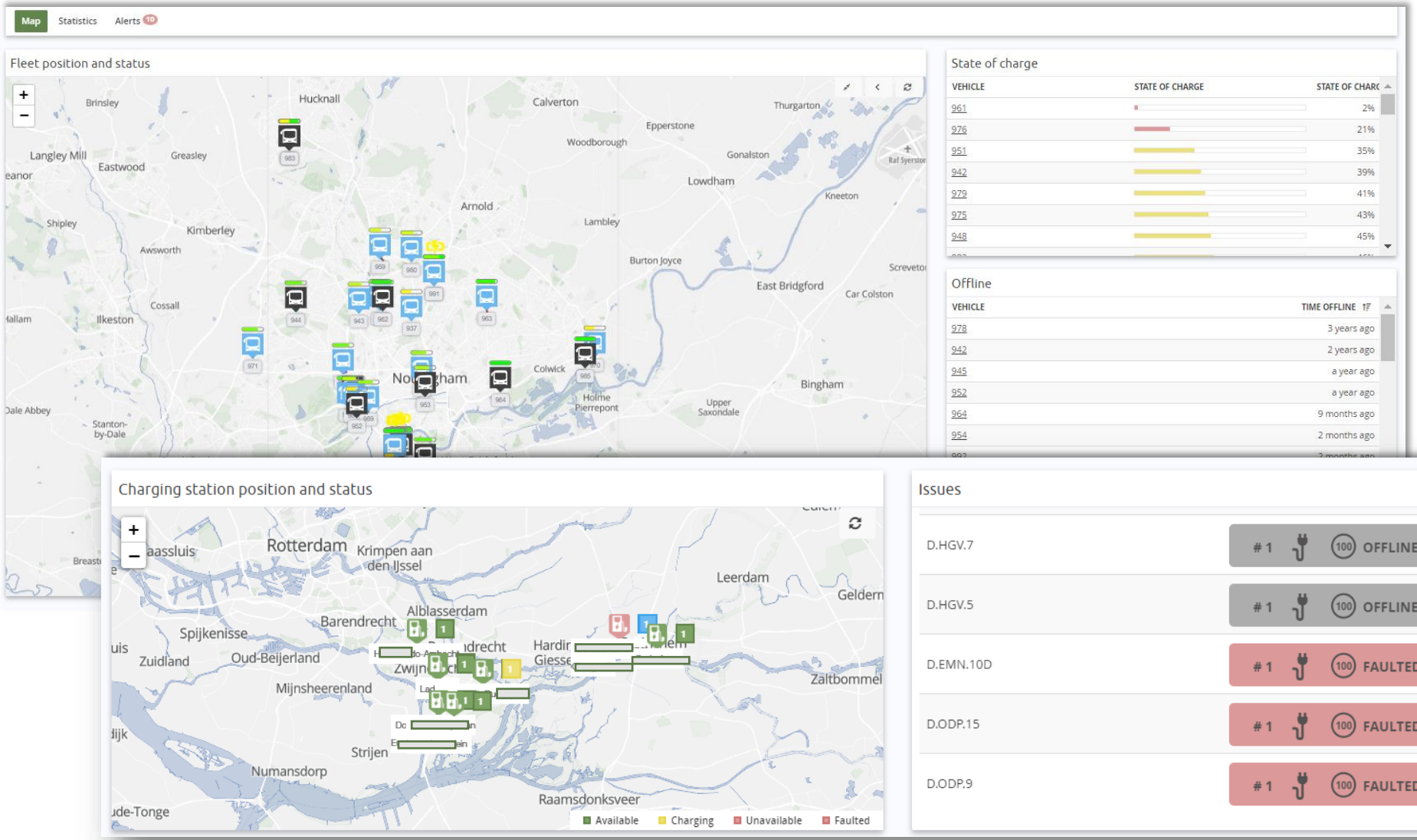
EV key indicators: state of charge / range, energy consumption, charging rate, battery faults





Vehicle / Infrastructure Operation

Vehicle location, remaining charge, availability of chargers, infrastructure planning, depot operation



3

Drivers

Real-life examples

Olaf

- Efficiency 0.96 kW/mi
- Driving during rush hour
- Eco driving indicator: 77

Greg

- Efficiency 0.81 kW/mi
- Driving at night
- Eco driving indicator: 69

INFO BOX

In general
↑ efficiency → ↑ smooth indicator

However
Here, efficiency of Olaf is worse than Greg's, but the score is better.

Why?
Different vehicles, traffic conditions, weather etc.

Result
Fair eco driving scoring, independent of external conditions

Vehicle Maintenance / Warranty

Both OEM and Operator can look at same data set to discuss issues: faults and repairs

Dashboard | Performance | Route Log | Alerts | Diagnostic Messages | **Battery** | Signals

Extremes

CELL VOLTAGE

max:	3481 mV	location:	module 29, cell 3	A FEW SECONDS AGO
min:	3390 mV	location:	module 29, cell 1,2	A FEW SECONDS AGO
delta:	91 mV			

CURRENT

max:	n/a	location:	n/a
min:	n/a	location:	n/a
delta:	n/a		

TEMPERATURE

max:	36.0 °C	location:	51	2 HOURS AGO
min:	22.0 °C	location:	40	11 HOURS AGO
delta:	14.0 °C			

STATE OF CHARGE

max:	98.0 %	location:	25, 28, 29, 30, 31, 36, 38, 39, 40, 44, 45, 46, 47, 48, 49, 51, 52
min:	97.3 %	location:	8, 10, 11, 12, 14, 15, 18, 19, 21, 22
delta:	0.8 %		

BMS Status

PACK 1

Charge mode

Balancing

Last reset at Reset

STATUS CHANGE DURATION

Equalizing to Charge complete	at last charge:	00h:38m	on average:	n/a

Communicating modules

Last reset at Reset

Communicating modules	52	of total 52 modules
Count of communication drops	20	

Charge status

LAST OCCURRENCES

State of charge under 20%		at least every **365 days**
Charge complete flag	4 HOURS AGO	at least every **14 days**
Charge complete flag and 200mV cell voltage delta	4 HOURS AGO	at least every **180 days**
Charge complete flag and 50mV cell voltage delta	4 HOURS AGO	at least every **365 days**

Summer / Winter Effects

"What gets measured, gets managed" – plan for worst day in winter

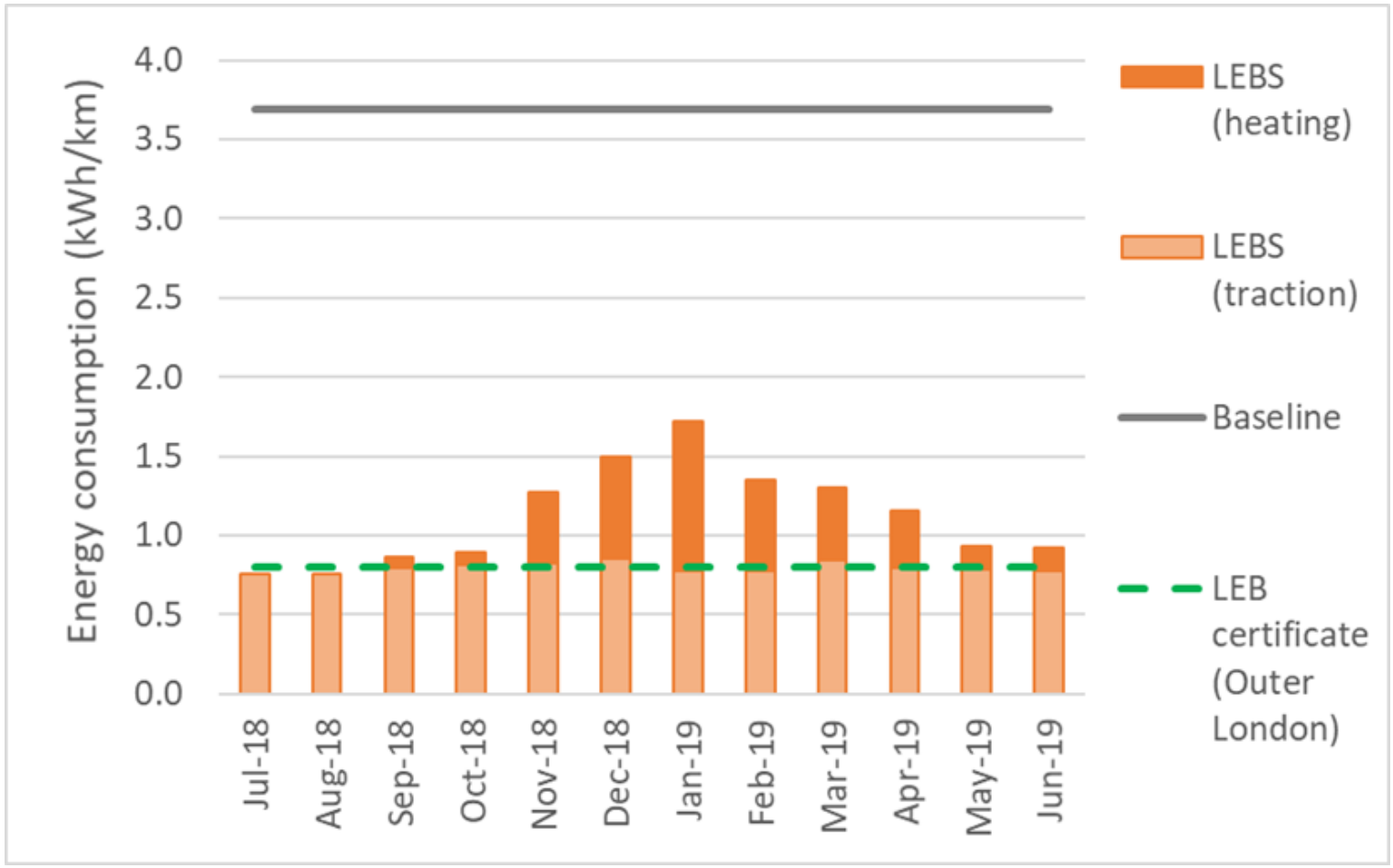
Time period: **01/06/2019-31/03/2020**	**Number of buses**	Difference in consumption between **Normal and Cold** temperatures	Difference in consumption between **Normal and High** temperatures
12m buses	**79**	**14%** ▲ in cold temps	**9%** ▲ in high temps
18m buses	**27**	**21%** ▲ in cold temps	**12%** ▲ in high temps

Table 1: Summary Statistics of consumption differences for two categories of buses

- To receive more details & the E-bus Performance Report contact s.radecka@viriciti.com

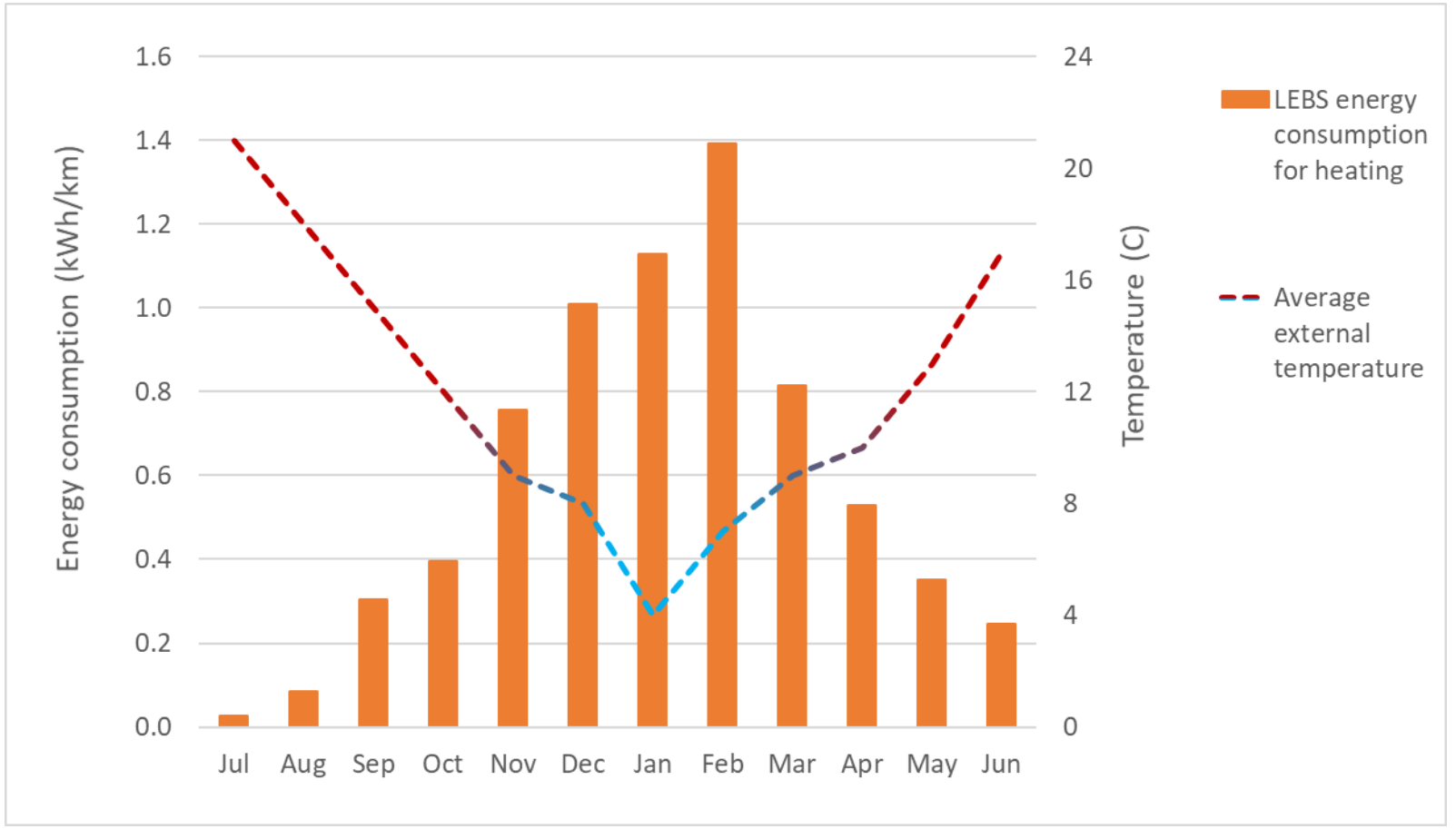
Energy consumption of EVs from LEBS monitoring programme

Heating can double energy consumption in winter months



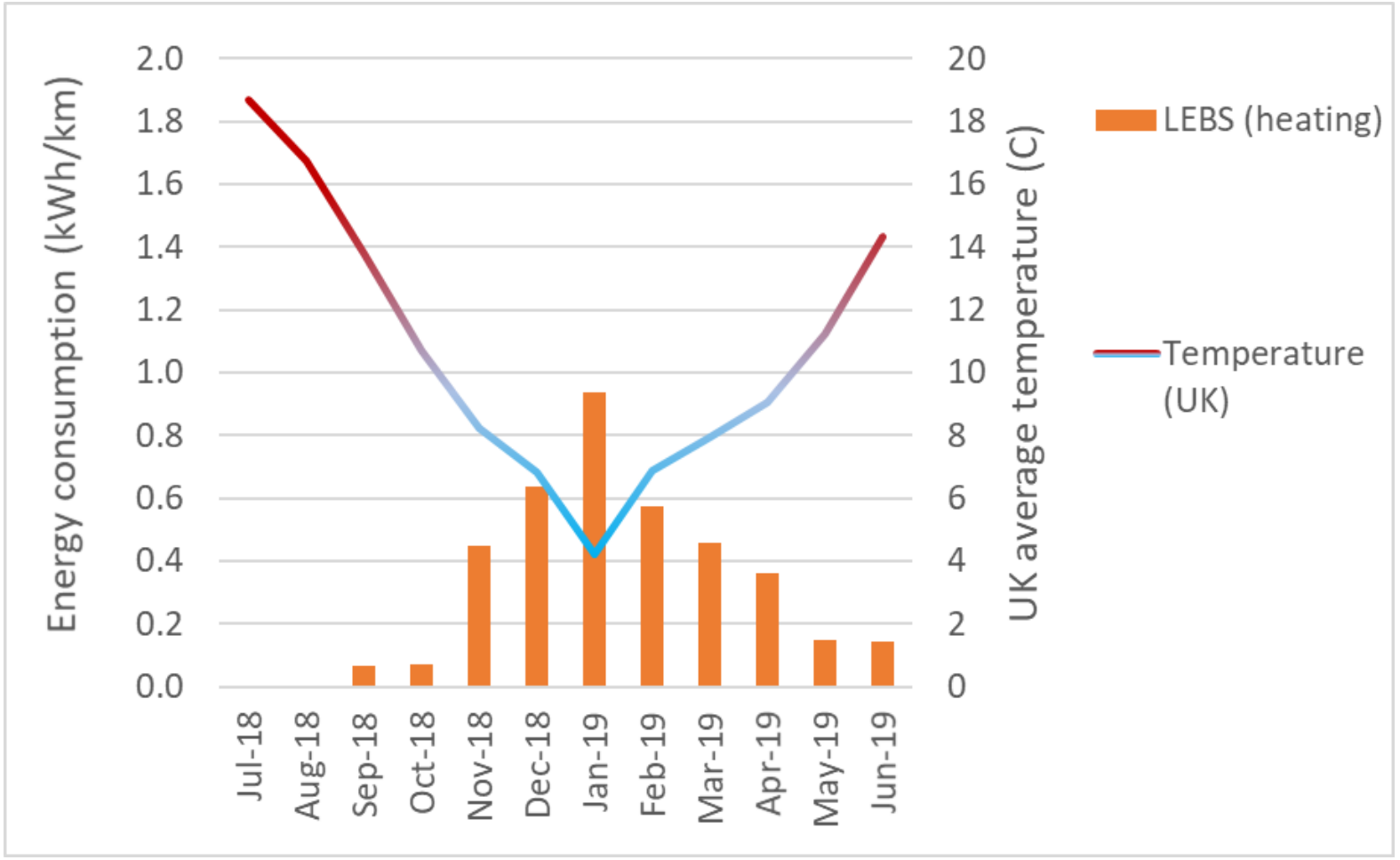
DfT Low Emission Bus Monitoring Programme

Heating Energy Consumption – manual heating



DfT Low Emission Bus Monitoring Programme

Heating Energy Consumption – with thermostat



DfT Low Emission Bus Monitoring Programme

Thanks for listening!

Questions and Answers

Daniel.hayes@lowcvp.org.uk