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Quantifying the trade-off between public acceptance and cost efficiency in decentralized energy systems

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Renewable energy technologies are most economical when planned at a large scale in a coordinated manner. But local resistance often hinders developments, especially for onshore wind. In these decentralized energy systems, the beauty of landscapes is particularly relevant for acceptance of wind turbines or transmission lines. Thus, by using the scenicness as a proxy for public acceptance, we quantify its impact on optimal energy systems of around 11,000 municipalities. In municipalities with high scenicness, it is likely that onshore wind will be rejected, leading to higher levelized costs of energy up to about 5 €-cent/kWh. Onshore wind would be replaced mainly by solar photovoltaics and the cost-optimal energy systems would be associated with higher CO_2 emissions of up to about 120%. The quantitative basis that we have created can be used to first identify municipalities where public resistance to onshore wind could be particularly high. Second, the results regarding the increase in costs and CO_2 emissions can be used to convince the citizens in these municipalities towards accepting onshore wind installations.