Charge Star Electric Vehicle Network Management & Billing System.

Charge Star

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1. GENERAL OVERVIEW

1.0 GENERAL REQUIREMENTS

This is a technical overview of the Charge Star network management, billing and load balancing systems provided by Charge Star.

The Charge Star platform is comprised of:

1. *The Charge Star network management OCPP server.*
2. *The Charge Star web portal for charging station providers*
3. *The NEXTCHARGE billing system for pubic networks.*
4. *The Cosmos billing system for private networks.*
5. *HUBJECT for network interoperability.*
6. *The THOR dynamic load balancer.*

Charging Station Network Management.

1.1 Network Management Systems - Charge Star.

Charging station networks require remote management and are commonly connected to a remote network management system utilising the OCPP protocol. The features of the ChargeStar platform are described in detail in Table A at the end of this document.

1.1.1 Charge Star Network.

Charge Star is an electric vehicle charging station network management serviced on behalf of public and private charging station providers throughout Australia. The Charge Star network is managed using the Charge Star platform. ChargeStar has been managing charging station networks right across Australia since 2015. We have a proven track record of providing robust and reliable charging networks and ensuring that electric vehicle drivers have a smooth and trouble-free charging experience.

City of Townsville **City of Vincent** **City of Perth** **Shire of Augusta Margaret River** **Shire of Bridgetown** **City of Bunbury** **City of Busselton** **Shire of Donnybrook** **City of Perth** **City of Wanneroo** **Shire of Harvey** **City of Bassendean.**	**City of Mandurah** **City of Swan** **Shire of Nannup** **City of Joondalup** **City of Cockburn** **Alexandrina Council** **Adelaide Hills Council** **Rural City of Murray Bridge** **District Council of Yankalilla** **City of Victor Harbour** **City of Onkaparinga**

Web: https://www.chargestar.com.au/

Private clients have also added their charging stations to the Charge Star network but these are not shown on the public map.

1.1.2 Network Management and Driver Management Services

Charge Star provides network management and driver management services for all charging stations on the Charge Star network. The charging station provider has zero network management overhead. Any operational issues, network issues and driver/usage issues are handled by the Charge Star help desk which operates a 24-hour help line: **1300 661 895**. The stations are monitored in real time and any software updates or configuration changes are administered remotely. The charging station provider has little or no contact with drivers. All queries are referred to Charge Star. The charging providers put signage in place with instructions to call Charge Star on 1300 661 895 if the drivers need information or experience any charging issues.

The Charge Star platform supports heterogenous charging stations from all OCPP compatible manufacturers such as:

- ABL
- ABB
- Alfen BV
- Chago
- Charge Amps
- CIRCONTROL
- DBT
- DELTA
- Generale Sistemi
- Growatt
- INGETEAM ENERGY
- Mennekes
- Scame Parre S.p.A
- Schneider Electric

Charge Star network management is provided as a managed service on an annual subscription basis.

1.1.3. Web Portal for Charging Station Providers.

Charge Star provides a web portal for charging station providers. The web portal gives information about charging station status, charging sessions, users and usage information. Reports can be downloaded in CSV format.

Demo Site:

- https://chargepoint.management/
- User: "TestUser" without quotes.
- Password "Testuser2019!" without quotes.
- 2 * twin socket eVolve Smart T.

1.1.4 Network Reliability

The Charge Star/NEXTCHARGE/ Circontrol combination is a mature and robust technological platform that supports over 70,000 drivers and over 30,000 charging stations on four continents.

1.1.5 HUBJECT - Interoperability with Other Networks

Charge Star is part of the Hubject network. Hubject is a middleware platform developed by a consortium of car manufactures in Europe that acts as clearing house for charging station networks. It is conceptually similar to the Australian banking clearing system that allows someone with a Commonwealth Bank ATM card to use a NAB ATM machine. For example, the New Zealand charging station network, ChargeNet, is also part of Hubject. Anyone who downloads and registers on the NEXTCHARGE smart phone application can fly to Auckland, rent an electric car at the airport and use NEXTCHARGE to activate a charging session at any of the ChargeNET charging stations using the credit card details linked to the app for

payment. It is envisaged that most charging station networks in Australia will join Hubject.

More information here: https://www.hubject.com/en/

1.1.6 ISO 15118 - Plug & Go Charging

Up until now, charging stations could only be accessed using a smartphone or charging card. The new ISO standard allows the payment mechanism to be associated with the car. The driver simply plugs into the charging stations and locks the car. The car negotiates the payment authorisation with the charging station. Plug and go charging is part of the ISO 15118 specification for bi-directional charging (vehicle to home and vehicle to grid) The first ISO 15118 compliant cars will be released in 2020. The EVolve Smart and ENext are built to be compatible with ISO 15118 and is future proofed.

1.4 Billing Solutions.

1.4.1 Public Charging Vs Private Charging.

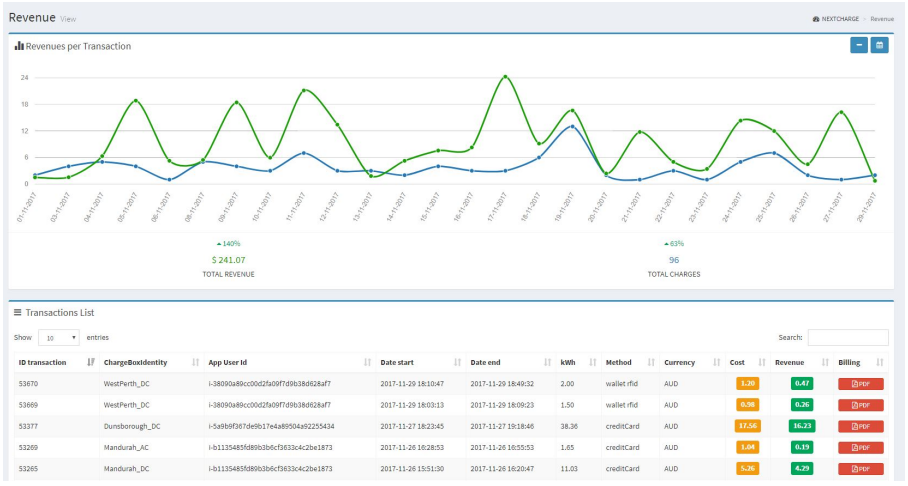
Public charging stations are available to the general public and require pay on charge billing systems. Drivers cannot be identified in advance and so cannot be billed in arrears. Existing AC and DC charging stations do not have credit card readers. Commercial public charging station networks are using smart phone applications with credit card payment features to charge drivers for power. Drivers download the smart phone application and register for the network. Charging revenue is collected by the network operator and then reimbursed to the charging station provider.

Private charging stations are restricted to known drivers. Drivers can be identified in advance and billed in arrears. Private charging stations are normally located in residential apartment blocks and commercial office blocks where car parking spaces are reserved for the occupants. Access is restricted using RFID cards issued to the occupants. The occupants are billed in arrears monthly or quarterly using invoices issued by the billing system. The invoices are issued with the banking details and livery of the charging station provider. The network operator is not involved in the collection of the charging revenue.

1.4.2 Public Charging Networks – Charge Star Billing System.

Charge Star Billing is a charging station management and billing solution for publicly available electric vehicle charging stations located in car parks where payment is required upfront and the charging stations do not have credit card readers.

Charge Star provides operators of public charging station networks with a billing system offering class leading features such as revenue reporting, multiple payment methods, payment direct to the network operator's merchandising account, charging session activation via smart phone app or RFID card, usage reporting, status reporting, and remote management of charging stations. Charge Star is designed for high volume pay as you go public charging stations networks used by members of the public.



Charging session activation is via the NEXTCHARGE smart phone app or NEXTCHARGE RFID

card: https://www.chargestar.com.au/nextcharge/

Charging session activation via the NEXTCHARGE smart phone app or NEXTCHARGE RFID card is necessary because most charging station manufacturers have not yet integrated credit card readers with charging stations. Two-way communication is required between a credit card reader and the charging station in the event that a problem occurs during the charging session or the driver simply stops the charging session from the car and drives off. The existing retrofit credit card solutions are unidirectional only and do not register termination of a charging session signalled by the station. The driver gets a free charge. Integration of credit card readers with charging stations requires modification of the charging system operating system and cooperation from the charging station vendor. This is not possible with a retrofitted credit card reader.

Charge Star is compatible with all charging stations using OCPP 1.5 and above.

Features:

1. Connected to the Charge Star Network: https://e-station.com.au/chargestar/
2. Charging sessions activated by the NEXTCHARGE smart phone application.
   - Credit/debit card.
   - Android Pay.
   - Google Pay.
   - Paypal
   - Wallet (buy credit in advance).
3. NEXTCHARGE App: https://chargestar.com.au/nextcharge/
4. Driver pays separately for each charging session.
5. Charge Star collects the revenue and reimburses the charging station provider at agreed intervals.

1.4.3 Payment/ Access Mechanisms

Using a Corporate RFID card

Charge Star can issue corporate RFID cards to charging station providers that are not connected to the NEXTCHARGE application or any other payment system. These cards are designed for employees of charging station providers who qualify for free charging on the network.

Using the NEXTCHARGE smart phone app

The NEXT Charge App can be used to activate charging sessions on paid public charging stations.

- A driver can download the NEXTCHARGE smart phone app and start charging straight away.
- A map and a list of stations are presented in proximity order. The closest station is the station the driver is standing beside.
- The driver selects the station then selects the socket.
- Charging starts automatically. No further intervention is required.
- If the station is a paid charging station, first time users are asked to enter their credit card details. The app connects to the Braintree payments system and debits the driver's credit card. Credit card details are stored by Braintree for future use. No credit card details are stored on the NEXTCHARGE app.

See http://chargestar.com.au/nextcharge/ and https://e-station.com.au/charge-star-strata/ for more details.

1.4.4. Using a NEXT CHARGE RFID card

A NEXTCHARGE RFID card can be ordered through the NEXTCHARGE smart phone app. The card is linked to the driver's account on the Smart Phone app for payment purposes.

- Show card ➔ Select Plug.
- Once the card is authorised the driver can plug into socket A or socket B. If the driver has already plugged in the station detects the cable and activates plug A or plug B accordingly. The LED beacon above the socket turns blue and the car will start charging as soon as the driver plugs the car in. If the left-hand socket is in use the LED beacon on the right-hand socket turns blue.
- The LCD screen shows consumed energy and charge time.
- The charging session is stopped by presenting the RFID card to the card reader or ending the charging session from inside the car and unlocking the plug.
- The RFID card reader can be disabled so that charging starts as soon as the driver plugs in the car. No RFID card or smart phone application required.

1.4.5 Private Charging – Cosmos Billing System

COSMOS is an embedded network billing system designed to generate invoices for charging station operators who provide charging stations located in controlled parking areas of the kind commonly associated with residential apartment and commercial office developments.

Common area car parking in strata and body corporate car parks presents a number of problems for electric vehicle car owners.

- Most common area car parks do not have electric vehicle car charging facilities. Electric vehicle car charging stations can be retrofitted to common area car parks. This normally requires a change to the strata by-laws as the walls of common area car parks and the embedded wiring are normally owned by the strata rather than the owners.
- Free charging from common area power is likely to raise the ire of unit owners who do not wish to subsidise another owner who just happens to have an electric car. Electric vehicle car charging can cost around $1000 per vehicle per year.
- There needs to be a system in place to meter electric vehicle charging and bill electric vehicle owners accordingly.
- Access to charging stations needs to be restricted to prevent charging stations being used by non-authorised users.

Generally speaking, most body corporates are putting the charging stations in visitor car parking bays until such time as the owners request charging stations for their own parking bays. Stations in visitor car parking bays are essentially public charging stations as the drivers cannot be identified. These stations need to be connected to a pay as you go billing system such as the Charge Star platform described above. Private charging stations which are installed in designated car parking bays assigned to individual drivers can be locked down to one driver using RFID card access. These stations can be connected to an invoicing billing system. The drivers are billed in arrears.

Features:

- Connected to the Cosmos Billing System: https://www.e-station.com.au/cosmos_billing/
- Billed in arrears by invoice.
- Charging sessions activated by RFID card.
- No requirement for a smart phone app.
- Driver pays every month or every quarter.
- Invoices:
    - Generated by Cosmos, branded with strata company livery and sent to the driver who pays the strata management company.
    - Alternatively, the strata management company can download a CSV file which can be uploaded to software packages such as StrataMax, StrataMaster or PropertyIQ for invoice generation and billing.
- Cheaper solution for single user charging stations as there are no credit card or payment system transaction costs.

COSMOS is similar in concept to the embedded metering systems already in place and used by many strata management companies to bill unit occupiers for electricity, water and gas. COSMOS is a cheaper billing solution than other pay as you go charging station billing systems that require the use of a smart phone application. Charging station operators have the option of downloading charging

session transaction data in a CSV file for direct input into strata management software such as StrataMax or PropertyIQ.

Charging station operators have access to a web portal allowing access to usage statistics and customer information.

DOCUMENTATION: https://e-station.com.au/wp-content/uploads/datasheets/cosmos.pdf

TABLE A

CHARGE STAR PLARFORM – FEATURE LIST TABLE

Network Management.	• Web based network management and administration portal. ○ Sub portals with granular permissions can be created for charging station providers. • Dashboard overview with network map. • Error reporting by network and by station. • Error notification by email alerts. • Station status and information including IP address, firmware version, OCPP Level, last heartbeat and map location. • Remote configuration of stations including display settings for map and smart phone application, tariff per connector, max time allowed for charging, tariff per kWh or per minute. • Remote retrieval of log files. • Clustered stations. Multiple stations at a single location appear as one entry on the smart phone app. • Local list management for authorisation. Clear cache option. • Remote hard and soft resets of charging stations. • Change availability status of station or an individual connector to operative/inoperative. • Remote lock/unlock connector. • Remote start/stop of charging sessions. • Remote firmware updates. • Full integration with NEXTCHARGE smart phone application. • Voucher promotion facility small business. Buy a meal and get a free charge. • Review of comments left by drivers on Smart Phone app.

Usage & Error Reports.	The following data is provided by Charge Star in the various reporting screens. The data can be downloaded in CSV file format for spreadsheet analysis. Charging Sessions. • Transaction ID. • Connector ID • Charging Station ID. • User Tag. • Start transaction timestamp. • Stop transaction timestamp. • Time station occupied per charging session in seconds.

	• kWh per charging session. • Meter reading in watt hours at start of charging session. • Meter reading in watt hours at end of charging session. • Average power drawn during charging session in watts. □ Total energy delivered by: • The network. • Each station. • Each connector. • Each user. □ Total number of charging sessions by: • The network. • Each station. • Each connector • Each user.

User Interface – Interactive Web Page and Smart Phone App	• Interactive web page for PC and laptop users who wish to plan journeys on the network.
	• The NEXTCHARGE smart phone app or the white label equivalent is the portal for drivers.
	• The smart phone app can be decorated with the livery and logos of the network operator.
	• Smart Phone Application Features:
	  ○ Map of stations and list of available stations in proximity order.
	  ○ Status of stations – available, occupied, reserved, off-line for maintenance.
	  ○ Integration with native smart phone navigation app such as Google Maps or Apple Maps.
	  ○ Realtime charging status update showing charge rate in kW, energy consumed in kWh, state of charge, estimated time remaining and accumulated cost.
	  ○ GST receipts for each charging session emailed to customers.
	  ○ Record of charging sessions and payments also accessible via the application.
	  ○ Start multiple charging sessions on different stations at the same time.
	  ○ Multiple payment options; credit card, voucher, RFID card (wallet), Apple Pay, Android Pay and Paypal.
	  ○ The app runs in background mode. The user can use other smartphone apps at the same time.

	○ No registration required. Just download and charge on the spot. ○ Notifications of new stations in user's area. ○ Stations can be reserved if the reserve feature is enabled. ○ Driver can add photos, reviews and ratings for each station.

Security and Compatibility.	• Compliant with Payment Card Industry Data Security Standards (PCI DSS). • Default smart phone payment platform is Braintree. • Hubject Compliant. • One dedicated instance of Charge Star per network operator hosted in a data centre chosen by the network operator. ○ Customer data is siloed and is not accessible across instances. • Encryption. ○ From SIM card to VPN gateway. ▪ 3G networks use the KASUMI block cipher with the UEA1 confidentiality and UIA1 integrity algorithms. ▪ 4G networks use the SNOW 3G stream cipher and the UEA2 confidentiality and UIA2 integrity algorithms. ○ From VPN gateway to server. ▪ IPSec tunnelling via Telstra VPN. • Compatible with OCPP 1.5, 1.6 and 2.0. • Compatible with ISO 15118. ○ Plug and charge. The vehicle provides authentication and verification via SSL certification. The charging session fee is billed to the driver's home electricity account i.e. Ergon, AGL etc. ○ Vehicle to grid. The driver sells power from the car battery back to the energy retailer i.e. Ergon, AGL etc. Works like a feed in tariff.

Mature Scalable Enterprise Level Charging Station Management System.	• 200,000 charging sessions • 2000 MWh energy delivered. • 120,000 NEXTCHARGE app installs on Android and Apple.

	• 80,000 charging stations on boarded from 80 networks using the Charge Star platform.

Payment Systems.	• Charge per kWh, per minute or free charge.
	• Payment via smart phone application.
	  ○ Credit/debit card.
	  ○ Android Pay.
	  ○ Google Pay.
	  ○ Paypal
	  ○ Wallet (buy credit in advance).
	• Payment via card reader on the charging station.
	  ○ Credit/debit card payment.
	  ○ Smart phone NFC payment.
	• On the spot payment transfer.
	  ○ Payments are transferred in real time to the merchant account of the charging station operator.
	  ○ Smart Phone App ==> Braintree==> Charging Station Operator Merchant Account.

Interactive Map for PCs and Laptops.