transmission, which means that the installation of batteries in the MV distribution may be more efficient to reduce losses if their efficiency is improved, than the installation of batteries in the transmission network. The efficiency of batteries to reduce losses may be even improved if they are operated to develop voltage control.

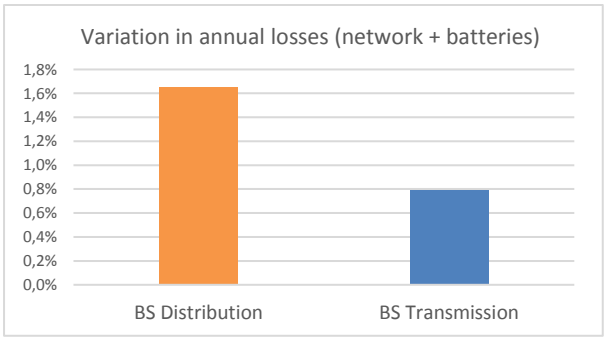

Fig. 9. Influence of BESS on the variation of annual total losses

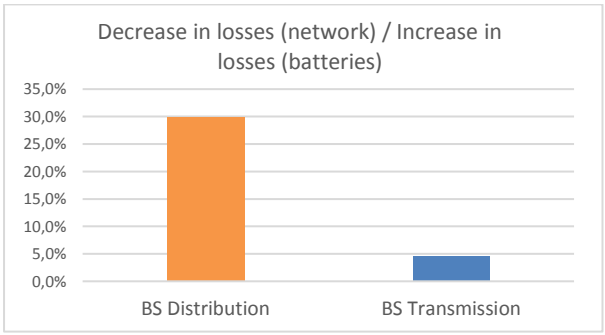

Fig. 10. Ratio of saved annual network losses and annual battery losses

5. Conclusion

It is widely accepted that the application of BESS in the power system can provide multiple system services. However, the optimal size and location of batteries is strongly influenced by how the batteries will be operated. In addition, the efficiency of the batteries in the provision of system services may depend on their size and location within the power system so it may be questioned whether an optimal location exists that maximizes the profit for the power system. In this paper, a methodology has been proposed for the determination of the optimal size and location of batteries in the power system in order to provide support during network contingencies. This methodology has been applied to the actual electric network of Murcia, in Spain, in order to evaluate the benefits of the installation of BESS in transmission and distribution. The results of the analysis have shown that the installation of batteries in the distribution network provides a better solution in case of contingency, as they can be located to mitigate not only distribution contingencies but also to provide support in case of contingencies in the transmission network. In contrast, it has been obtained that the allocation of batteries in the transmission network provide only very limited support to distribution contingencies leading to loss of load. The deployment of batteries in the distribution network has shown also to have a better performance in comparison to the allocation of batteries in transmission, as they improve the network voltage profile and the affection to electricity losses is lower.

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