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Optimal design of electric vehicle charging stations considering various energy resources

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1 Optimal Design of Electric Vehicle Charging Stations

2 Considering Various Energy Resources

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6 Abstract

7 In this paper the optimal design of an Electric Vehicle Charging Station (EVCS) with the
8 goal of minimizing the lifecycle cost, while taking into account environmental emissions,
9 is presented. Different energy sources such as renewable energy technology based and
10 diesel generation are considered, with realistic inputs on their physical, operating and
11 economic characteristics. In order to address the "range anxiety", concern of EV owners
12 regarding the distance the vehicle can travel, the design of an EVCS along highways, as
13 an isolated microgrid, is studied. In another study, the EVCS is assumed to be connected
14 to the grid as a smart energy hub. The charging demand of the EVCS is estimated
15 considering real drive data. Analysis is also carried out to compare the economics of a
16 grid-connected EVCS with an isolated EVCS and the optimal break-even distance for the
17 grid connected EVCS to be a viable option, is determined.

18 Keywords

19 Electric vehicle charging station, Renewable energy, Plug-in electric vehicle, Microgrid,
20 Environmental emissions.

21 Nomenclature

22	x	Index for EVCS supply component options (solar PV, converter, diesel
23		generator, battery energy storage system (BESS), grid connection)
24	N	EVCS project life, yr
25	N_x	EVCS component life, yr
26	i	Annual real interest rate (the discount rate), %

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