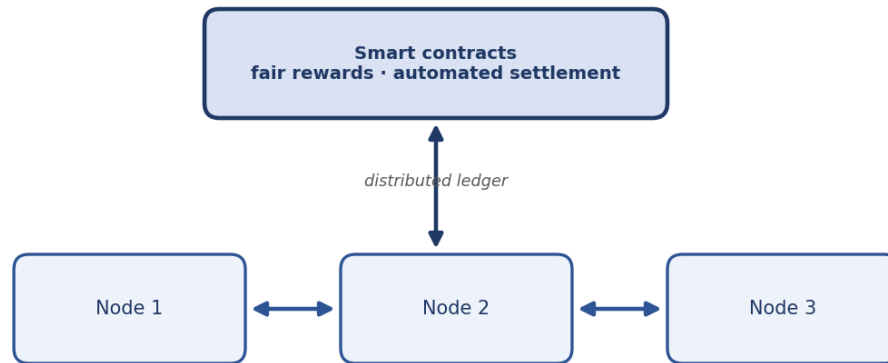


# Trust by design: blockchain and smart contracts in the energy system

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## Trust by design: a hybrid blockchain and cybersecurity approach



Raw data → conventional cybersecurity | metadata & transactions → energy-efficient (proof-of-stake) ledger

When many different participants share energy, data and rewards across a flexibility system, one question quickly becomes central: how can everyone trust that the records are accurate and fair? FlexCHES answers this with distributed-ledger technology — commonly known as blockchain — and smart contracts.

A distributed ledger is a shared record that is maintained across many points in a network rather than held by a single central authority. Once information is recorded, it cannot quietly be altered. For an energy system, this provides something valuable: traceability and transparency. Participants can have confidence that data about flexibility provided, energy exchanged and services delivered has not been tampered with, intentionally or by accident.

Smart contracts build on this foundation. These are pieces of code that automatically carry out agreed rules — for example, rewarding a participant when they provide flexibility, or settling a transaction when conditions are met. In FlexCHES, smart contracts are used to reward contributors fairly, to reduce the number of intermediaries in the system, and to make flexibility trading more dynamic and open. They can also help guard against undesirable behaviour in the market through well-designed incentives.

Energy use is a genuine concern with some blockchain technologies, so FlexCHES has made a deliberate choice. The project uses a technology based on a "proof-of-stake" approach, which consumes far less energy than older "proof-of-work" systems. It also adopts a hybrid design: conventional cybersecurity tools handle raw data, while the blockchain is reserved for metadata, transactions and key decisions. This keeps the system efficient while preserving the security and trust that the ledger provides.



Importantly, FlexCHES treats blockchain as a means, not an end. It is used only where it adds value — for trust, traceability and automated rewards — while conventional, energy-efficient methods handle everything else. This pragmatic, hybrid design keeps the system's own energy footprint low, an essential consideration for technology meant to support decarbonisation rather than add to the problem.

The aim throughout is fairness and confidence. By recording contributions transparently and rewarding them automatically, FlexCHES encourages participation, protects data, and reduces the need to rely on central authorities. For energy communities and prosumers, it offers a clear and trustworthy way to see that their contribution counts — and to be rewarded for it.

In a future energy system built on the participation of many small actors, that trust is not a luxury. It is the foundation everything else depends on.

### **References and further reading**

- [FlexCHES project — CORDIS, European Commission](#)
- [FlexCHES project website](#)
- [Directive \(EU\) 2019/944 on the internal market for electricity — EUR-Lex](#)



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