Optimization of future power systems focusing on reliability of supply

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The overall efficiency of future power systems is expected to improve with renewable and distributed energy sources, as the level of losses induced by the Carnot cycles are decreased. However these sources challenge reliability of supply and may induce extra-losses. In this work, we apply variational principles, deduced from thermodynamics, to take reliability into account and assess the overall amount of losses. It appears that centralized power systems are disadvantaged by the efficiency of the Carnot cycles, whereas distributed systems are penalized by the losses induced by reliability.