Regulations and Subsidies

Ruling organisms

Considering the matter of charging stations for EVs, the current situation is a bit blurred. In fact, since the market is still new, and covers new areas in term of technology, the rules are made along the way. The governments and international organizations are adapting the existing rules to the technologies used, but most of the future methods and rules are intrinsically established by the research and companies that build the new EVs park.

A few organism that have adated rules and started to create some on the EV charging stations matter:

* National Electrical Code in the US
* Centre National du Transport Avancé (CNTA) in Canada
* International Electrotechnical Commission
* European Environment Grenelle in the EU

Companies and Societies that are imposing standards and rules by having the monopole on the edge technology:

* Society for Automobile Engineers, SAE International
* ChargePoint
* CHAdeMO (Tokyo Electric Power Company, Nissan, Mitsubishi and Fuji Heavy Industries)

Existing regulations

* **Safety standards**

<http://www.calstart.org/Libraries/E-Truck_Task_Force_Documents/Article_625_Natl_Electric_Code.sflb>.ashx

* **Design standards**

At present, all commercially available charging stations are conductive, that is, the electricity is transmitted through conductors, as in an electrical outlet. Conductive stations are covered by SAE Standard J1772.4 The voluntary standards of SAE International are often adopted by automakers. All recent EVs, such as the Chevrolet Volt, the Mitsubishi i-MiEV and the Nissan LEAF, are equipped with J1772 sockets. Another standard for conductive charging stations is CHAdeMO,5 which covers only DC fast charge stations. Although there are other types of charging stations, this Guide only deals with stations built to one of these two standards

<http://www.hydroquebec.com/transportation-electrification/pdf/technical-installation-guide.pdf>

* **Framework** (Agents, Grid connection and charging installations, metering, communication and control, EV charging modes, coordination between EVCs and EMC)

Existing agents:

* Distribution system operator (DSO): owner and operator of the distribution good (generally a monopoly)
* Supplier : the agent that sells energy to final customer
* Final customer: agent requiring electricity; forbidden to resell electricity. He can be residential, commercial or industrial customer
* Independent System Operator (ISO) or transmission system operator (TSO): responsible for keeping a secure system operation at the regional or national transmission level. He can procure system services, like operational reserves and frequency regulation, from market participants.

“Regulatory framework and business models for charging plug-in electric vehicles: Infrastructure, agents, and commercial relationships - Tomas Gomez San Roman, Ilan Mombern, Michel Rivier Abbad, Alvaro Sanchez Miralles”

* **Rating of the supply voltage**

Should of course match the existing power outlets, but also be able to be implemented in new systems and grids

* **Charging levels/Modes**

Described in previous parts of the document

* **General system requirement and interface**
* **Connection between the power supply and the EV.**

Should at least match the existing characteristics of already developed EVs.

* **Specific inlet, connector, plug and socket-outlet requirements**

Regulations needed & current discussions

Among those actions the call for international or at least European standardization of charging infrastructures and technologies, including smart grids, with open communication standards, should be highlighted.

The currently perceived purchase premiums compared to internal combustion engines are widely being discussed and a multitude of different policy schemes to foster EV adoption is evaluated.

In addition to technological developments and policy measures, regulatory issues related to investment and deployment of the required infrastructure need to be formulated and adequately solved.

Coherently, there is a need for discussing how and which agents should be authorized to provide EV charging and pricing of those services, as well as how EV storage capability could be appropriately marketed to provide vehicle-to-grid (V2G) services.

Therefore, still many questions remain to be answered within a consistent regulatory framework considering rules and players in existing electricity markets.

As an example of these issues, in California, the Public Utilities Commission has opened a rule making process, in which a number of issues are proposed for consultation with stakeholders. It is yet to be determined (i) how to implement obligatory variable tariffs (ii) legal status of electricity resellers, (iii) incentive creation for users to adopt remote charge control of valuable 2 batteries, and (iv) allocation and recovery of investment in infrastructure in a fair non-discriminatory framework (CPUC, 2010a). Furthermore, there exists an intense discussion about critical metering policies in terms of metering arrangements (single, sub-and separate metering) and their implications on cost, installation time, and billing flexibility (CPUCb, 2010b).

Research proposal

Cf “regulatory framework and supply chain in charging stations”

**New agents:**

* Plug-in electric vehicle owner (EV): owns an electric vehicle and wants to charge its battery
* EV supplier-aggregator (EVSA): agent selling electricity to the EV owner
* EV charging point manager (CPM): acts as a final customer for electricity, he is assumed to install the charging infrastructure. He can buy the electricity to charge his own EV or resell it to other EV owners connected to the charging station under a commercial agreement. The access to the charging stations depends on the terms and conditions it sets; but it should obtain a license to exercise this activity, like technical capability and financial liability. He could be:
  + a residential customer who installs the charging station at home for private use
  + an office building owner who installs the charging station in the office parking area for the private use of the employees
  + a commercial building owner who installs the charging stations for the use of its clients
  + a charging station owner who installs the charging stations to deliver this service for the public
  + If the charging station is installed in a public area, the business is regulated and charging stations developed by the corresponding DSO in the area. The access is universal to EV owners contracted with different EV suppliers.



**Grid connection and charging installations:**

* Distribution grid
* Final customer connection point
* EV charging infrastructure
* EV charging point or charging post (CP): is the connection point between the Ev and the charging infrastructure, where the EV is plugged-in to be charged. A single or multiple charging posts would make up a charging station.

**Metering, communications and control**

* Final customermeter(FCM): itislocatedatthefinal customer connectionpoint.Itisknownasthe‘‘utilitymeter’’.It meters theenergyconsumption(kWh)andpeakconsumption (kW) inaperiodoftime.Measurementscanbecollectedbytime- of-use, inpeakandoff-peakhoursforinstance
* EV meter(EVM): wouldmetertheenergyconsumption,the peak consumptionandtheperiodoftimeduringwhichanEVhas been connectedtoachargingpointforbillingpurposes.EV meters canalsobeembeddedinthecar.Insomecases,EVmeters would communicatewiththeEVsupplierforbillingandpotential remote chargingcontrol.
* Energy managercontroller(EMC): isacontroller,similarto an energymanagementsystemorenergybox,operatedbythe corresponding CPMorEVSA(Livengood andLarson,2009). It schedules achargingprogrammeforeachoftheconnectedEVs.
* Electric vehiclemeter(EVM): itprovidesinformationabout energy consumption,peakconsumption,andtimesofconnection on request.
* On-board EVstateofchargeindicator(SoC): measuresthe state ofchargeoftheEVbatteryasapercentageofthefullcharge or inkWh.
* On-board EVcontroller(EVC): isaprogrammablecontroller that providesamenuofalternativestotheEVownerforcharging the EVbatteryduringitsconnectionperiod.9



Source <https://www.rvo.nl/sites/default/files/2014/04/Electromobility%20in%20the%20Netherlands%20Highlights%202013.pdf>

<http://www.acea.be/search/de7db054743d8d51591526e8c57a5d02/>

<http://www.acea.be/publications/article/overview-of-incentives-for-buying-electric-vehicles>

<http://en.wikipedia.org/wiki/Government_incentives_for_plug-in_electric_vehicles>

# Annexe: Example of a regulation framework in Quebec

REGULATORY FRAMEWORK

6.1 Laws, regulations, codes and standards

The installation of charging stations is subject to several laws, regulations, codes and standards. The laws and regulations stipulate the situations in which you must call in a professional (engineer or master electrician). They also prescribe application of the Québec Construction Code, Chapters I and V. Here is a list of the main documents applicable to charging station installation.

* Québec Engineers Act, R.S.Q., c. I-9
* Québec Master Electricians Act, R.S.Q., c. M-3
* Québec Building Act, R.S.Q., c. B-1.1
* Municipal bylaws
* Québec Construction Code, Chapter I – Building, and National Building Code of Canada 2005 (amended)
* Québec Construction Code, Chapter V – Electricity, C22.10-10, 2010
* CSA, C22.1HB-09: CE Code Handbook: An Explanation of Rules of the CE Code, Part 1
* CSA standards on hazardous locations (see list below)
* Hydro-Québec Standard E.21-10, Low-Voltage Electrical Service (“Blue Book”), 9th edition (2008)

Municipal bylaws, including those on land use and development, must be taken into account in the installation of charging stations. The Québec Construction Code is prescribed by the Building Act, and Chapter V on electricity is particularly relevant to charging station installation. Section 2-014 of Chapter V lists the situations requiring the production of drawings and specifications. The Code and the “Blue Book” are essential tools for charging facility designers. Depending on the nature of the work, other documents such as the Building Code may also apply. The “Blue Book” specifies voltages and methods for connecting Hydro-Québec customers.

Here is a non-exhaustive list of Code sections relevant to charging station installation:



Equipment installed in hazardous locations, as defined in the Code, may be subject to the

following standards:

* CAN/CSA-C22.2 No. 157-92: Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations
* C22.2 No. 213-M1987: Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
* C22.2 No. 60079-0-07: Electrical Apparatus for Explosive Gas Atmospheres – Part 0: General Requirements
* C22.2 No. 60079-1-07: Electrical Apparatus for Explosive Gas Atmospheres – Part 1: Flameproof Enclosures “d“
* C22.2 No. 60079-2-02: Electrical Apparatus for Explosive Gas Atmospheres – Part 2: Pressurized Enclosures “p“
* C22.2 No. 60079-5-02: Electrical Apparatus for Explosive Gas Atmospheres – Part 5: Powder Filling “q“
* C22.2 No. 60079-6-02: Electrical Apparatus for Explosive Gas Atmospheres – Part 6: Oil-Immersion “o“
* C22.2 No. 60079-7-02: Electrical Apparatus for Explosive Gas Atmospheres – Part 7: Increased Safety “e“
* C22.2 No. 60079-11-02: Electrical Apparatus for Explosive Gas Atmospheres – Part 11: Intrinsic Safety “i“
* CAN/CSA-E79-18-95 (R2009): Electrical Apparatus for Explosive Gas Atmospheres – Part 18: Encapsulation “m“

Lastly, SAE Standard J1772 on AC charging stations encompasses all applicable UL and CSA

standards, but is not mandatory.

# Annexe: Example of the EV home charging

Agents involved: the homeowner,thesupplier,andtheDSO. The homeownerwillnotifythesupplieraboutthemaximum required chargingpowerwhereasthesupplierwillnotifytheDSO if additionalpowerdemandisrequiredunderthesupplycontract (Fig. 4).

Contracts: The supplycontractbetweenthesupplierandthe residential finalcustomerwouldbeacontractwithatleastToU prices, i.e.peakandoff-peakpricestopromotechargingat off-peak hours,oritcouldbeamoresophisticatedcontractwith hourly timepricesthatpromotesanintegratedmanagementof the EVwiththerestoftheloads.InthiscasetheFCMshouldbe upgraded toasmartmeterinordertomeasurehourlyconsump- tions. ThesupplierwillpaytheDSOforthecorresponding regulated networkcharges.

Communication andchargecontrol: The EVownerwould programme hisEVCinaccordancetohis/herdriverrequirements and simultaneouslyminimizingelectricitypaymentstothe supplier. Thesuppliercanofferthehomeowneranintegrated management ofhisloadsaswell.Inoptimizationmodethere needs tobeacommunicationofpricesignalsbetweenthe supplier andtheEVC.

Settlement: The settlementofthecontractwouldbebasedon the totalhomeelectricityconsumptionaccordingtothepricesset in thecontract.Thesepricesingeneralwouldbe:(i)ademand charge (h/kW-month), and(ii)anenergycharge(h/kWh) with different ToUratesorhourlyprices. Under theschemeofmodeHO-SA-UCO,aspresentedabove,it is notpossibletobilltheelectricityusedfortransportation differently fromdomesticenergyconsumption.Ifthiswasthe intention, asforinstancenecessarywhenincludingspecialrates or taxesontransportation,theconnectionoftheEVcharging point shouldbemeteredtoo.In Fig. 5 two independentmetersare installed forthispurpose.Aseriesconnectionwithsubtractive calculation forbillingwouldalsobepossible(PG&E, 2010). In these cases,thehomeownercouldhavetwodifferentsupply contracts orrates,theformerforbillingthehomeelectricity consumption andthenewoneforEVchargingwithanEVSAfor instance.

