

# Blockchain and Distributed Ledgers: A revolution for the power market

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# Applications in the power sector

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# Wholesale energy and small-scale trading are currently the most disruptive blockchain applications for the power sector

## Blockchain applications in the power sector

### 1: Energy trading and process optimization

- Energy trading in the wholesale market
- Energy metering and billing processes
- Centralized customer information (energy supplier switching)

### 2: Grid management

- Centralized generation/transport/consumption information
- Grid management (preventive/curative O&M)
- Implicit/explicit demand response for residential consumers

### 3: Renewable financing

- Cross-border crowdfunding
- Crypto-GoO: SolarCoin

### 4: Small-scale P2P trading

- P2P power trading/collective self-consumption
- P2P EV charging

Note: O&M = operations and maintenance.  
Source: IHS Markit

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# Energy trading and process optimization: Eliminating intermediaries

## Trading in wholesale markets

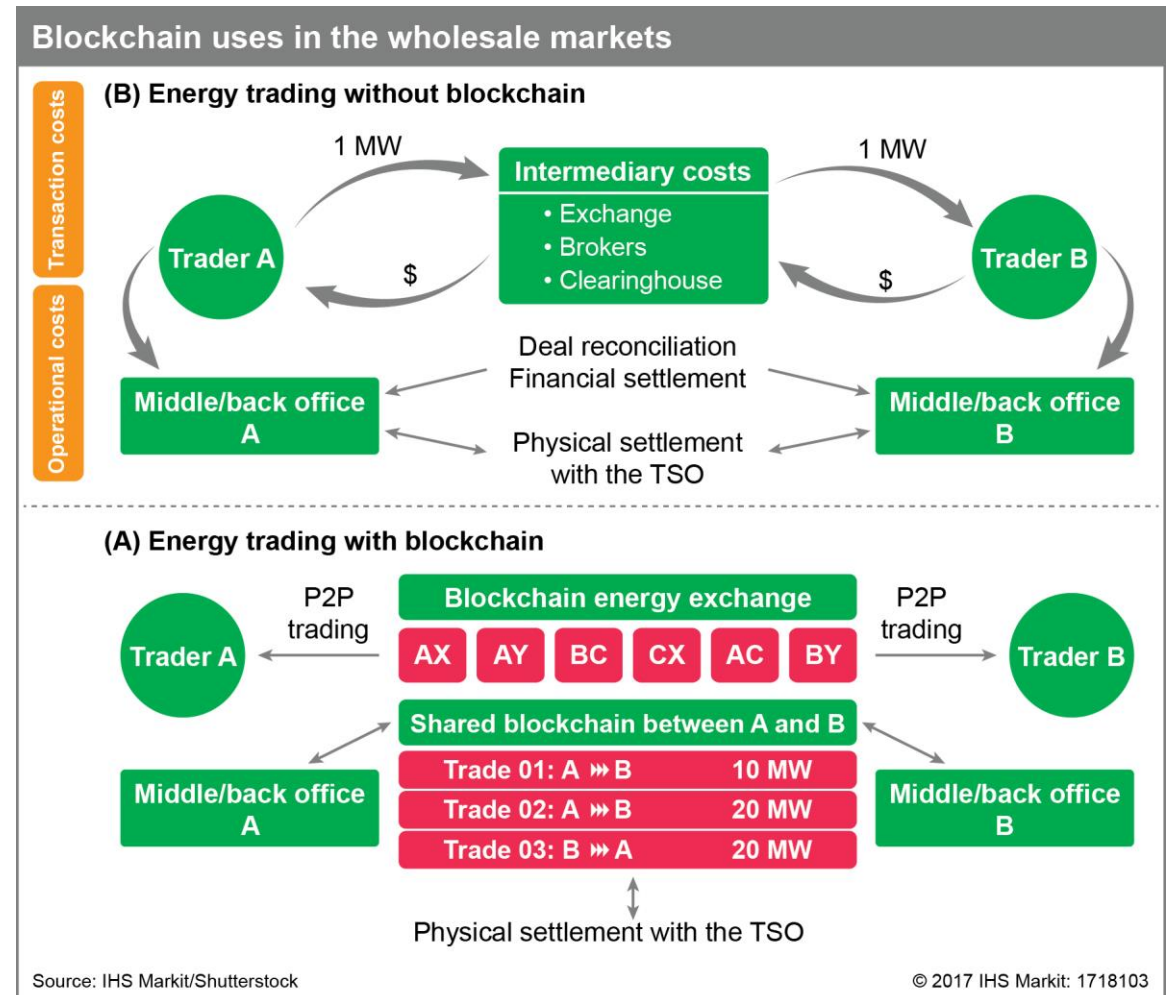
### Principles

Energy trading involves many intermediaries:

- During the deal
  - **Clearinghouses** mitigate the counterparty risk.
  - **Brokers and exchanges** give market access and provide liquidity.
- After the deal
  - **Back/middle office** books the deal and settles it physically and financially with the counterparty and the transmission system operator (TSO) (nominations).

### What does blockchain provide?

- Blockchain provides a more efficient marketplace for energy traders with lower transaction costs, by eliminating intermediaries.
- Blockchain reduces operational risks and fraud.
- Blockchain could automatically settle the deal physically and financially and proceed to nominations with the TSO.



# Grid management: Improving grid reliability and efficiency

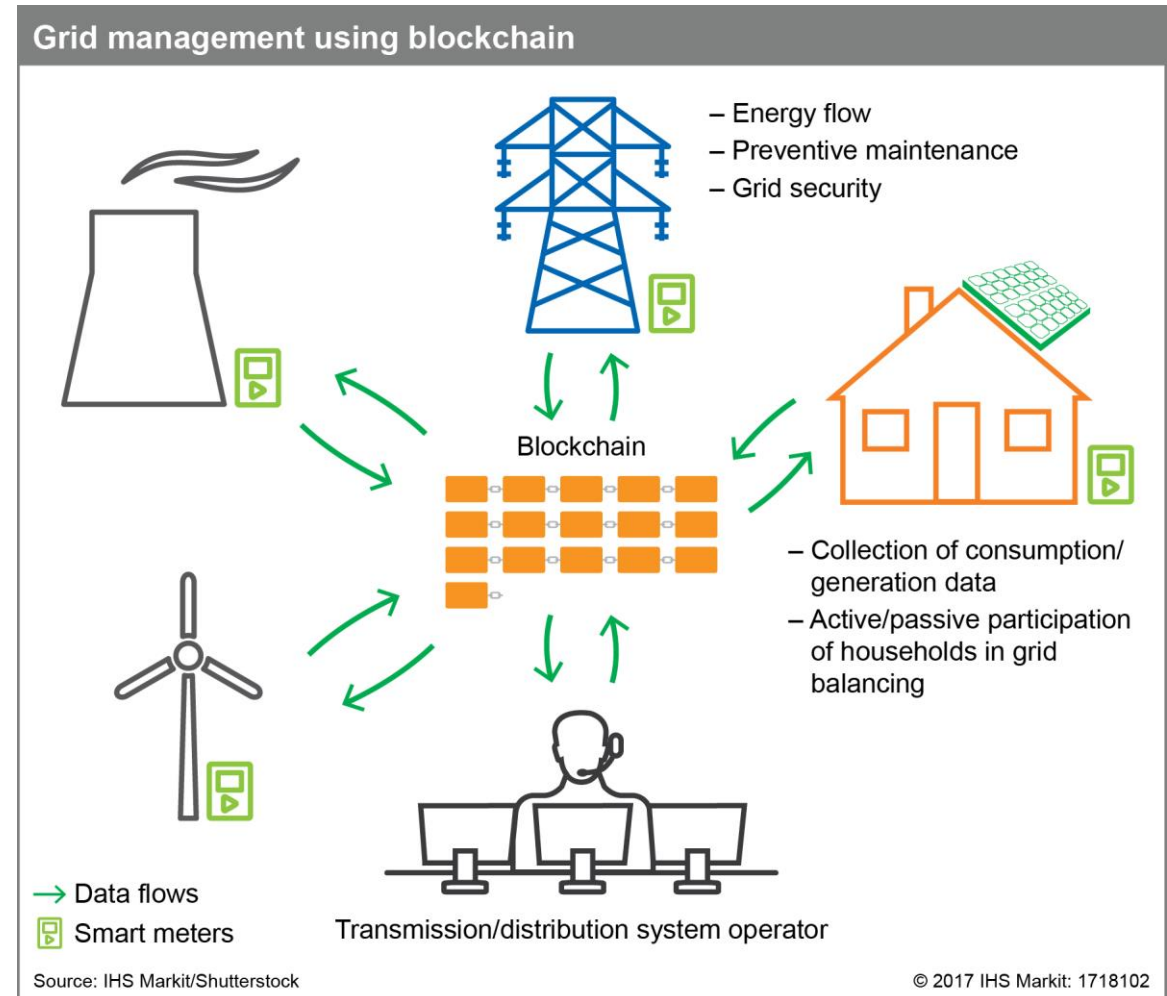
## Grid management

### Principles

- Blockchain coupled with monitoring devices (smart meters, IoT) facilitates the collection of data, using a transparent and secure protocol, that could enhance grid management (distributed solar generation metering, local grid balancing).
- As the grid management becomes more and more decentralized, blockchain and smart contracts could enable secure self-management of the grid (e.g., curtailment of wind power, redispatch, automated activation of reserve plants).
- Blockchain facilitates consumer participation in providing a flexibility solution to the grid (e.g., implicit demand response, battery aggregation).

### What does blockchain provide?

- Blockchain makes the grid more efficient by enabling automated grid management at the consumer level using IoT and smart contracts.
- Blockchain enables a more granular approach to grid balancing using a bottom-up approach.



# Renewable financing: Facilitating cross-border investments

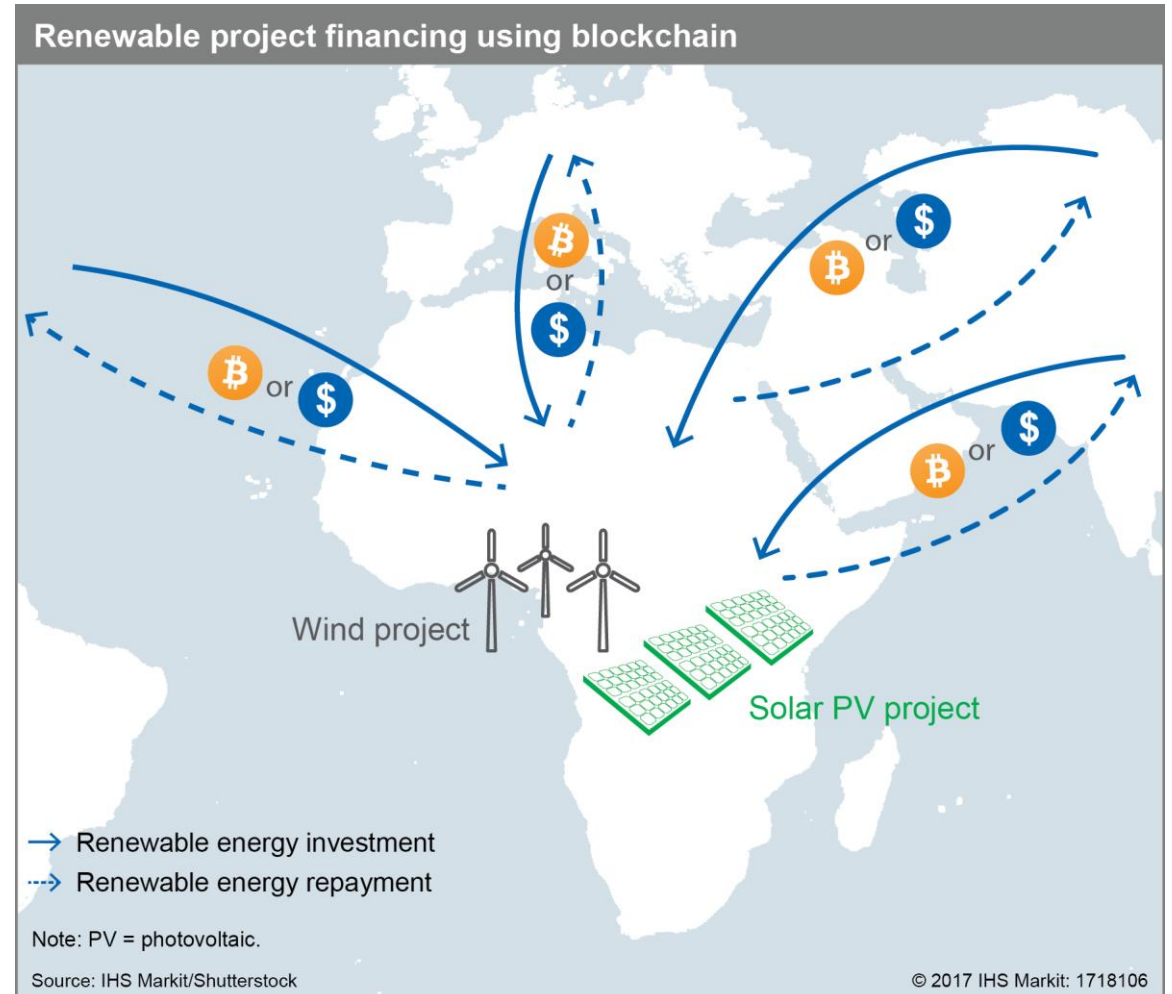
## Distributed energy funding

### Principles

- Blockchain provides a fast, secure, and universal solution to financially support renewable energy developments. It opens renewables ownership to every type of investor around the globe.
- Two applications:
  - **P2P lending.** Individuals invest in “green” virtual/nonvirtual bonds to fund renewables projects.
  - **Support mechanisms.** Blockchain and smart contracts enable the creation of support mechanisms to reward renewable energy projects (e.g., 1 MWh = 1 SolarCoin).

### What does blockchain provide?

- Blockchain provides a transparent and secure platform for individual investors that facilitates access to cross-border transactions at a low cost.
- Blockchain can add an additional layer of virtual revenues for renewables projects (SolarCoin, carbon credit).



# Small-scale P2P trading: Increasing EV charging station network

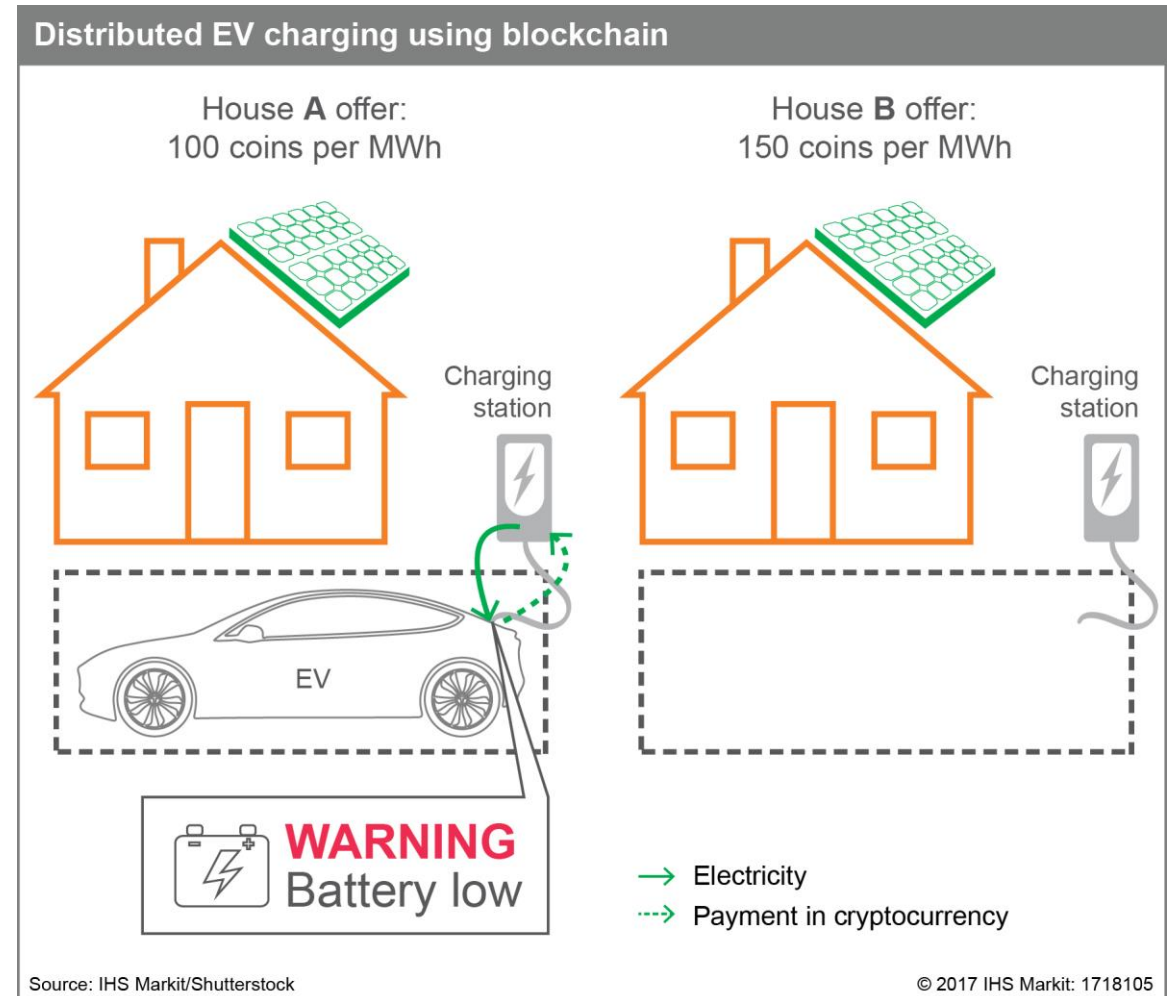
## EV charging station using blockchain

### Principles

- Blockchain provides a marketplace to manage and expand access to charging stations involving third parties (households with a charging station, supermarkets, and existing charging stations).
- Three applications:
  - Establishing an EV charging interface to handle metering, billing, and payment process
  - Opening EV charging market to third parties
  - Harmonizing charging services to increase the compatibility of charging processes across countries/companies and providers

### What does blockchain provide?

- Smart contracts:
  - Offer a fully automated authentication, charging, billing, and payment solution
  - Give the opportunity to third parties to provide dynamic pricing for charging services



# Small-scale P2P trading: Collective self-consumption

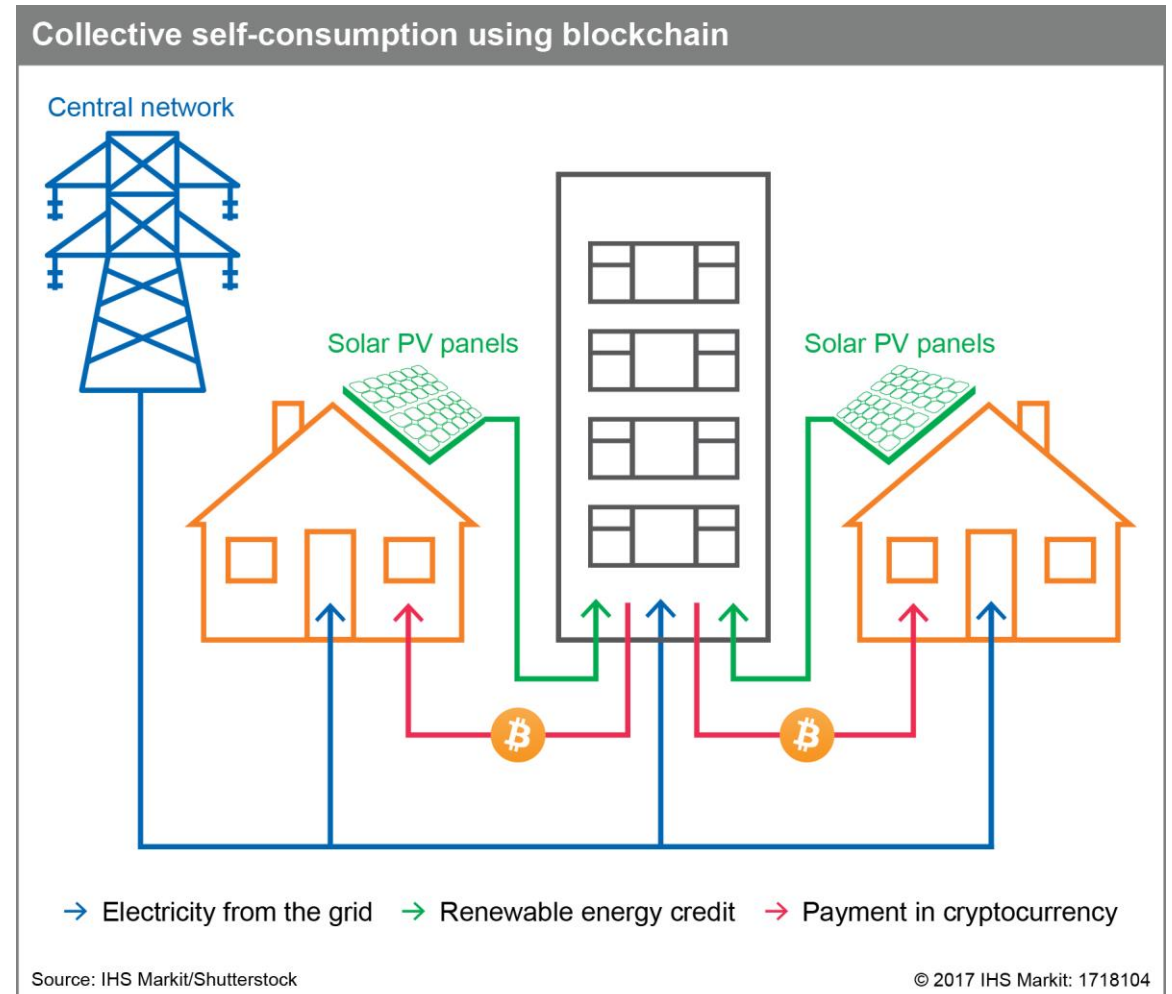
## Collective self-consumption

### Principles

- Blockchain provides a marketplace to connect consumers to producers that are willing to buy local energy.
- Two approaches to collective self-consumption:
  - **Virtual collective consumption.** Producers and consumers trade only the “origin” (renewable energy certificates, green certificates, GoO) of the electricity.
  - **Real collective consumption.** Producers and consumers trade both the “origin” and the actual energy, combining the use of blockchain, smart grid, and the IoT.

### What does blockchain provide?

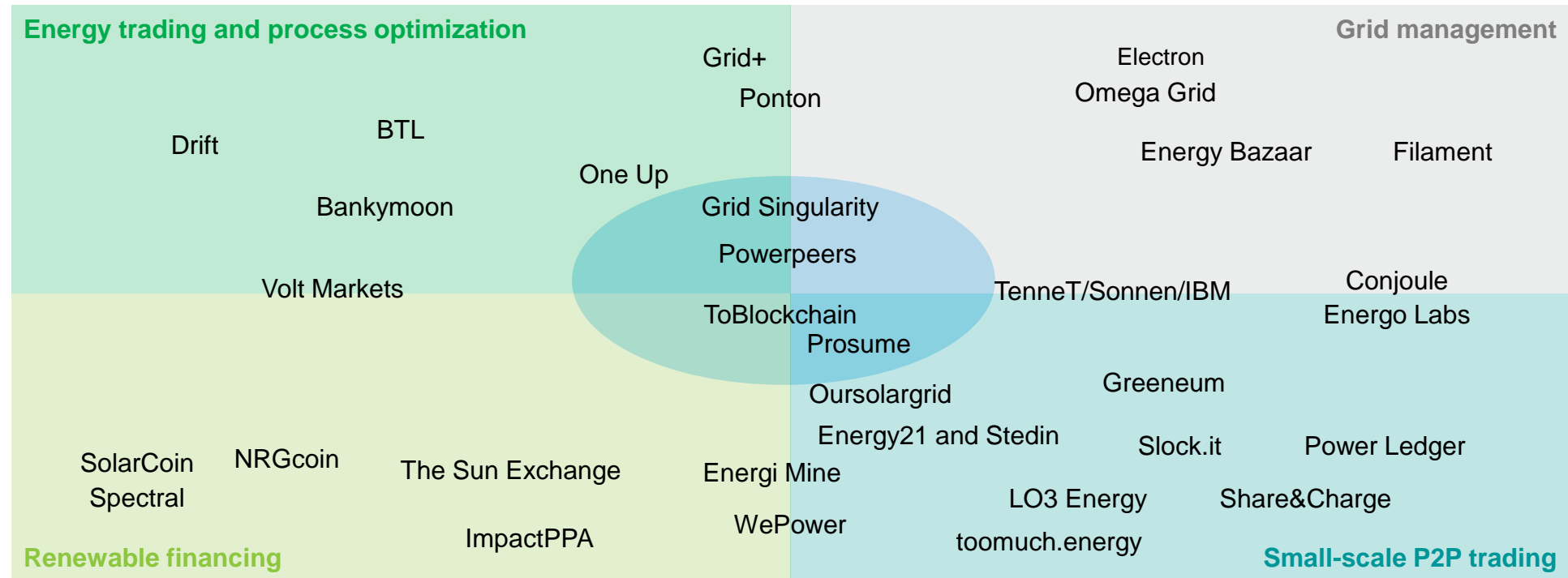
- All metering data and energy flow transactions are saved in a secure and immutable distributed ledger.
- Smart contracts define
  - The terms and conditions at which producers and consumers want to trade automatically
  - An automated supply strategy (budget, energy needs) for each consumer





# Mapping blockchain initiatives

## Selected blockchain start-ups per application



Source: IHS Markit

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More than 60% of the blockchain initiatives are located in Europe, focusing primarily on small-scale P2P trading, energy trading on the wholesale market, and process optimization.