British Columbia Utilities Commission
An Inquiry into the Regulation of Electric Vehicle Charging Service
INFORMATION REQUEST NO. 1 TO DONALD FLINTOFF

Tuesday, June 05, 2018

Sent via email/eFile

Patrick Wruck
Commission Secretary

Re: British Columbia Utilities Commission – An Inquiry into the Regulation of Electric Vehicle Charging Service – Project Number 1598941 – Information Request No. 1, EXHIBIT A-11.

Dear Mr. Wruck:

Enclosed please find my response to British Columbia Utilities Commission (BCUC) Information Request No. 1, EXHIBIT A-11. .

Sincerely,

Mr. Donald Flintoff
don_flintoff@hotmail.com

/djf
Enclosure

A. BASIS FOR EV CHARGING SERVICE REGULATION EXEMPTION

Reference: Exhibit C4-2, p. 6; Exhibit C6-2, p. 5 1.0The British Columbia Utilities Commission (BCUC) Thermal Energy System Guidelines (TES Guidelines), p. 7 Ministerial exemption

On page 6 of Exhibit C4-2, Donald Flintoff states:
Clearly, the operators of the DCFC charging stations are a public utility. Through the Commission, the operators of DCFC stations may be able to seek a ministerial exemption from regulation which can be withheld/cancelled on complaint. Any exemptions should expire after five years and another inquiry should be held to determine if the exemptions are working in the public interest. Further discussion on this matter assumes the Commission can obtain the necessary exemption from the Ministry.

On May 19, 2016 by Order G-71-16, the BCUC granted Bakerview EcoDairy an exemption from Part 3 of the *Utilities Commission Act* (UCA), except sections 25, 38, 42, 43, 44 and 49.[1]

[1] http://www.bcuc.com/Documents/Proceedings/2016/DOC_46352_05-19-2016_Bakerview-Exemption-Approved_G-71-16.pdf

1.1. Flintoff submits that any exemptions should expire after five years and another inquiry should be held to determine if the exemptions are working in the public interest. Would it be more practical and regulatory efficient for the BCUC to continue the exemption and initiate another inquiry after a period of time (e.g. five years) to determine if the exemptions should continue? Why or why not?

1.2. In Flintoff's view, if the BCUC were to recommend a class of cases exemption to government in relation to EV charging service, what factors should be considered in developing the classes? Further, what sections of the UCA, in Flintoff's view, should EV charging service be exempt from?

1.3. Does Flintoff have a view on what the classes could be (e.g. based on different levels of EV charging equipment, charging station geographic locations, type of dwelling, owner/operator structure, some combination of the above, or others)? If yes, please describe.

Response

2.1. If the public utilities are permitted to participate in providing DCFC charging stations, then an inquiry should be held after a time (say 5 years) to determine if their continued participation in providing DCFC charging stations is required and in the public interest.

If only the non-regulated businesses of the public utilities are permitted to participate in providing DCFC charging stations and other non-regulated owner/operators, then an inquiry does not have to be held to determine if their continued participation in providing DCFC charging stations is in the public interest and any exemption could remain in effect until a complaint triggers a review process of any exemption.

2.2. This is a two part question.

1.2.1. Assuming that other provincial legislation or regulation does not apply to the public utilities, the factors that could be considered in developing the classes (a class of cases exemption to government in relation to EV charging service) are:

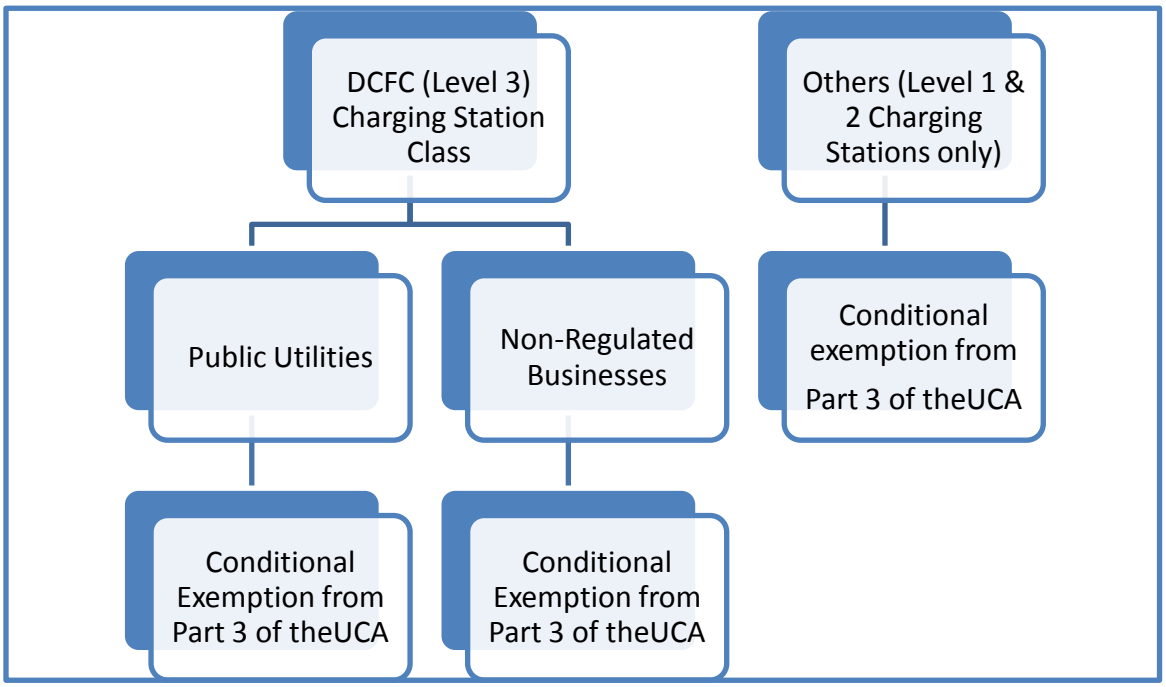


Figure 1 Classes seeking Exemption

The class, "Others", would have a very low impact on demand load on the grid until such time as the EV numbers become significant. This class (level 1 &2 charging stations only) could include: MURBS, Employers, tenants, stratas, etc. Municipalities are already exempt. The Commission could seek a partial or conditional exemption for level 1 &2 charging stations.

The Commission could seek a partial or conditional exemption for all DCFC (Level 3 and up) charging stations in order to reduce the regulatory burden, but retain demand billing.

1.2.2. EV charging service for DCFC charging stations that the Commission could consider for exemption from the following sections of Part 3 of the UCA are:

Conditional Exemption from sections in Part 3 of the UCA				
DCFC (Level 3 & up) Charging Stations				Level 1 & 2
UCA Section	Description	Exemption for Public Utilities	Exemption for Non-Regulated Businesses	Exemption for Others
25	Commission may order improved service	No	Yes	Yes
38	Public utility must provide service	No	Yes	Yes
42	Duty to obey orders	No	No	No
43	Duty to provide information	No	No	No
44	Duty to keep records	No	Yes	Yes
49	Accounts and reports	No	Yes	Yes

Yes – means exempt from the UCA section.

No – means not exempt from the UCA section.

2.3. This question is mostly answered by my response to 1.2. However, the geographic location and load factor are of concern as some of these charging stations may not be profitable.

Is it the ratepayers' responsibility to provide charging stations for EVs that are purchased in rural/remote locations? In my opinion, EVs owners must bear the responsibility for their type of EV purchase by using common sense and acquire PHEVs not BEVs in rural/remote areas, or pay the fair market energy price of providing DCFCs in these locations.

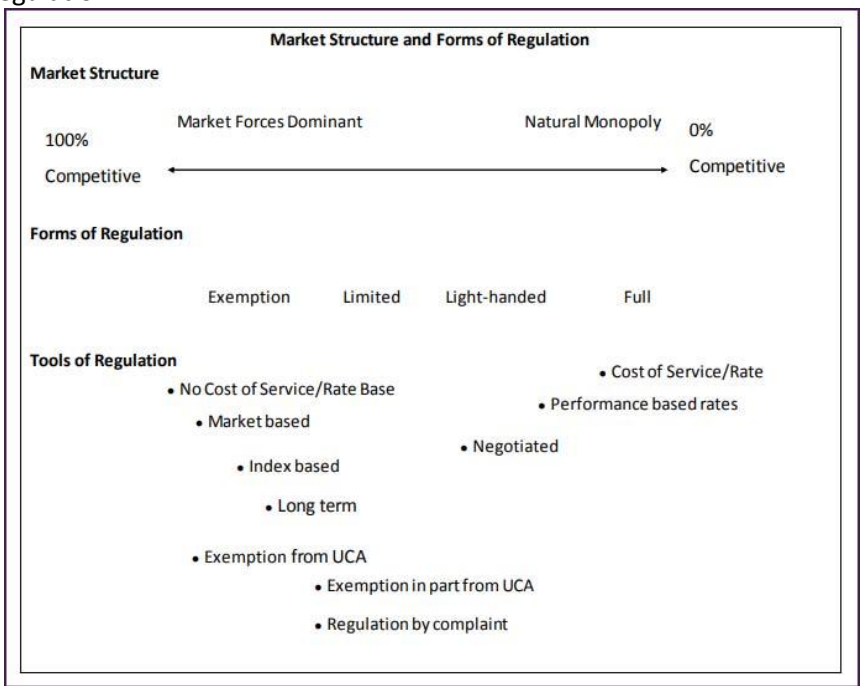
The Commission should remain mindful other the other technologies that are available in the market place. For instance, as an owner of a diesel collector car, I am mindful that I can not access diesel at every gas station. Similarly, owners of hydrogen full cell EVs or CNG vehicles are very limited in accessing the energy necessary for their vehicles. As both hydrogen and CNG by definition could be regulated by the

Commission, does this mean the ratepayer may be requested to provide this new technology fuelling stations in the future? So should EV owners in rural/remote location be granted access to DCFC charging just because they are EV owners?

Reference: The BCUC Inquiry into FortisBC Energy Inc.'s Offering of Products and Services in 2.0Alternative Energy Solutions (AES) and Other New Initiatives proceeding, Order G-231-13A with Reasons for Decision, pp. 23–24 Proposed regulatory framework and guide for thermal energy service utilities

On pages 23 and 24 of the Reasons for Decision attached to Order G-231-13A, the BCUC states:
The [AES] Inquiry found that the form of regulation should be determined by the market structure. The Panel agrees with this assessment. The figure below illustrates the Panel's view of the relationship between market structure and the various tools of regulation.

The Panel in Order G-231-13A also agreed with the basic regulatory concepts outlined in the AES Inquiry Report whereby regulation should be the option of last resort and competition should always be preferred over regulation.



2.1 Please discuss whether the BCUC in this EV Inquiry should consider the relationship between market structure and forms/tools of regulation, as shown above in the diagram. If not, why not?

2.2 Suppose the BCUC uses the above diagram as a guide to determine the appropriate form of regulation. Given the market structure noted in Mr. Flintoff's submission, what would be the corresponding form of regulation and tool of regulation? If any different, please explain in terms of the Flintoff's view of the current market structure and the expected market structure in the

next 3-5 years.

Response

2.1. Assuming that other provincial legislation or regulation does not apply, the Commission, in this EV Inquiry, could consider the relationship between market structure and forms/tools of regulation, as shown above in the diagram.

2.2. Given the market structure noted in my submission, the corresponding form of regulation and tool of regulation is as follows:

Market Structure
Market structure is the most problematic as location of the DCFCs is an issue related to competitiveness. If the public utilities enter the market early, then the most desirable and profitable locations will be occupied by the public utilities. Because of the lack of profitable and desirable locations available to the private sector, further investment by the private sector will be limited and may not occur. This assumes the urban market is profitable while the rural/remote market may not be profitable.

If the public utilities enter the market as non-regulated businesses, then the market structure may be more competitive, since they may not acquire most of the desirable locations.

Forms of Regulation
For DCFC charging stations, the form of regulation should be exemption-limited; and for Levels 2 and Level 2 charging stations the form of regulation should be exemption: light-handed.

Tools of Regulation
For DCFC, Level 1, and Level 2 charging stations, the tools of regulation, given exemption in part from the UCA, should be regulation by complaint.

If the public utilities enter the market, then the form of regulation must be cost of service to protect the ratepayers from the risk of unprofitable DCFCs and stranded assets.

If the public utilities enter the market as non-regulated businesses, then there is no requirement to protect the ratepayers from the risk of unprofitable (low load factor) DCFCs and stranded assets; and the tools of regulation could be market based.

In terms the current market structure and the expected market structure in the next 3-5 years, my view is the EV market will still be in its infancy and its penetration of the overall market place will be low. However, this will depend somewhat on battery development. As the battery capacity (power density) increases and charging times

reduce, the uptake of EVs in urban areas should increase. However, if the public utilities are permitted to enter the DCFC market place the competitive nature of the market place may be stalled as most of the profitable and desirable locations (higher load factor locations) for these DCFC charging stations will be acquired by the public utilities. Hence, the competitive nature of the market structure will remain about the same over the next 3-5 years. This assumes that the public utilities will obtain most of the choice urban locations and preferred corridor locations for their charging stations in the near future using their rate base to support their DCFC program development.

B. INVESTMENT DECISION

Reference: Exhibit C12-2, p. 19; Exhibit C20-2, p. 8 3.0 Business model

On page 19 of Exhibit C12-2, FortisBC Inc. (FBC) states:
FBC recommends that a new rate should be developed for electricity supply to EV charging stations, since its existing retail and wholesale rate schedules contain components, such as demand charges or high customer charges that would make them inappropriate to support the development of EV charging infrastructure in the province. The rate should reflect the unique characteristics of the service being provided.

On page 8 of Exhibit C20-2, AddÉnergie Technologies Inc. states:
The Commission can support the development of DCFC public charging by providing a demand charge-free charging rate. This approach has been used in Québec in a 5-year pilot (the Québec BR rate) and has substantially reduced some of the economic barriers to providing public DCFC charging.

3.1 Please comment on an alternative rate structures such as the Québec BR rate.

Response

3.1 The Quebec BR rate[1] and alternate rates G-9[2] and M[3] will be discussed together.

First of all the Quebec BR rate is an experimental rate. Second, this is not a retail rate. This is the Hydro Quebec's rate (wholesale rate) charged to the EV charging stations.

For customers who install a stand-alone fast charging station, BC Hydro charges them under general service rates. [BCH Exhibit C1-2. p. 14] BC Hydro appears to be charging EcoDairy under the Medium General Service rate. The medium General Service Rate includes and Demand and Energy Charge as well as a Power Factor Surcharge.
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The Quebec BR billing rate is based on 3 pricing levels:

- consumption associated with the first 50 kilowatts (kW) of maximum power demand expressed in kilowatthours (kWh), which is the product of the maximum power demand up to 50 kW, the load factor and the number of hours in the consumption period,
- consumption associated with the maximum power demand exceeding 50 kilowatts, which is the product of the excess maximum power demand, the load

[1] http://www.hydroquebec.com/business/customer-space/rates/rate-br-experimental-rate-fast-charge-stations.html
[2] http://www.hydroquebec.com/business/customer-space/rates/rate-g9-general-rate-limited-use-power.html
[3] http://www.hydroquebec.com/business/customer-space/rates/rate-m-general-rate-medium-power-customers.html

factor up to 3% and the number of hours in the consumption period the remaining consumption,
- the remaining consumption.

Maximum power measured during a consumption period. It is the higher of the following two values: real power in kilowatts (kW), or a percentage (90% for domestic rates and small- and medium-power rates, or 95% for large-power rates) of the apparent power in kilovoltamperes (kVA).

Hence, if the maximum power measured during a consumption period is greater than 50kW, then both **demand** charges **and power factor** charges are applicable.

	Hydro-Quebec Rate BR[4]
	¢/kWh
Energy associated with the first 50 kW of power	10.95
Energy consumed in the next bracket	20.54
Remainder of energy consumed	16.14

The following table compares four customers with a billing demand of 140 kW, but different load factors.

Case	LF	KWH	Rate G-9	Rate M	Rate BR	BCH Medium GS Rate
Customer 1	10%	10,080	$1,596	$2,527	$1,104	$984
Customer 2	20%	20,160	$2,604	$3,030	$2,208	$1,968
Customer 3	30%	30,240	$3,612	$3,533	$3,312	$2,953
Customer 4	40%	40,320	$4,620	$4,036	$4,830	$3,937

As the load factor increases, Rate M becomes the preferred rate. The BR rate is preferential to EV charging stations and should not be considered if it is to the determent of the ratepayers. However, it may be suitable for Level 1 and Level 2 charging stations. Further, the BC Hydro medium General Service rate, already accepted by the Commission for EcoDairy, appears to be more generous than the Quebec-Hydro BR rate.

Considering the above, BC Hydro has already determined that a suitable rate for DCFC charging stations is their medium General Service rate, 1500, which has already been approved by the Commission and is available to Customers who qualify for General Service

[4] http://www.hydroquebec.com/business/customer-space/rates/rate-br-experimental-rate-fast-charge-stations.html

and whose Billing Demand is equal to or greater than 35 kW but less than 150 kW, and whose Energy consumption in any 12-month period is equal to or less than 550,000 kWh. Supply is 60 hertz, single or three phase at Secondary or Primary Voltage. BC Hydro reserves the right to determine the voltage of the Service Connection.

C. TECHNOLOGY

Reference: Exhibit C4-2, p. 22 4.0 Power factor

On pages 22 of Exhibit C4-2, Mr. Flintoff states:

Since the charging station power factor of 0.96 is only specified at full load then a power factor penalty should be applied and/or a kVAR/kVARh charge introduced in the EV charging station's rate schedule. The DCFC station should have an input power factor of not less than 0.95 through the capacity range of 0 to 100% of rated input amperes.

4.1 Please provide some background material or reference on how it is known that the EV charging station power factor of 0.96 is only specified at full load.

4.2 Please clarify the role of power factor plays when considering the potential regulation of the EV charging service market.

Response

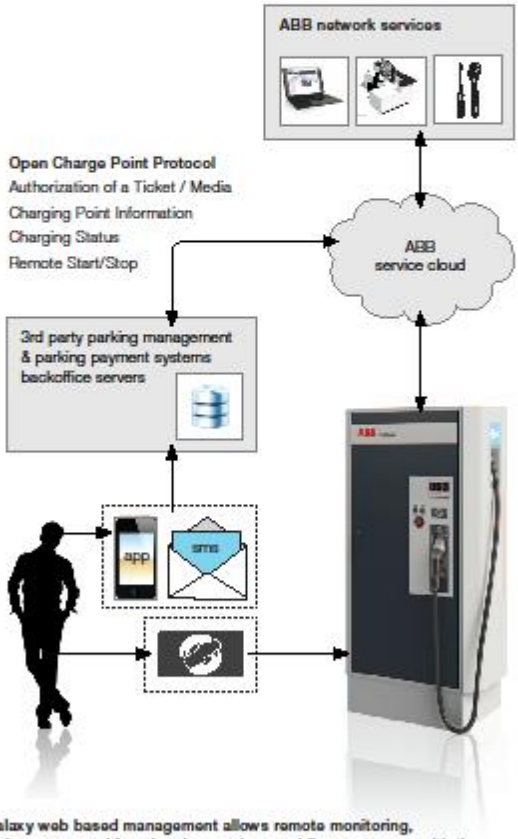
4.1 ABB Terra 51 EV charging station power factor of 0.98 is only specified at full load in FortisBC's Application for Approval of Rate Design and Rates for Electric Vehicle (EV) Direct Current Fast Charging (DCFC) Service, Exhibit B-1, Appendix D, Terra 51 fast charging station, p.2. The power factor is 0.98PF not 0.96.

The CEC has determined that EV Power Factor corrected battery chargers[5] for EVs are essential. The California Energy Commission[6] has adopted requirements of 0.90 PF to improve efficiency in large battery charger systems aimed at non-consumer electronics. The CEC 0.90PF requirement is similar to the PF surcharge in BC Hydro's medium General Service Rate, 1500.

The ABB charger uses a different design than Porsche to address power factor concerns.

4.2 If EV chargers have poor power factor or failed components (i.e. reactive power components) then the unit will draw more reactive power. This reactive component will have to be supplied by the utility and may impact the kW capacity of the public utilities supply equipment.

[5] https://www.amrita.edu/publication/power-factor-corrected-battery-charger-electric-vehicle
[6] https://www.iotaengineering.com/pplib/IOTA_Tech_PFC%20in%20Battery%20Chargers.pdf



Galaxy web based management allows remote monitoring, maintenance and functional upgrades providing customers with the tools necessary to gather customer usage statistics and reports.

Technical specifications	
System	
Type	Single DC fast-charging station
Operating temperature	-10°C to +40°C -35°C to +40°C (low temp. option)
Storage temperature	-40°C to +70°C
Relative humidity	20% to 95%
Environment	Indoor / outdoor
Compliance and safety	UL / CHAdeMO
Input	
AC power connection	3P + PE
Input voltage range	480 V_{AC} +/-10%
Nominal input voltage	480 V_{AC}
Nominal input current	70 A 32 A – 70 A (Software limit option)
Nominal input power	55 kVA 22 kVA – 55 kVA (Software limit opt.)
Input frequency	60 Hz
Power factor (full load)	> 0.98
Input over-current protection	Yes
Efficiency	> 92% at nominal output power
Output	
Maximum output power	50 kW
Maximum output current	120 A
Output voltage range	50 – 500 V
Output over-current protection	Yes
Output short-circuit protection	Yes
General	
DC connection standard	CHAdeMO compliant
DC cable length	15ft std; other lengths upon request
DC plug type	JEVS G105
RFID system	13.56 MHz, ISO 14443A
Network connection	GSM / UMTS modem 10/100 Base-T Ethernet
Standby power consumption	
Idle	100 VA (nominal)
Climate control	1000 VA (max)
Protection	Type 3R
Operational noise level	< 45 dBA
Dimensions (D x W x H)	
Charge station	23" x 38" x 78" 600 mm x 960 mm x 2000 mm
Weight	
Charge station	880 lbs / 400 kg

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New Berlin, WI 53151
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US 20170240063A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0240063 A1**

Herke et al. (43) **Pub. Date: Aug. 24, 2017**

(54) **METHOD AND DEVICE FOR OPERATING CHARGING STATIONS**

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(72) Inventors: **Dirk Herke**, Kirchheim unter Teck (DE); **Ralf Oestreicher**, Sindelfingen (DE); **Volker Reber**, Michelbach an der Bilz (DE); **Anja Heinzelmann**, Stuttgart (DE)

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(21) Appl. No.: **15/427,370**

(22) Filed: **Feb. 8, 2017**

(30) **Foreign Application Priority Data**

Feb. 22, 2016 (DE) ..... 102016103011 .2

Publication Classification

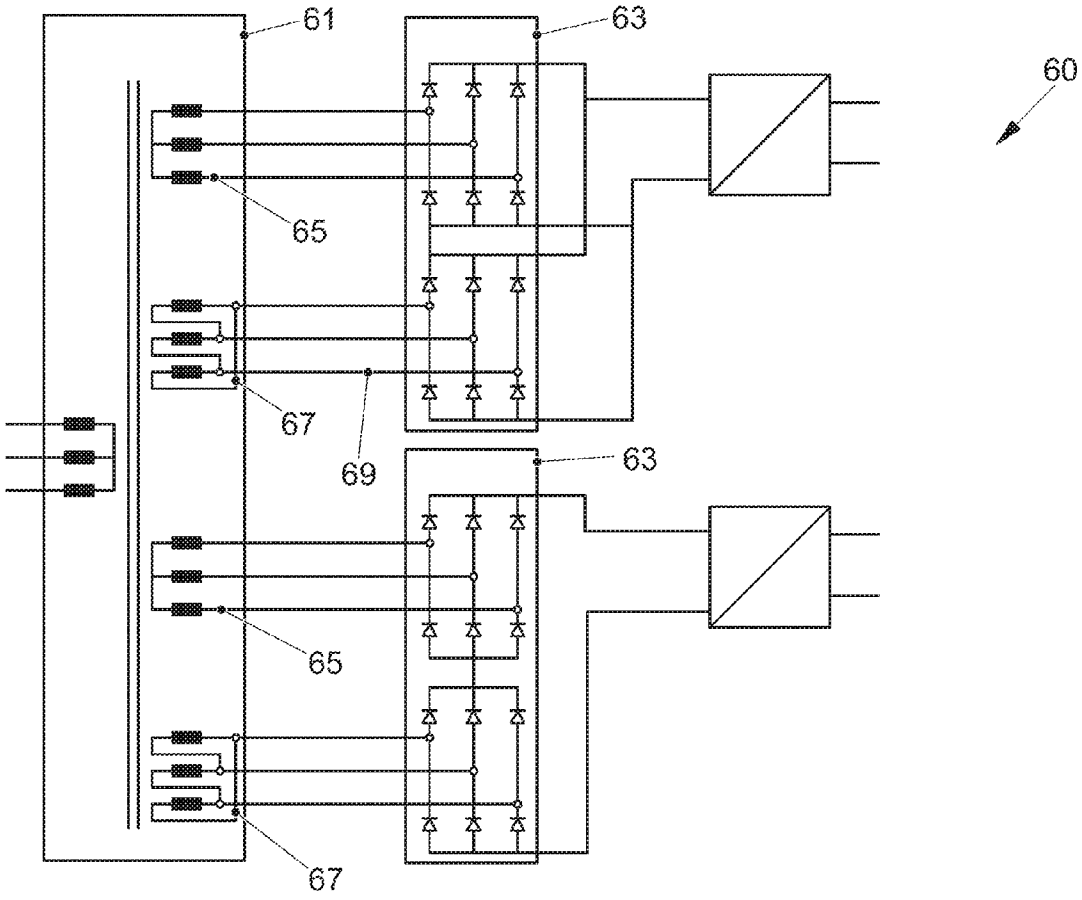
(51) **Int. Cl.**

B60L 11/18 (2006.01)

H02J 7/00 (2006.01)

(52) **U.S. Cl.**

CPC ***B60L 11/1838*** (2013.01); ***H02J 7/0027*** (2013.01); ***B60L 11/1811*** (2013.01); ***H02J 7/0068*** (2013.01)

(57) **ABSTRACT**

A method for supplying a number of electric charging stations with electricity, wherein AC voltage provided by an electricity source is transformed into a prescribed AC voltage level by at least one transformer via at least one star winding and at least one delta winding and subsequently routed via AC voltage lines to the number of electric charging stations and converted directly to direct current in respective charging stations from the number of electric charging stations locally by at least two rectifiers of the charging stations.