Supplementary Materials

A. Hyperparameter Settings

The hyperparameter settings of the proposed learning-to-optimize (L2O) framework for low-carbon distribution network reconfiguration (LDNR) are summarized in Table I. The overall architecture consists of a main optimization network, a soft-rounding module, and an iterative projection stage.

For the *main network*, the learning rate is set to 1×10^{-3}. The penalty-related parameter μ is set to 100. The network adopts a multi-layer architecture with $L = 5$ layers. The hidden layer sizes are set to $\{208, 1136, 4688\}$, corresponding to the 5-bus, 33-bus, and 136-bus test systems, respectively. The *soft-rounding module* is designed to handle discrete decision variables in the optimization problems. The temperature parameter τ is set to 1.0, and the scaling factor κ is set to 0.5. This module consists of two layers, with hidden layer sizes of $\{112, 296, 976\}$ for the 5-bus, 33-bus, and 136-bus systems, respectively. For the *iterative projection stage*, the feasibility project rate ε is set to 0.01. The maximum number of iterations is limited to 2000, and the convergence tolerance is set to 1×10^{-5}, ensuring accurate satisfaction of power system operational constraints. All networks were trained using the Adam optimizer for 100 epochs with a batch size of 32. To prevent overfitting, batch normalization was employed along with a dropout rate of 0.25. These hyperparameters are consistently applied across all experiments to ensure consistency.

TABLE I
HYPERPARAMETER SETTINGS OF THE PROPOSED METHOD.

Stages	Parameters	Values
Main network	Learning rate	1×10^{-3}
	μ	100
	Hidden layer size	{208, 1136, 4688}
	L	5
Soft-rounding	τ	1.0
	κ	0.5
	Hidden layer size	{112, 296, 976}
	Layer num	2
Iterative projection	ε	0.01
	Max iteration	2000
	Tolerance	1×10^{-5}
Shared	Optimizer	Adam
	Hidden unit nonlinearity	ReLU
	Epochs	100
	Batch size	32

All the numerical experiments are conducted in Python v3.10.13 using VScode on a desktop computer with 12th Gen Intel$^{\mathrm{R}}$ Core$^{\mathrm{TM}}$ i9-12900H clocking at 2.50 GHz, NVIDIA GeForce RTX$^{\mathrm{TM}}$ 2050 GPU, and 16.0 GB of RAM. Specifically, the proposed L2O framework is realized based on the PyTorch package. To obtain the oracle solution, we use SCIP coupled with Ipopt for comparison.