

K2 Mobility

Depot- and Charge-Management for Public Transit Operators

Markus Kröger, Managing Director K2 Mobility



Bus electrification comes with 5 distinct challenges, requiring integrated dynamic charge-management



Time for charging needs to be fitted into sometimes tight operational schedule



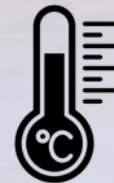
Managing available range to be sufficient for each tour



Managing energy cost & power consumption regarding required utility contracts and infrastructure*



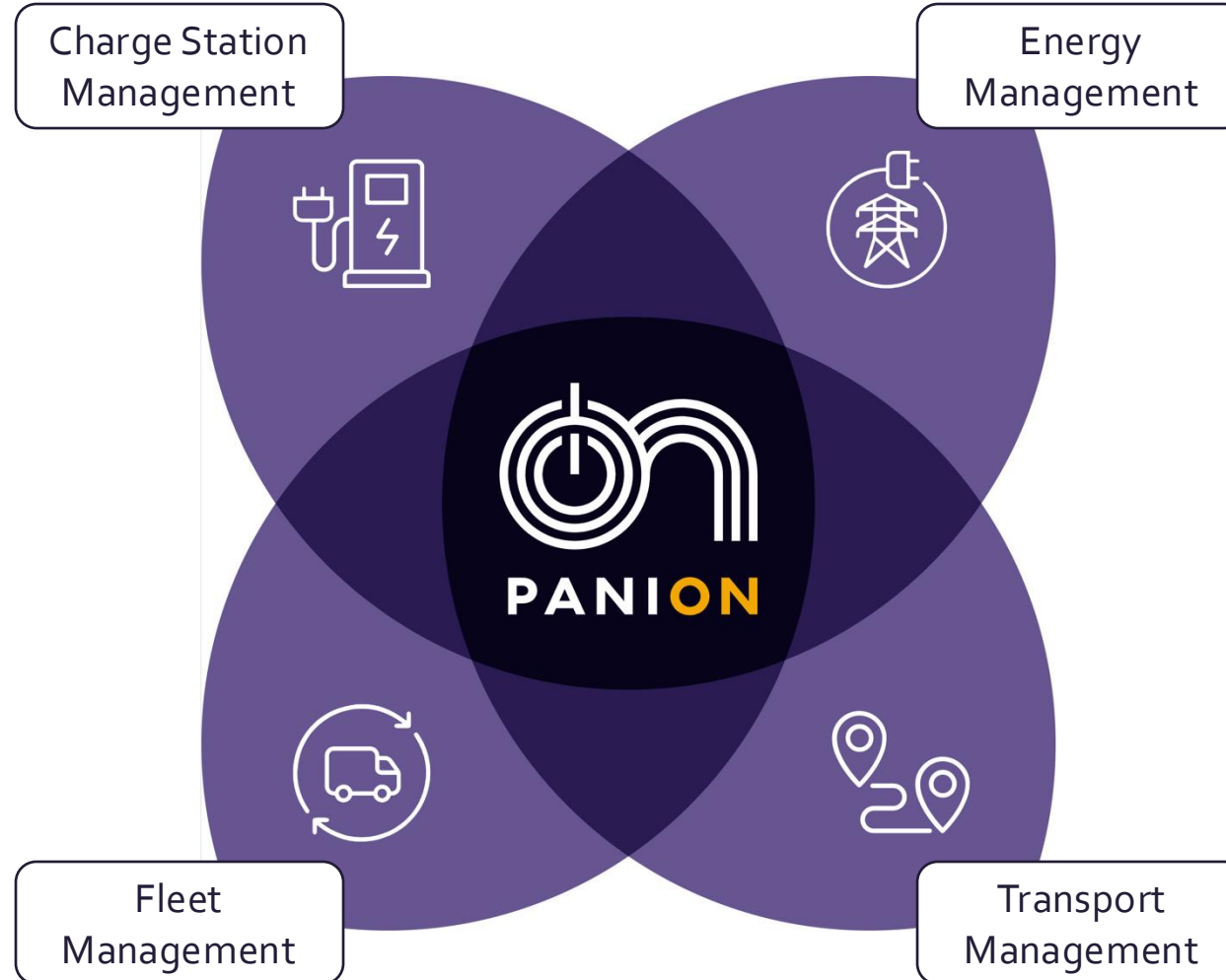
Vehicle-to-Tour assignment: coordination of charging and parking



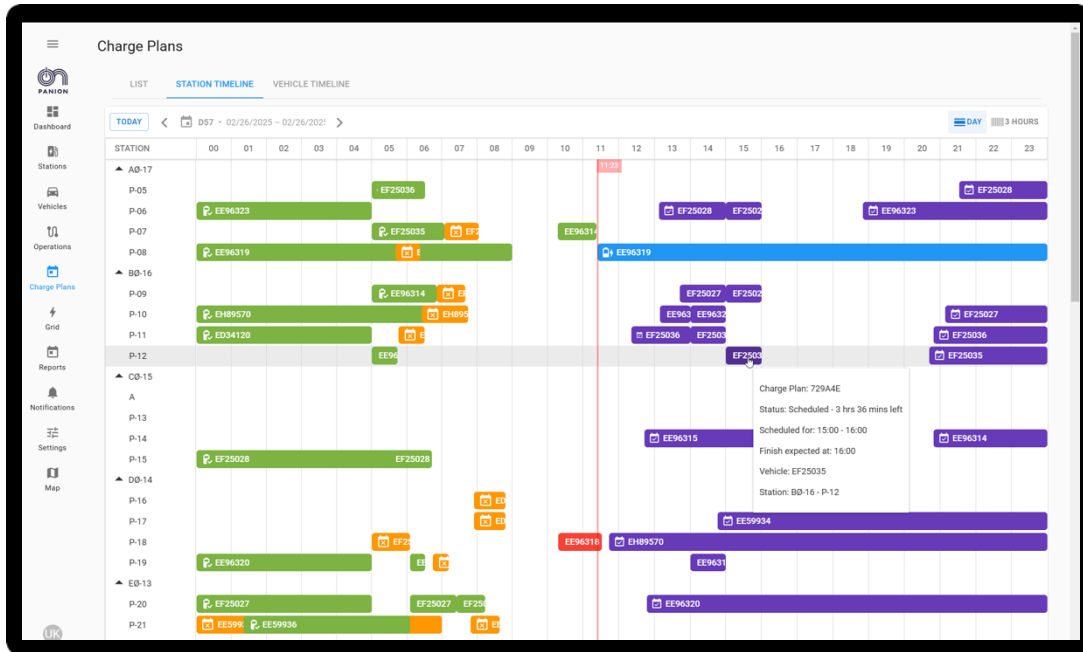
Pre-condition planning: needs to be accounted for in charge plan

* Power available on site is typically constraint to < 1MW

Maintaining the integrity and continuity of the core transit operations requires integration and contextualization



PANION Charging: real-time integration of charging and energy operations into the transportation schedule



What it is:

- reconciling **real-time information** from **vehicles** (incl. GPS, SOC), **charging infrastructure**, **energy grid** and **TMS**
- **predicting** needed **energy** and **target SOC** per vehicle per trip
- **planning / scheduling** and constant **updating** of **charging activities**, **resources** and **timing** for every vehicle
- **communicating** plans, updates and to-dos to all relevant **stakeholders** (e.g., drivers, dispatchers)

Sample Case:

short turn-around-cycles in grocery distribution

PANION Bus Parking: dynamic parking allocation and communication to drivers and dispatchers



Arrivals in the next 6 hours - ØST		14:11		
Vehicle	ETA	Start	Charge point	Parking area
EF25030	13:52	13:52	N0-02 2	Skalken P S56
EF25031	13:59	13:59	N0-02 1	Skalken P S57
EF25028	14:10	14:10	A0-17 1	Gates P 5
EE96314	14:10	14:10	K0-07 2	Hesteskoen P H50
EE96315	14:11	14:11	K0-07 1	Hesteskoen P H51
EE96323	14:11	14:11	B0-16 2	Gates P 10
EE59934	14:27	14:27	B0-16 3	Gates P 11
EF25029	14:37	14:37	L0-06 1	Hesteskoen P H53
EE59935	14:48	14:48	D0-14 2	Gates P 17
ED34117	14:52	14:52	M0-01 2	Skalken P S54
			A0-17 2	Gates P 6
			A0-17 1	Gates P 9
			A0-17 2	Hesteskoen P H46



What it is:

- **automated parking allocation** for every individual vehicle before its arrival at the depot
- **arrival screen, directing the driver to the correct parking spot**, displaying number plate (or other vehicle identifier), arrival time, start time of charging session, charging point and parking lot
- **automated instantaneous re-allocation** and respective communication, if required by **new circumstances**
- **Additional direct communication to driver and dispatcher** through individual messaging (via text message, e-mail and/or mobile app)

Sample Case:

Depot gate communication

PANION Monitoring: full transparency allows for better and more timely communication and problem response



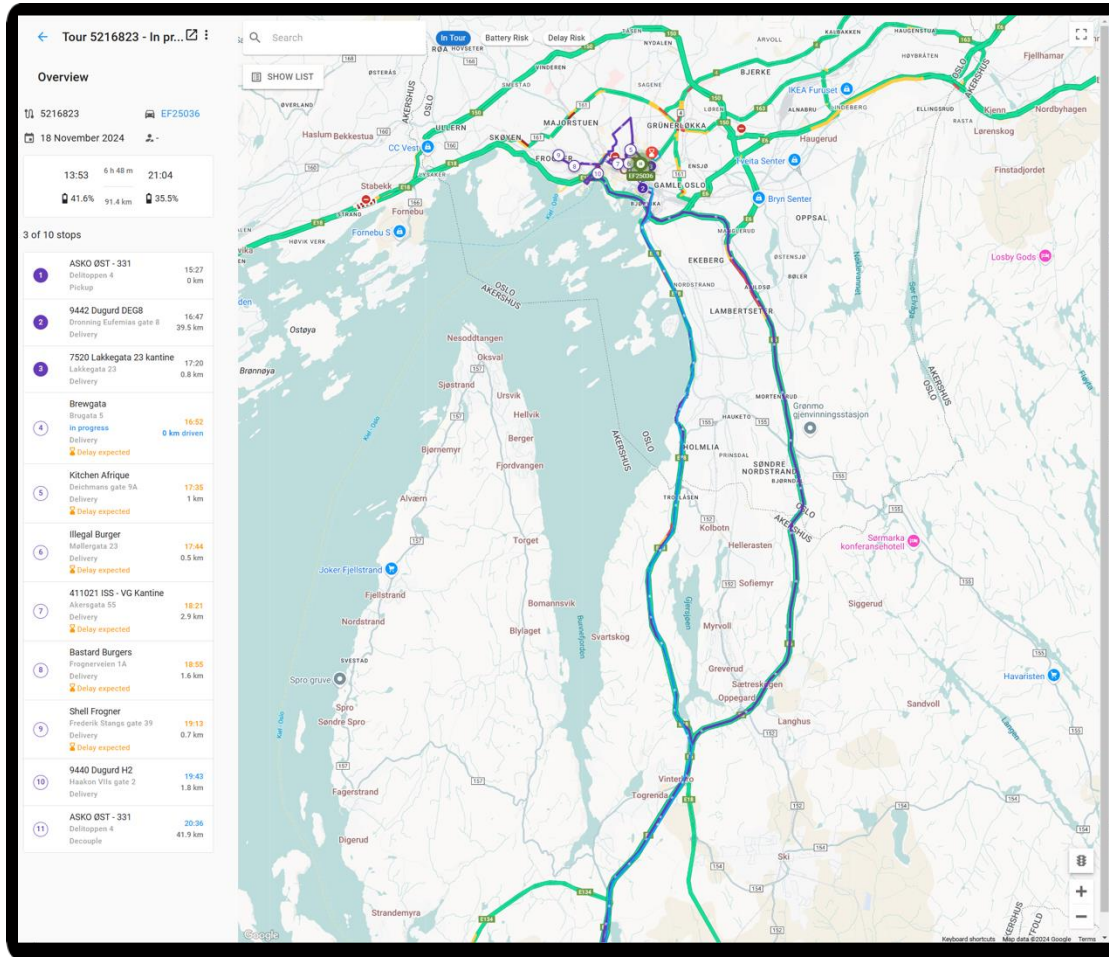
What it is:

- provide remote operational access to charger (**OCPP backend**)
- **display real-time current charger activity** and performance
- link **vehicle data contextualized** → 360° perspective
- **expose** information on large monitoring **screens**, **mobile app**, web-interface as well as feed-integration into existing platforms
- provide **Ready-to-Drive** indicator
- enable charge session **alerts** and response management
- furnish charge session **Reporting**

Sample Case:

charging status displays in driver lounges and transport or dispatch offices

PANION Tours: keeping the eyes on the vehicles - and the vehicles on the road



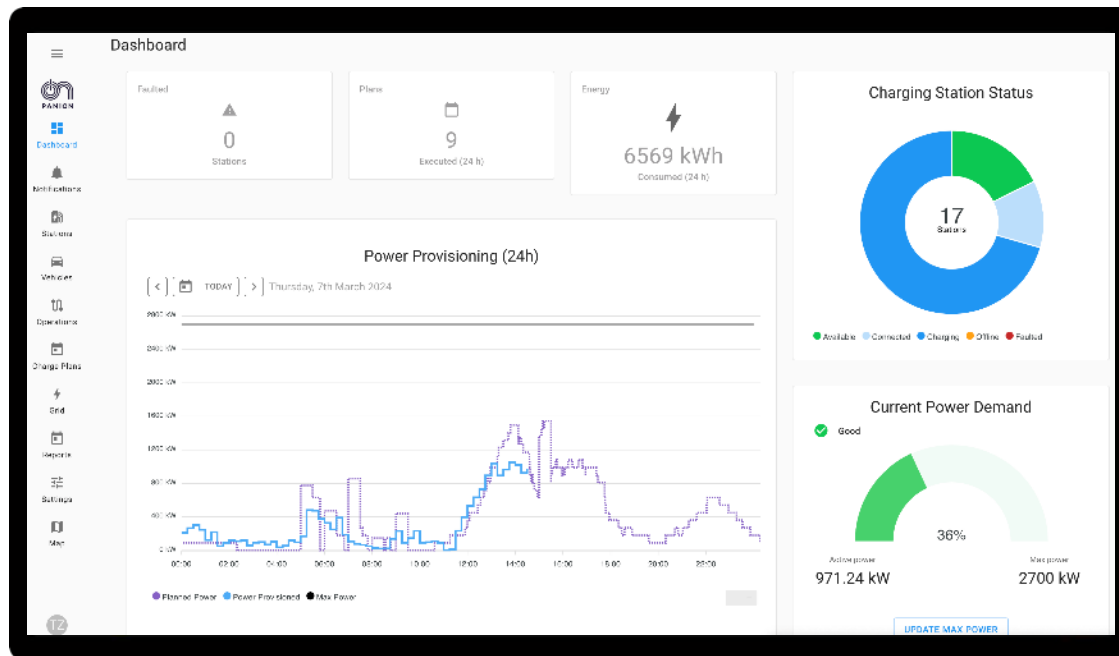
What it is:

- **monitoring** geo-location, SOC and traffic for every vehicle in real time
- **recalculating** ETA and expected SOC constantly – adjusting affected charge plans and triggering communication updates accordingly
- **helping** the fleet manager to devote time and attention to **business operations** and customer service
- generating **recommendations** to change the tour and resolving the charge shortages of the EV (opportunity charging) in case of an emergent shortage of battery SOC

Sample Case:

manage enroute battery SOC by visualizing tours and related risks, adopting proven user-friendly patterns

PANION Power Management: hardware capability enhancement through smart software



What it is:

- **allocating power per charger outlet** following a schedule (e.g., toggling between 90 kW or 180 kW – manually or automated)
- **allocating power dynamically per truck** based on operational needs (requires **PANION Charging**)
- **controlling power** across transformer substation hierarchies
- **protecting** and monitoring **grid** limits
- starting and stopping of charge sessions remotely

Sample Case:

fast charging during day shift, economic charging throughout the night

Concise communication with all stakeholders in the ecosystem



Facility power monitor

433 kW
of 3100 kW used

Substation power monitor

Hestekoen 261 / 1500 kW

no Substation 0 / 1000 kW

Skalken 171 / 1600 kW

ØST

A0-17 P-05 EF48732 11kW 11kW K07	C0-15 A 180kW	E0-13 P-20 EF25027 15kW 15kW M21	H0-10 44 180kW	L0-06 52 EE96316 11kW 12kW D02	P0-04 60 EE96318 89kW Y61
P-06 180kW	P-13 180kW	P-21 180kW	45 EF25031 12kW 12kW B41	53 EE96319 14kW 15kW L85	61 EE96322 11kW 11kW S49
P-07 180kW	P-14 180kW	P-22 180kW	I0-09 46 EE96323 14kW 15kW B97	M0-01 54 EF25034 10kW 11kW H67	Q0-05 62 180kW
P-08 180kW	P-15 180kW	R0 180kW	47 EE59932 0kW 147kW S20	55 EE59934 9kW 10kW C26	63 180kW
B0-16 P-09 180kW	D0-14 P-16 180kW	F0-12 40 ED34116 13kW 13kW V06	J0-08 48		
P-10 EH89570 144kW V81	P-17 180kW	41 EE96315 100% 16:26			
P-11 ED34120 2kW A57	P-18 180kW	G0-11 42			
P-12 EE96315	P-19 EE96320				

16:39

Charge Plans

STATION TIMELINE

VEHICLE TIMELINE

Today 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

AD-17
P-05 EF48732
P-06 EF48732
P-07 EF48732
P-08 EF48732
P-09 EF48732
P-10 EF48732
P-11 EF48732
P-12 EF48732
P-13 EF48732
P-14 EF48732
P-15 EF48732
P-16 EF48732
P-17 EF48732
P-18 EF48732
P-19 EF48732
P-20 EF48732
P-21 EF48732

EF25035 has stopped charging
Status instruction: Please restart charging

EF25035
56% on arrival
Ready to drive
39 min
11:09 - 11:48
Charge point
A0-17 P-07
DC CCS2
Enable notification
Keep me informed about the charging process

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Recharge Charging Station

Ringneskveien 1, 3414 Lierstranda, Norway

Opening Hours

Monday: Open 24 hours
Tuesday: Open 24 hours
Wednesday: Open 24 hours
Thursday: Open 24 hours
Friday: Open 24 hours
Saturday: Open 24 hours
Sunday: Open 24 hours

Energy Required +1.16 kWh
Distance +1 km
Additional Time +0 min

Adjacent stops

Stop 12 10% full
Stop 13 20% full

Total score: 2.2
distanceToLastStop: 0
preferenceRankScore: 0.5
deliveryModeRankScore: 0
defaultLengthScore: 0.1

Map

Leading E-Bus and –Truck operators depend on PANION



Hanse NV, >1,500 buses, 20 depots

"We have **selected PANION** ...for their **integration and interaction with our core business systems**, allowing us to utilize **electric vehicles in daily operations efficiently, cost effective and without or minimal manual coordination**. All these are **prerequisites** for us leading the way in decarbonizing public transportation."

Pieter Steurbaut

Chief Operating Officer, Hanse NV



Amazon Transportation Services Europe –
10,000 trucks, 75+ depots

"Amazon has **been working with PANION since late 2022**... We appreciate their **customer centric way of working** and are looking forward to our **continued collaboration**."

Hadrien Cimino

Program Manager,
Amazon Transportation Services



Norway's largest grocery distributor – 700
trucks, 18 depots

"The PANION team gained **deep understanding of our operations**. ... We now **feel comfortable** to further continue the **ramp up of our fleet of electric trucks** leading to a **fossil free transportation by 2026**."

Svein Sollie,

Director Transport ASKO NORGE AS



What do you need to do to use PANION? FAQs

What systems and tools do I need to have already?

- **No pre-existing tools needed!**
- A Digital bus scheduling system would be good, but not required

Do I have to hire more people for planning bus operations?

- **No additional personnel required.** The PANION depot management solution is fully automated and once it is set up, it interacts with the existing team members in a very intuitive way

Do I have to train my team in a special way for charge planning?

- We will give every staff member that needs to be involved a brief introduction of the PANION solution, but **that doesn't take more than 1 hour**

Does my charging, grid and vehicle equipment need to meet certain criteria?

- **Chargers** need to support **OCCP 1.6J** (like ABB chargers)
- **Vehicles** need to either have **telemetry** onboard that is accessible over the cloud (which most electric models do nowadays) – or we can suggest suitable inexpensive retrofit solutions.
- **No further requirements**

How much time and effort do I need to plan in to set up PANION?

- Most onboardings don't take more than **2-4 weeks**.
- The time that the **customer team** needs to invest in the set-up is **minimal** – 95% is done by K2 Mobility

What's next?



Ready...

**K2 enables
operability of e-
mobility from the
first e-bus**



Steady...

**Onboarding a new
customer or facility
takes only 2 weeks**



Go!

Charging automatically managed
Drivers are guided to the right
charging station
Exceptions generate alerts to
relevant stakeholders
No additional personnel needed
PANION Service fee is based on
kWh charged



Markus Kröger

Founder CSO / CMO

markus@k2mobility.com

+49 (0) 151 11348248



Ulrich Kalex

Founder CPO / CTO

ulrich@k2mobility.com

+49 (0) 172 9721074