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UNIVERSITY OF THE WITWATERSRAND

MASTERS DISSERTATION

Implementing electric vehicle focused tariff structures to support electric vehicle adoption and rooftop solar PV integration

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Declaration

I, **Ouma Enesia Tlou Bosaletsi**, declare that this Dissertation titled, "**Implementing electric vehicle focused tariff structures to support electric vehicle adoption and rooftop solar PV integration**" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
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- I have acknowledged all main sources of help.

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Abstract

The research work proposed a three-part dynamic distribution tariff structure comprising of the energy charge (as a price signal for energy efficient consumption), the network losses charge (as a price signal for energy efficient consumption) and the maximum demand charge (as a price signal for managing local transformer rating violation). The novel part of the proposed tariff is that the network voltage violation and network equipment rating violation will be managed by sending price signals to customers.

The energy charge will differ during the day due to the dispatch of generation plants according to the merit order. This makes the tariff time-of-use based. Different ramp rates are applied with the slope of the ramp function based on the averaged local transformer loading to defer costly infrastructure upgrades. The hypothesis is that if tariffs are based on the costs of meeting demand, the customers will have incentives to modify their usage behaviour in ways that reduce the overall network costs.