CHARGING FOR CHARGING

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ABSTRACT

Billing for electrical vehicle (EV) charging faces several business challenges, especially given that the amount of energy to be charged for may only be worth a couple of cents and that several companies may be involved in the charging process. In this complex environment, the cost for billing may easily be higher than the cost for the energy supplied. Therefore value-added services or a different approach are required to make charging for charging a viable proposition.

One approach is to create a shared business-to-business (B2B) service platform providing a common service infrastructure for billing. This platform could significantly reduce the cost of entry for electro-mobility operators and value-added service providers.

INTRODUCTION

Currently, concepts for new electric vehicles and for electro-mobility services have a high profile in industry, politics and with the general public. If we want electro-mobility to succeed, it needs to be simple and understandable. At the same time, it needs to be profitable and cost effective if it is to become part of the future transport landscape.

Why may there be a need for clearing?

The concept of clearing is based on the need to settle transactions between parties where the transaction event is unpredictable in terms of time, value and location – and where the location necessitates the use of infrastructure that is not directly connected to the user of the service. The perceived need for "clearing" is driven by the ability for the electric vehicle to physically move between charging infrastructures where these are different asset owners, network providers and energy suppliers. The assumption is that clearing will settle each individual transaction based on the infrastructure used (i.e. a charge element for the use of the charging asset), the power consummed, and any additional services taken at the point of supply.

Whilst the benefits of clearing are clear around the micro management of the transactions, the viability of clearing is unclear given the small transactional value and the complexity of gathering the transactional information.

MARKET VIEW

The market for electro-mobility infrastructure is currently driven by the desire to raise driver confidence, e.g. by deployment of public charging points. Short-term, this will result in a large number of these units being deployed within metropolitan areas for open access by any driver. Additional chargers along the key routes will enable cities to be linked.

Recharging a vehicle at a public charger creates a number of problems – the biggest is the undesirable waiting time for drivers and passengers. Where payment is taken for charging, the transaction will also have to be measured and recorded using certified equipment and then settled so that both the energy and the associated costs can be allocated.

We expect that in the near future, public charging (on street) will be much reduced and that the majority of charging will be carried out on semi-public and private sites such as the workplace, transport hubs, depots, and the home. The need to join cities by EVs may currently be over-estimated. The more likely evolution will include a mix of technologies. Pure electric cars will be focussed on metropolitan areas, whilst pluggable and hybrid vehicles will be preferred for intercity travelling. High efficiency diesels will remain dominant for long distance travel. Few drivers will use a pure electric vehicle to make long journeys.

The central issue is whether the volume of electric vehicles, the mode of operation and utilisation of public charging can support a dedicated clearing and billing infrastructure.

In determining the potential for advanced settlement, the needs of the various customer groups needs to be understood.

Driver (end-customer)

If drivers are provided access to public chargers, they will expect to top-up their cars any place and any time they want. Payment should be easy using a widely accepted electro-mobility membership card, credit/debit/prepay card or cash payment.

Drivers will want to understand the cost of the service they are buying, and whilst many commentators push for time of use tariffs, these are unlikely to be popular. The market is expected to drive a rapid simplification of pricing as was seen in the mobile telecommunications segment.

Business-to-Customer (B2C) Operator

Car rental companies, OEMs, energy distributors, retailers, parking operators, and metropolitan sites want to offer electro-mobility as a method to bind customers to their services. However, they will have to continually deliver attractive and competitive services to win customer loyalty in a market where consumers will be free to roam between different areas served by different operators. The high start-up costs and small volumes are unlikely to justify dedicated infrastructure solutions.

Business-to-Business (B2B) Operator

There are a number of essential 2nd tier players that will enable the wide-scale adoption of electric vehicles. These business-to-business players will be in financing and fleet management. These vital second tier providers will want easy access to the emerging market where they can sell their products through a customer-facing organisation. These organisations will demand comprehensive asset tracking and billing. Providing visibility in a "C through B" relationship will be key to securing these enabling second-tier providers.

Business relationships

The introduction of the electric vehicle drives a more complex supply chain. This layered set of business relationships requires a complex set of new commercial arrangements between operators. Whilst there are many common business services (and related IT services) the overhead of co-ordinating many, small-value transactions between numerous independent parties will be highly inefficient, time consuming, and expensive – especially if each operator builds-up their own infrastructure and maintains individual contracts and clearing/billing cycles with each of their business partners.

So in summary, the electric vehicle market is likely to be sub-critical in terms of volume and value for a number of years. Customers adopting these new technologies want to be agnostic of the underlying supply chain complexity. Customers want to have certainty about the costs.

VALUE-ADDED PROPOSITIONS

Given the low value of charging service (a few EUR per charge), operators needs to generate added value around the core proposition.

Value-added service providers attempt to capture more value by bundling several services within a single offering. This will enhance the low-value core offer of energy with services around access, availability, comfort, predictability, and operation. Value-added propositions are expected to dominate in the public charging arena.

There will be two value-adding models: one where charging is bundled with an existing proposition, and one where additional services are bundled with charging

Here are some example services. Some of them require a cross-operator view to generate sufficient benefit.

Park & Charge

Combine premium parking with EV charging infrastructure and bill for the combination of both. This service can be enhanced by online reservation. Electric power will be an "add-on" rather than the core proposition.

If a payment infrastructure for the parking area already exists, Park & Charge would simply be priced at a premium over regular parking. The car park operator would take the fee for parking plus a premium for power and simply pay for the power used through their existing contractual relationship with their energy supplier.

The location of parking bays may further contribute to the overall service value.

The viability of Park & Charge in supermarkets or malls is less clear, as parking is not the core offering and providing electricity on top may require new payment infrastructure and maintenance. However, Park & Charge may be used as a competitive differentiator. Additionally, coupons could be given out to customers for a free charge while shopping.

Navigation and Reservation Service

Drivers will like to know where the next available charging spot is located. "Next available" includes the aspects of location, compatibility with the car, and free time slot. Ideally, the driver can make a reservation in advance, optimally, directly in combination with his navigation system from within the car.

Integration with public transport

Providing "door-to-door" mobility planning, linking private and public transport is an interesting emerging value area. Such a service could determine optimal switching points between car, bus, and train according to the current traffic situation as well as taking out the complexity around the timetables and ticketing – providing a single "through-ticket" for an end-to-end journey.

Fleet Management

Drivers can locate and reserve cars from a pool. Billing could be just based on the distance driven or on the time the vehicle was allocated. EV power could be included in the price. If energy is to be billed separately, the necessary metering and "after-the-act billing" will make this application much more complex.

Driver Help Desk

End-customers may encounter problems with services like authentication, authorization, charging, reservation etc. where it is not obvious what the underlying problem may be. Maintaining individual help desks per B2C operator is expensive and will lack the necessary end-to-end view for problem resolution. E.g., charging problems may be caused by the car, the charging spot, a network power failure, or authentication/authorization problems beyond the scope of the B2C operator.

Calls to the single help desk could be part of a B2C mobility package. Alternatively, free-call or premium-charge service numbers could be offered for help-desk access.

Vehicle and battery management

Vehicle maintenance and update services can be performed while charging. This service will most probably be part of an electro-mobility package rather than a separately billed service.

Vehicle-to-Grid

Using plugged-in electric cars as an energy store for peak energy supply or for emergency energy supply may gener-

ate additional income for car owners. Rates for peak energy and emergency power can be very attractive. The model of pooling a high number of cars as a "virtual power plant" will only work out if it is well orchestrated. Reimbursement for energy taken from vehicles will most probably need to be individual, as the car needs to be connected to the grid as well as sufficiently charged at the time the energy is needed.

Summary on value-add scenarios

Whilst there are a large number of possible innovative service models, they all rely on the aggregation of a large number of small-value transactions. Whilst transaction volumes will increase over time, it is likely that private transactions will be settled locally (e.g. by the employer or private car park operator). This will reduce the number of public transactions which will require inter-agent settlement.

To overcome the volume and value barriers for market entry, it is worth considering whether existing infrastructures can be utilised to support these new applications.

CHARGING CONSIDERATIONS

Because electric vehicles are new, this does not mean that the underlying processes have to be invented. Whilst in today's energy market the point of consumption is always fixed, there exist automated processes that enable a change of supplier to occur at each point of supply as well as a change of tenancy. The time base for this process is nominally weeks with settlement occurring about every year (which is driven by the manual meter reading process). For electric car charging, the same process could also be used but the time base would have to be adjusted. This is not an impossible problem to solve in "near-time", i.e. on a transaction by transaction basis, but becomes significantly easier if settlement is done "after the act", for instance at the end of the day. The question is whether the charging transaction is "cash flow" critical or whether transactions can be processed bulk – the key issue here is around the credit risk of "after the act" settlements

Value estimation of a charge cycle

The value of a charging transaction is low. The expectation is that the current model of free energy will be quickly replaced and the driver will pay for the energy either within a service bundle or as a commodity. At today's energy prices, a full charge can be roughly estimated at 25 kWh * 25 cents = 6.25 €. Most vehicles will charge much smaller amounts because they will rather top-up than do a full charge. Thus, charging revenue generated through energy alone will be fairly limited – even if additional taxation or pricing differentials are introduced.

Current legislation requires calibrated metering as a basis for energy charging. Meters and calibration are expensive as is the billing infrastructure that would be required to collect this data for use in the energy and payment settlement processes.

Given the low value of the core service, the overhead around transaction processing and payment has to be minimised. There are a number of established payment methods for small value transactions and these could be considered for public electric vehicle charging.

Paying for public charging

The challenge of payment at point of consumption is around the merchant fees levied by a card operator, the need for more complex authorisation, and the issue of credit risk. The assumption is that the transaction will be authorised to a maximum level (an established process) and once the charge is finished the transaction will be closed based on the delivered quantity. However, as the charging cycle is long, this may require two remote authorisation sessions (one to validate and one to register the transaction) and that the merchant and communications fees could be a significant element of the overall price.

If the transaction is locally enabled, then some organisation will have to take the credit risk. Normally this is a credit card company but it is far from clear where this risk will sit if the access card is issued by a local authority or energy supplier.

Immediate payment (cash, debit card)

Authorization issues and credit risks may be overcome by cash payment or pre-payment, but the issues of low transaction value drive granularity. For instance, all cash-based payment will no doubt result in change being given at the end of the transaction – driving higher equipment costs and risks.

The credit model

The use of a credit card to pay for energy is an option. The process is well established for a range of applications like car parking, pay and display, pay at pump, road tolling. The process works by having an intermediary that is willing to take the credit risk in order to enable access to a service and then charges a fee to cover this risk and the managing overhead.

Charge card

A "Charge Card" would be the basis for a scheme led by an electro-mobility provider. The driver is able to use the card at any charging point. Based on the card type, a default energy supplier may deliver the power, or a preferred energy supplier is assigned to the point of supply for the duration of the transaction (as in a change of supplier). Where a preferred supplier is assigned, the transaction can be billed back to the residential account for that customer. Otherwise, the driver will get a bill from the default provider.

The issue here is around security, the latency of the process, and the credit risk. If the customer card was cloned or stolen, misuse would be detected only on the regular energy supplier billing run (monthly or quarterly), and if the default supplier was used this would require a "send bill to home"

relationship to be established for what is a trivial quantity. The other option is to provide more granular billing services which will be difficult to support within the existing energy retail systems, or to use a dedicated third party platform.
One interesting alternative is to use the existing settlements process but to shorten the cycle – allowing multiple "change of supplier" to occur per day. With the introduction of smart metering the settlement cycle is expected to shorten to monthly billing, and countries with centralized energy clearing could extend these platforms to support electro-mobility. However, the question is whether they want to be congested with what could become the second largest source of micro-payments (after telecommunications) and who would be responsible for holding the credit risk between settlement cycles.

Post transaction settlement
The final solution is simply to do clearing on a less regular basis such that it fits already existing processes around energy supply. In this case, transactions would be gathered on a regular basis (e.g. daily), aggregated, assigned, and then submitted into the energy pool for post transaction settlement. This method would require some additional infrastructure for data collection and would create a slightly increased credit risk (as settlement would lag consumption of the service). However, many systems rely on this simple method and assume that the losses will balance out across the various players.

Semi-public charging

As private schemes become the dominant model, the need for settlement outside of the existing energy industry process reduces. The settlement point will be the incoming meter, and the private site operator will offer a number of services that will not need to be externally settled on a transaction-by-transaction basis. In some cases employers may need to track monetary benefits based on charging, but these are small-scale schemes and are already in operation in cafeteria, staff shops and so on.
Retail store locations may want to restrict the amount of energy given for free and/or provide incentives to their customers through vouchers or loyalty points – this is also a relatively simple "private" system that required no change to the external settlement process.

Private charging

There is limited or no need for separate EV power metering and billing, unless required by future legislation.

Taxing

Currently, there is no extra taxation for EV power. As the number of electric vehicles will increase, many commentators suggest that governments will want to recover lost fuel taxes and as such will drive a market for advanced billing and settlement for electric cars.
Whilst this is a possibility, the alternative is to use this effect as a further reason to introduce "charge by the mile" or "road tolling". This approach provides more flexibility for governments to tax across all vehicle fuels and creates a single infrastructure justified on a higher value base – i.e. use of the road rather than energy purchased. Many governments have road tolling on the agenda and the introduction of electric vehicles simply provides further justification for its introduction.

BENEFITS OF A COMMON B2B PLATFORM

What is clear is that future is unclear! There will be many entrepreneurial services wrapped around the electric vehicle, and some will succeed and some will fail.
However, what is clear is that in the early stages, and possibility even into the medium or long term, the volume of electric vehicles and the transactional value is unlikely to support multiple transactional infrastructures.
A common B2B service platform for electro-mobility, including, but not limited to clearing house functionality, can offer an interesting solution allowing operators to enter the market without having to invest in collecting, processing, and recovering their transactions. By using the functional building blocks within a B2B service platform, they can create their necessary business solutions whilst avoiding the initial investment and ramp-up effort.
Operators immediately benefit from the simple commercial model, simple and fast configuration, and a fully managed and maintained platform by moving to a variable-cost model on a shared platform.
Additionally, a common B2B service platform can provide a single point of entry for a range of other customer services around reservation, journey planning, charger location and pricing as well as providing detailed information around use of the energy network, power density, and travel routes.

SUMMARY

The need for clearing in the EV domain appears to be limited, and the requirement is expected to decrease over time as public charging reduces. Whilst EV charging and associated clearing appears to be a large opportunity due to the high number of open access chargers and the "connected cities thinking", over time the expectation is that the small volume and low value of the transactions will see EV settlement be consumed within larger industry processes that get created around smart metering and can largely be achieved through different means.
However, there will be huge benefits for the whole electro-mobility industry to build and maintain a common B2B services platform that provides an easy market interface for operators and promotes care-free compatibility for end-users. Demand for such a platform may initially be triggered by clearing considerations. While the electro-mobility industry matures, the initial focus will change and become much broader.