



Fast charging of electric vehicles

Crijn Bouman, VP Business Development,
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- ⊙ Epyon introduction
- ⊙ Fast charging Technology
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Introduction of Epyon

- Epyon is a 5 year old 35 FTE fast growing high-tech company, based in the Netherlands, led by Hans Streng, CEO
- Offices in the Netherlands (Rijswijk , Eindhoven) and London UK, Tokyo JP
- The core expertise of Epyon is in optimized fast charging of Li-Ion batteries.





Brief History

- 2004 - First fast charge proof of concept
- 2005 - Start of extensive li-ion fast charge testing efforts, still ongoing
 - BKC: li-ion battery life prediction models
- 2006 - Charger product development & first commercial contracts
- 2008 - Start of validation programs with vehicle makers and end users
 - First li-ion fast charge solutions in Material handling (forklift)
- 2009 - Start of commercial fast charger sales
- 2010 - Roll-out into light commercial vehicles and fleet cars
 - Ramp up for consumer electric vehicle





What is fast charging?

**The ability to recharge a battery of any electric vehicle
within 15-30 minutes**

- Without significant impact on battery life
- Enabled by 2nd generation lithium-ion batteries





Epyon products

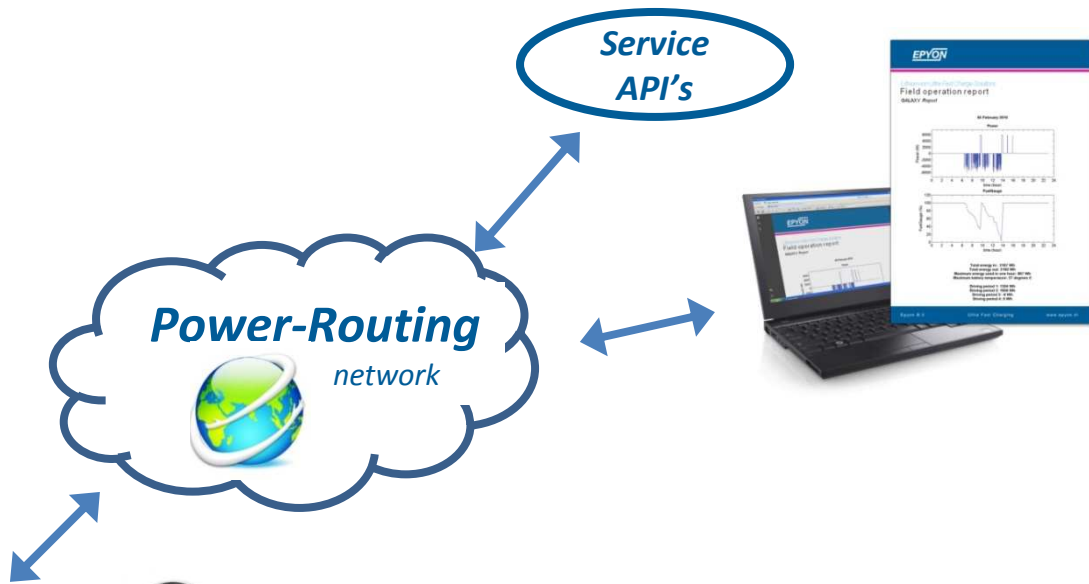
Service interfaces

 **EV fast chargers**
6 kW - 100 kW



AC public

DC fast





Market focus

Charging
infrastructure



Fleet
solutions



Industrial
solutions





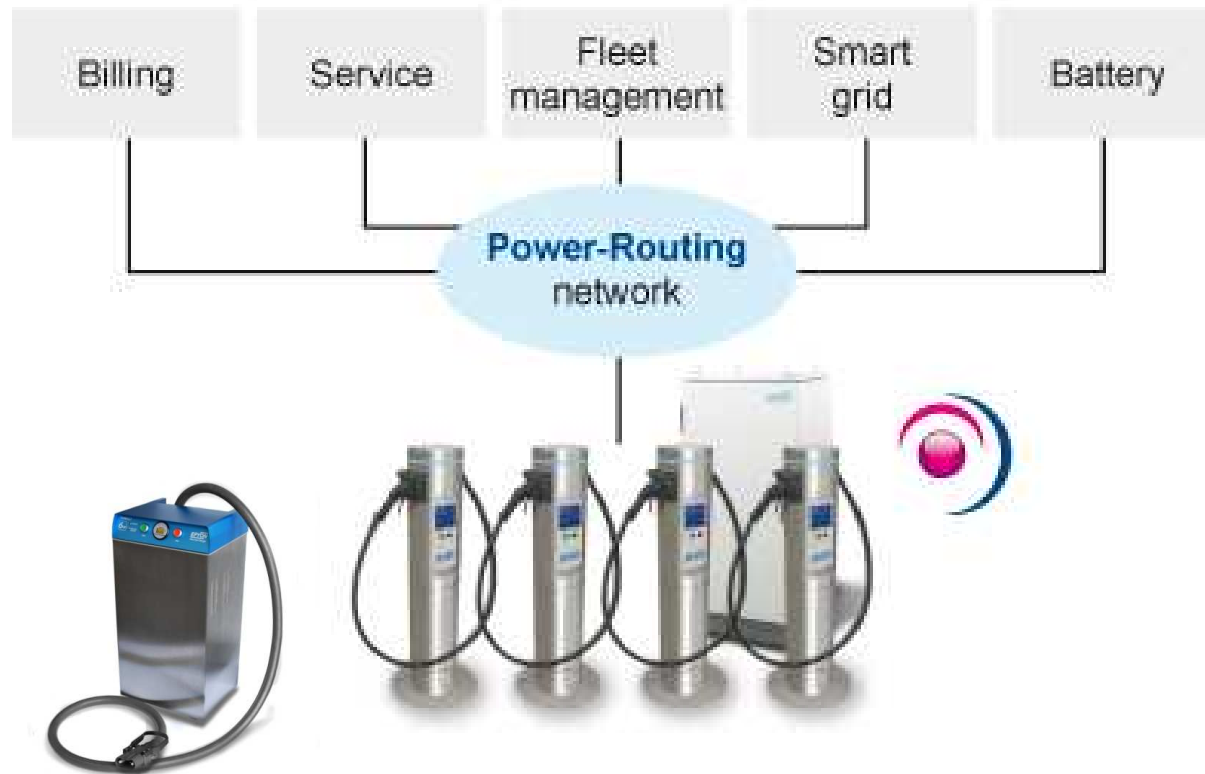
Some highlights

- Invited partner in Nissan Leaf roadshow
- Member of CHAdeMO, Fast charge standard
- Opened Europe's first commercial fast charge station
- Start of commercial roll-out in forklift market via first large distribution partner PON / QLion





Epyon Power-Routing technology





Today: the Schiphol business case

Fleet solutions

epyon FAST CHARGE



Industrial solutions

epyon FAST CHARGE





Today: the Schiphol business case

Test with cleaner in busy passenger area

- Tennant T15 cleaner
- Arrivals-3 passenger area
- Epyon *Terra* fast charger
- 24-hour operation
- 15 minute charge
- Online *Galaxy* reporting



epyon  FAST CHARGE





Lithium-ion battery technology

2nd generation for industrial use

Specially developed for automotive and industrial use

Advantages

- Small & low weight
- Very high power
- Very long life (> 2 times conventional)
- Dry technology: No maintenance
- Reliable and robust
- Very high energy efficiency
- Intelligent battery system





Epyon fast chargers

Industrial quality

- Example: Epyon TERRA 6.1
- Connected to regular 16A – 3 phase
- Regular DC -250 A REMA connection to vehicle
- Computer controlled
- Very easy to operate: auto-start, auto stop





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Key parameters of business case

Today:

- 24 hour operation
- 2 vehicles needed: 1 charging, 1 driving
- Charging time +- 8 hours
- Lead acid batteries





Contents

Key parameters of business case

- 24 hour operation
- 1 vehicle needed: 1 driving, 15 minute charging in every coffee break
- Lithium-ion batteries





Contents

Proposed advantages:

- Reduction number of vehicles
- Reduce consumed floor space
- Reduce energy consumption & CO₂ emission
- No maintenance





Succes criteria

What had to be proven?

- Ability to operate at least 16 hours/day with 1 machine
- Fit in the regular business process of cleaners
- High reliability
- Energy efficiency improvement > 5%



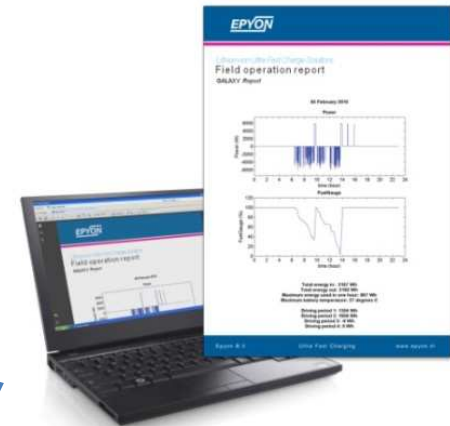
Installed system



Tennant T15 cleaner



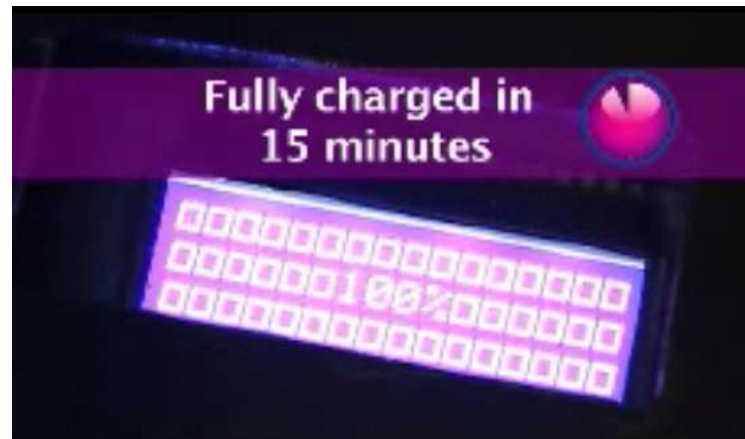
***Epyon TERRA 20.1
Fast charger***



***Epyon GALAXY report
online reporting tool***



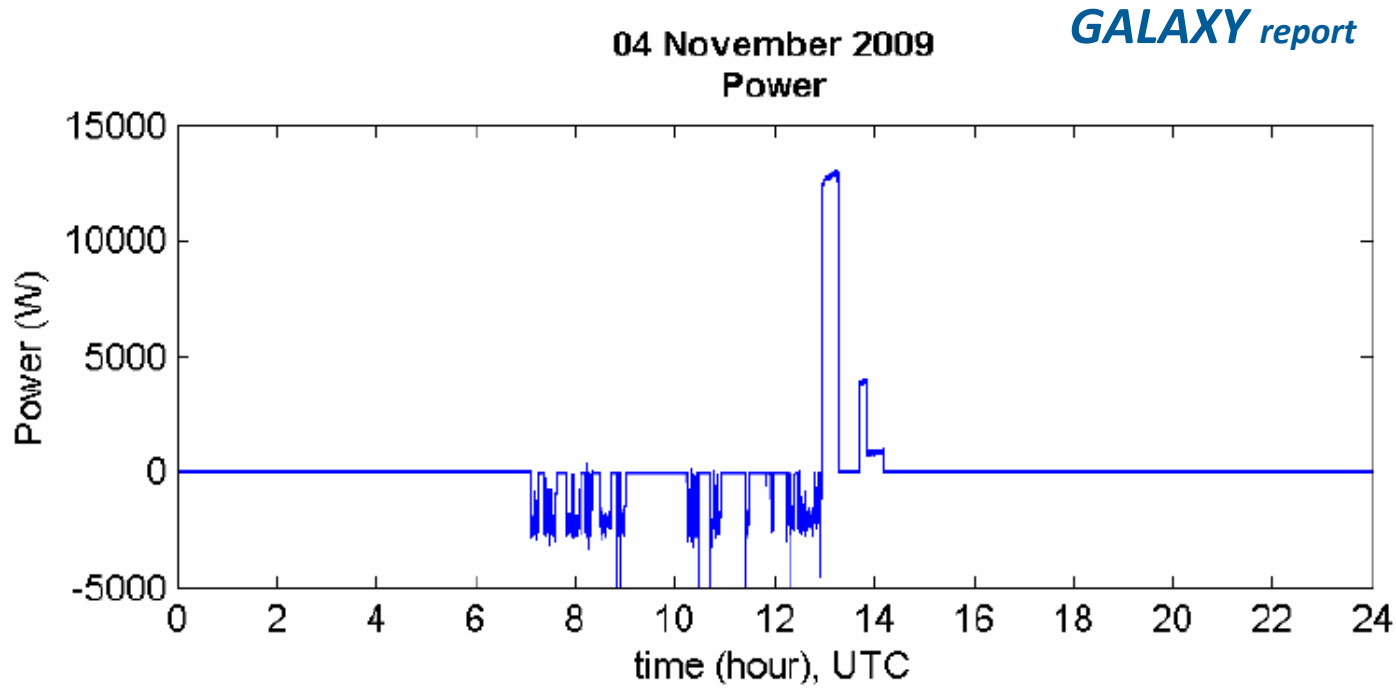
Setting





Results

First 4 weeks : 8 hour operation

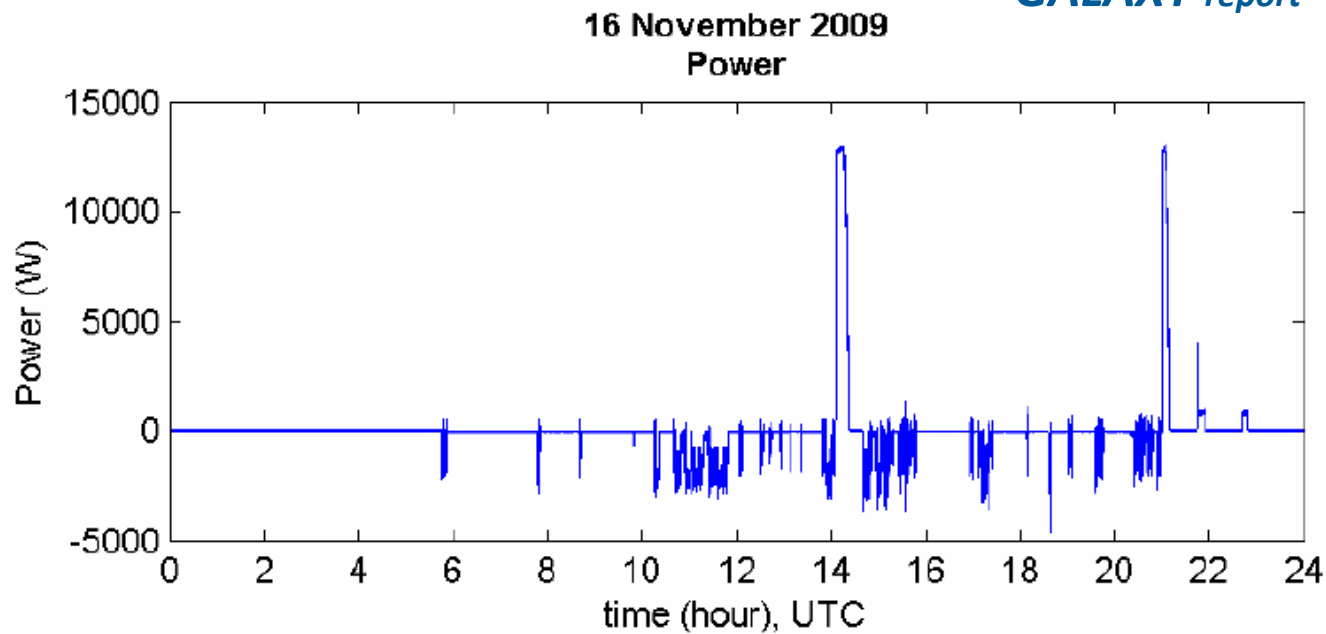




Results

From 5th week: 16 hour operation

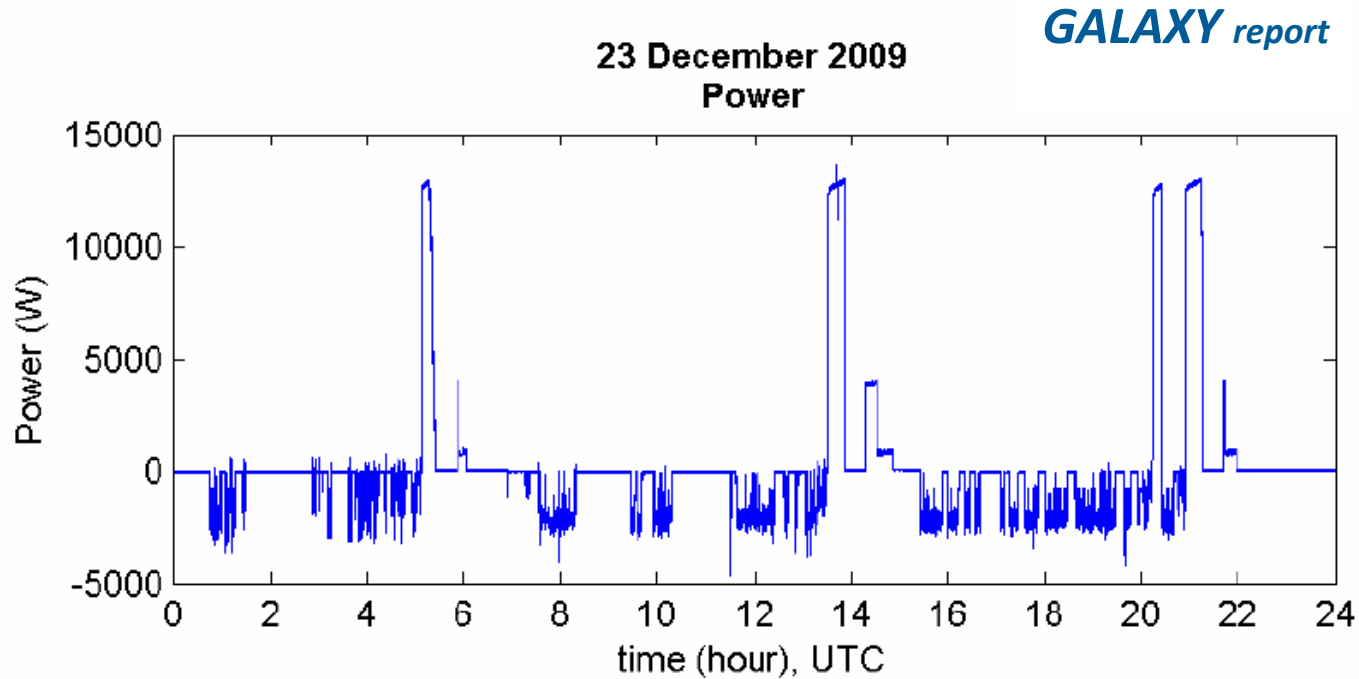
GALAXY report





Results

December 2009 until today: 24 hour operation





User satisfaction report

Power consumption / quality of charger is good



Bram van Herwaarden, Schiphol group

- *the performance was beyond all expectations*
- *The machine is simply always up and running*
- *The image of Schiphol airport is improved, people speak positive about it.*



Hugo Tuijp, CSU cleaning services

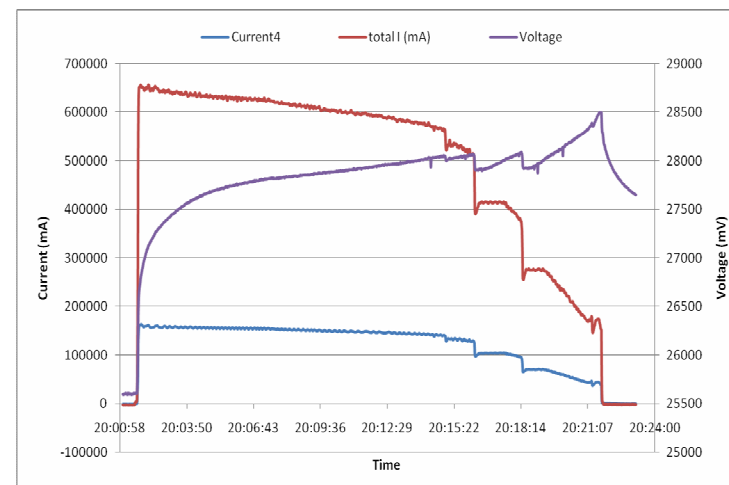
- *We can clean significantly more surface in the same time*
- *The great availability of the machine improves our cleaning performance*



Energy efficiency comparison

Regular solution with lead-acid batteries and slow charging
versus fast charging with lithium-ion

Result: 10-14% energy efficiency improvement!





Conclusion

Succes criteria

- Ability to operate at least 16 hours/day with 1 machine
- Energy efficiency improvement > 5%
- Fit in the regular business process of cleaners
- High reliability

Result

- 24hour/day since December 2009
- Energy efficiency improvement of 10-14%
- Very positive user satisfaction report
- Improved uptime of the machine reported



Roll-out indoor: what would it mean?

Preliminary conclusions study

Replacement of 200 regular vehicles for a fast charge solution would:

- Reduce the number of vehicles with > 25% (+- 50 vehicles)
- Create > 300 m² free floor space in commercial area's (@ > 600 Euro/m²/year)
- Reduce electricity consumption with > 50 MWh/year
- Reduce CO₂ emissions with 22.000 kg/year





Opportunity: outdoor vehicles

Replace Diesel vehicles for electric trucks with fast charge

- Same availability & reliability through fast charge
- Proven technology
- Estimated CO₂ reduction for 200 vehicles@ 20.000 km/year:
>760.000 kg/year



epyon
POWER FAST CHARGE





Contribution to a better Airport

Epyon fast charging can:

- Help to meet the energy efficiency & CO₂ targets
- Improve the operation
- Create more available space for commercial area's
- Enable the replacement of diesel vehicles for electric



Thank you for your attention

www.epyonpower.com

Delftweg 65, 2289 BA Rijswijk
The Netherlands
+31 (0)70 307 62 00