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**ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΕΙΑ ΕΝΕΡΓΕΙΑΣ**

**Fostering sustainable energy development in smart cities through blockchains applications**

# Framework

✓ Within the 2030 climate and energy framework the EU Commission has set very ambitious commitments till 2030 regarding

    ✓ the reduction of greenhouse gas emissions,
    ✓ the penetration of RES in the electricity generation and
    ✓ the improvement of energy efficiency

✓ One of the major challenges that EU faces within the scope of sustainable energy development is the increasing energy demand patterns of cities.

✓ Cities can influence over 70% of the total ecological footprint.

# Initiatives and policies related to energy, cities and technology innovation

- ✓ Covenant of Mayors (CoM) initiative

  - ✓ mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories.

- ✓ Energy-efficient Buildings Public Private Partnership

  - ✓ This initiative aims to address the challenges of the European construction sector. Attention is given to the development and integration of design and simulation tools, new materials, building systems and equipment and ICT for energy efficiency.

- ✓ The Strategic Energy Technology (SET)-Plan

  - ✓ A process of designing an integrated roadmap that identifies research and innovation challenges and needs of the EU energy system,
  - ✓ Evolved to a whole systems approach to ensure better integration across sectors and technologies.

# Initiatives and policies related to energy, cities and technology innovation

- ✓ European Innovation Partnership on Smart Cities and Communities

  - ✓ The SCC partnership bridges the areas of energy and ICT with the objective to catalyse progress in the areas of energy production, distribution and use.

- ✓ European Energy Research Alliance Joint Programme on Smart Cities

  - ✓ Its main objective is the development of scientific tools and methods that will enable an intelligent design, planning and operation of the energy system of an entire city in the near future.

- ✓ Smart Cities Stakeholder Platform

  - ✓ It aims to accelerate the development and market deployment of energy efficiency and low-carbon technology applications in the urban environment.

# Blockchain in energy

The core concept behind blockchain technology is to provide a decentralized and distributed database with encrypted documentation to share information in a secure manner.

Possible uses of blockchain technologies for better implementation of smart city principles in the power sector :

**Peer to peer energy trading** allows consumers to buy the surplus of the energy of other users in order to meet their energy needs.
- ✓ decentralize the market
- ✓ reduce transaction costs
- ✓ allow smaller producers to sell their RES surplus
- ✓ decrease energy prices
- ✓ Increase the competition of the market

**Smart contracts** allow producers to avoid third parties and distribute their products easier, faster and with increased security through blockchains.

# Blockchain in energy

**Grid management and system operation** contribute to ensure that power and storage energy will be used to balance supply and demand in the electricity market.

✓ Through smart contracts, renewable energy surplus could be stored and used when energy is inadequate.

✓ Blockchains could benefit distributors and transmission operators, in tracking energy transactions.

The use of the blockchains at the energy network

✓ provides power reliability
✓ helps to the renewable energy integration
✓ contributes to the optimisation of energy efficiency
✓ encourages consumers to manage their energy usage wisely and save money

# Blockchain in energy

**Financing renewable energy development**

Blockchain technology offers an attractive platform for bringing together energy demand and finance supply through its :
- ✓ potentially low transaction costs
- ✓ efficient processing and
- ✓ security features provided by smart contracts, and its payment capabilities.

**Renewable Energy Certificates (RECs)**

Blockchains would be applied as a mean of immediate certification of the producer who uses RES for the electricity generation, the moment the electricity is generated.

Smart contracts can record in **real time** the event and make it available to the consumers who are willing to buy at the moment. By this, public agencies which are responsible for the RECs could reduce costs by streaming data verification and automating REC awarding.

**Electricity mobility**

Blockchain could be used in order to allow **consumers to charge their car and pay** as well **without** any **intermediate.**

The entire charging and payment process happens without further action from the driver through the use of decentralized ID and payments via the blockchain, without the involvement of third parties.

# Blockchain in energy

| Peer to peer energy trade | | |
|---|---|---|
| **Name** | Country | Description |
| **Power Ledger** | **Australia** | **Residential P2P electricity trading marketplace between prosumers and local consumers.** |
| **Powerpeers** | Netherlands | Platform for energy trading through a P2P network. Initiative of Vattenfall. |
| **Vector** | New Zealand | P2P local energy market. Initiative of Power Ledger |
| **Eneres** | Japan | Trading of energy surplus of energy prosumers between households through blockchain. |
| **Bouygues Immobilier** | France | Blockchain approach to exchange energy between solar producers and energy consumers. |
| **Conjoule** | Germany | P2P energy trading in local communities |
| **Divvi** | Australia | Distributed marketplace for renewable energy |
| **Energo Labs** | China | Start-up for P2P energy sharing. Involves prosumers, consumers, energy storage and smart grid devices. |
| **Energy Bazaar** | India | Local energy markets in emerging countries. |
| **BLOC** | Denmark | Local and community energy markets in Denmark and Samso. |
| **Greeneum** | Israel | Decentralised energy market with applications in Israel and Cyprus. |
| **Oursolagrid** | Germany | Community energy systems and P2P energy trading |
| **Power-ID** | Switzerland | Pilot energy trading project. |
| **StromDAO** | German | Blockchain for energy market structures. |
| **PowerToShare** | Netherlands | P2P digital platform for energy exchange |
| **Jouliette at De Ceuvel** | Netherlands | P2P Energy sharing platform. |
| **Brooklyn Microgrid** | **US** | **Blockchain-based energy trading platform. Initiative of LO3 Energy.** |
| **Lazarettgarten microgrid** | **Germany** | **Local energy market with focus on market mechanism design and required regulatory changes. Initiative of LO3 Energy.** |
| **Allgau microgrid** | **Germany** | **Project to explore interest of consumers in energy markets and integration of microgrids and marketplaces in the existing systems. Initiative of LO3 Energy.** |

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# Blockchain in energy

| Grid management and system operation | | |
|---|---|---|
| **Gridchain** | Germany | Simulation of future processes for real time grid management. |
| **Grid Singularity** | Austria | Smart grid management solutions. |
| **TenneT** | **Netherlands** | **Blockchain connected residential batteries for provision of grid services** |
| **Sonnen** | Germany | Flexibility at periods of grid constraint through battery technologies. |
| **TenneT - Vandenbron** | Germany | Vehicle-to-grid for balancing and ancillary services. |
| **EvolvePower** | US | Enables energy utility companies and grid operators to access and control data at the grid edge and control demand response services. |
| **Filament** | US | Efficient management of transmission and distribution networks for grid operators. |
| **Power Ledger** | Australia | Solutions for microgrid operations |
| **Electron** | UK | Collaborative trading platform for all demand response assets. |
| **OurPower** | UK | Local balancing of rural decentralised energy networks with high RES penetration. |
| **PROSUME** | Switzerland | Energy storage devices and transmission exchanges to improve load balancing |

# Blockchain in energy

| Financing renewable energy development | | |
|---|---|---|
| **Sun Exchange** | **South Africa** | **Sharing economy blockchain platform aiming to crowd sale PV projects to potential investors.** |
| **WePower** | **Estonia** | **Brings together RES generators and investors. Renewable energy produced is tokenised and traded to purchase electricity or exchanged for fiat currencies or cryptocurrencies.** |
| **ImpactPPA** | US | Decentralised platform for RES projects funding. |
| **EverGreenCoin** | US | Cryptocurrency designed for sustainable and renewable investments. |
| **Solar DAO** | Israel | Brings together stakeholders for the construction of solar panels. Enables trading and purchase of tokens. |
| **PROSUME** | Switzerland | Cryptocurrencies for green energy asset sharing |
| **Green Energy Wallet** | Germany | Blockchain used to facilitate leasing of residential storage devices. |
| **Farad** | UAE | Cryptocurrency based on the economic activity of manufacturing energy storage ultracapacitors. |
| **MyBit** | Switzerland | Incentivise investment in IoT services, crowd-funding of assets and distribution of revenue. |
| **Sun-e** | US | Cryptocurrency that aims to financially support local and renewable energy investments. |
| **Dooak** | Brazil | Marketplace to bring together sustainable energy projects and prospective investors. |
| **SolarCoin** | US | Rewards solar energy production. |

# Blockchain in energy

| Management of renewable energy certificates | | |
|---|---|---|
| **Nasdaq** | US | Green certificates trading. |
| **Veridium** | US | Carbon trading credits and natural capital assets. |
| **Poseidon** | Switzerland | Smart contracts to trade and track carbon credits. |
| **DAO IPCI** | Russia | Blockchain and smart contracts for carbon and environmental assets services. |
| **MITO** | Russia | Exchange currency to execute smart contracts on environmental assets trading |
| **CarbonX** | **Canada** | **P2P carbon trading between consumers** |
| **Energy Blockchain Lab** | China | Decentralised platform for trading carbon credits and other environmental attributes. |
| **Grid Singularity** | Austria | Trading of green certificates |

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# Blockchain in energy

| Electric mobility | | |
|---|---|---|
| **Share&Charge** | **Germany** | **P2P transactions between EV drivers and private EV charging infrastructure owners.** |
| **Oxygen Initiative** | US | Real time payment settlement in EV charging stations. |
| **eMotorwerks** | US | Control over charging patterns, cost and power generation mix used for charging. |
| **Alliander** | Netherlands | Dynamic customer contracts for EV charging arrangements. |
| **Car eWallet** | Germany | Car charging from different energy suppliers and charging stations. |
| **PROSUME** | **Switzerland** | **Decentralised platform for EV management and data collection.** |
| **Energo Labs** | **China** | **EV charging stations for coordination of EV charging and automated payments.** |
| **Eventy** | Australia | EV charging for private, semi-public or public EV charging infrastructure. |