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Abstract The popularisation of electric vehicles (EVs) and the development of dynamic wireless charging technology have created an emerging trend of transportation electrification, which strengthens the coupling between electrified transportation network (ETN) and power distribution network (PDN). Meanwhile, the stochastic routing behaviour of EVs and prediction error of traffic demand pose a severe challenge to the coordinated ETN-PDN operation problem. This paper proposes a new hybrid optimisation method using stochastic user equilibrium (SUE)/information gap decision theory (IGDT) to study the impact of the unavoidable uncertainties on the coordinated ETN-PDN operation, which consists of the following two stages. In the first stage, a collaborative optimisation model based on SUE and Dist-Flow equations is established to deal with the stochastic EV routing behaviour. Built upon this model, the second stage continues to consider the traffic demand prediction error and establish a risk decision model using IGDT. The proposed model can provide proper road congestion tolls and local generator production schedules to lead to a minimum expected socio-economic cost. Also, two different coordinated operation strategies, that is, risk-seeker and risk-averse strategies, are provided to deal with the uncertainties. Case studies are carried out to demonstrate the effectiveness of the hybrid SUE/IGDT optimisation method.