These lecture notes describe the stakeholders that are involved in the charging infrastructure market, as described in the lecture in more detail. Read once more and in more detail on the goals of each of these stakeholders.

Car makers

For carmakers this is strange new territory. They naturally see themselves in the lead, as evidenced by the fact that they usually call charging infrastructure simply electric vehicle support equipment. But in reality, they have no say over most charging locations and EV drivers will want to use them all. Their role in charging infrastructure is mainly to finally standardize the sockets (at least per continent) and to make sure their vehicle can be interfaced with. They could expand their role by usurping other roles.

Charge point manufacturer

An important new role is charge point manufacturer. This equipment will be needed in large numbers all over the world. The main issues to look out for in a charge point (apart from solidity and safety) are that it is reliable and future proof.
That probably means their aim is ample computing power. Charging points should support an open standard like OCPP, so they can be used by many users and charge point operators. Recent developments show the integration of so called smart meters, according to specs given by the grid operator (the DSO). Once every continent has a single plug on the car side, chargers will include a cable to connect them to the car directly.

**Users**

Users will look at the utility of charge points in a different way. If they buy one at home, they will want one that is future proof and from an independent car maker, so it is still useful if they buy a different car. If they use public chargers, they will want to know where they are located and when a charge point is broken or unavailable. It sounds trivial, but this is still the biggest grievance for many users in the Netherlands. They will also want interoperability and roaming. For example: you want to be able to charge in another country the same way you can charge in your own. And their role in the whole energy system will change, consumers are becoming prosumers, especially when they have solar panels, heat pumps or electric vehicles.
Charge point operators

The role of charge point operators or CPOs, is to facilitate requesting, selecting and placing a charge point. They can also offer remote assistance and repair. If multiple people can use the charge point, the CPO can make the availability of the charge point known on websites and facilitate authentication, metering and billing. An interesting new function is saving money by facilitating smart charging. There are multiple variables than can be optimized on, namely: Grid congestion, Voltage and Frequency. To do this properly, the CPO must be able to communicate with the user, the mobility service provider of the user, the local grid operator and the national grid operator, the energy producer, and the aggregator. The open standard OCPP helps the CPO to keep charge point hardware interchangeable. The open standard OCPI facilitates roaming and communication with the other parties just mentioned.
e-mobility service provider

It is unclear if this is the name the industry will settle on, but the functional role is an important one to grasp. The problem is that an EV driver will visit charge points of many different charge point operators. And you don’t want to get a new RFID card or app, anytime you visit the charge point of a new charge point operator. So, an e-mobility service providers contracts all the different charge point operators and offers them in a nice package to the users. A bit like a credit card offers an interface to many different vendors. But preferably more flexible and at lower transaction costs.

Municipalities
Municipalities have an important role in street charging because they are responsible for the public space. They have to provide the parking space, often some funding, and in return they can set the requirements that make sure that all charge points are interoperable from the user perspective. They can also contribute greatly to the process of placing them by providing a shared environment for all the stakeholders involved in the placement process, such as the user, maybe the dealer, the charge point operator, the grid operator, the municipality itself and the different sub-contractors doing the actual physical work. It also really helps if they make sure there is one contractor for municipality, grid operator and charge point operator who does the physical activities in one go.

**National governments**

National governments must enable regulation for smart grids, including incentives. They can really help to kickstart the process if they provide some small financial incentives to start knowledge sharing institutions that make sure the different stakeholders start talking to each other. Pilots can also be helpful to kickstart the process and of course open standards.

**Energy suppliers**

Energy suppliers must supply energy to charge points of course. They should also cooperate in establishing a mechanism that can reward smart charging. The problem we often see is that energy suppliers are used to being a very important party but in this whole process they only have one rather small role. This often leads to obstruction for smart charging, so be warned.
Grid operator

The same is true for the grid operator that on the one hand is very much interested in smart charging but on the other hand not used to really cooperating with others and especially not on the time scales that innovators need. To make matters worse, many are incentivized to put more hardware into the ground, even if that’s more expensive for society, and that doesn’t help the smart charging case.
Transition System Operator (TSO)

The transition system operator is a less dominant player, but frequency regulation can be facilitated by smart charging too, so don’t forget that. Also, the TSO often has a role in electricity markets and then opening them up to aggregators is very important.

Balance Responsible Party (BRP)
Next up is the balance responsible party. The role of the BRP is to make sure that every user’s demand is predicted in advance. And if the demand is unexpected, this must be fixed. What we want in the future smart grid is that the user can give this responsibility to innovative new companies that fulfill the role of the aggregator.

Check out this video by Elexon, a BRP in the United Kingdom to get a better grasp on the role of the BRP.

Grid operator

The aggregator brings together supply and demand in the smart grid of the future. In the case of electric vehicles this is done by coordinating smart charging a whole bunch of them and thereby creating a very large and extremely fast buffer to balance the grid and to use renewable electricity when it’s most abundant and cheapest. Opening up this new role to innovative start-ups is going to be extremely important for the efficient deployment of renewables.