**Understanding the spatial dynamics of BEV adoption on transmission and distribution networks for carbon neutrality: Insights from simulations by high-resolution integrated assessment model, GCAM-EML**

**Highlights**

Removing setback regulations enhances PV potential.

Rooftop PV systems are key to improving deployment efficiency in urban areas.

Strategic approaches balance economic feasibility with renewable energy expansion.

Customized policies ensure effective PV deployment in limited land areas.