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### **The limits of blockchain applications' scalability**

In most cases, the concerns around the scalability of blockchain applications relate to public blockchain networks, such as Bitcoin or Ethereum. Anybody can join the public network, that's why they are more reliable but slower.

The private blockchain frameworks are closed, only approved users can participate in the network and make changes to the blockchain (add new data, etc.). These networks are less decentralized but faster and more scalable.

### **Blockchain applications in electricity markets**

In the energy sector, the specific fields of using blockchain can be found, where private blockchain strengths are needed for the markets' actors. For example, electricity trading (retail markets or microgrids), smart metering, billing, tracking certificates of energy origin.

### **The blockchain and energy attribute tracking**

One of the positive cases of using blockchain as a tool for energy market solutions is a blockchain application to the tracking certificates of energy origin. The certificates separate the environmental attributes of renewable energy from the underlying electricity. Consumers can regardless of a physical location support renewable energy sources by trading with the certificates. Every certificate has an identification number for which the blockchain system provides transparency and double-spending problem solution while reducing transaction costs using non-fungible tokens as unique certificates. Such a tracking system can ensure the issue, transferring, expiration, and cancellation of certificates and can monitor ownership assigning during the certificate's lifecycle. The blockchain ledger, distributed among multiple types of light nodes and full nodes, can be integrated with existing exchanges for records keeping and for authority control. Likewise, certificate market actors join a blockchain platform to observe that the system operates correctly with the respect to a grid specification.