

Layered Energy System

LAYERED ENERGY SYSTEM
APPLIED IN HOOG DALEM:

LEF

LEF, based in Hoog Dalem (The Netherlands), is all about making the power grid smarter. In this pilot project, an energy community - formed by a group of homeowners - generates its own electricity. The purpose is self-consumption or to mutually exchange this electricity within the community and settle the price immediately. LEF not only stands for Local, Energy and Flexibility, but is also the Dutch word for courage: the act of taking a bold decision to participate in this project and to contribute to innovations in the energy market.

When self-production falls short, energy can be bought from the grid through the use of flexibility or ancillary (grid) services.

Founding partners of LEF:

- Stedin
- iLeco
- ABB
- Jules Energy



A perfect match with blockchain technology

Large scale infeed of distributed renewable energy production in a top-down designed market model causes a growing risk of imbalance on both the demand side and the supply side. Renewable (local) infeed is unpredictable, volatile and can cause grid congestion. In many European countries the energy system already squeaks and it becomes clear that adding more renewables increases the risks for security of supply.

So, the pivotal question here is: how can more renewable energy sources be included in a sustainable way? The answer is a decentralized, layered, energy-sharing economy. The Layered Energy System (hereafter LES) that is jointly designed and developed by Energy21 and Quantoz captures this.

LES explained

LES is a conceptual energy market model that is designed to stimulate all stakeholders in the energy market, operating on different levels or 'layers', to interact with each other. By organizing both demand and supply bottom-up as well as top-down, energy flexibility can be optimally shared with a financial stimulans.

The LES-framework facilitates local energy communities by offering a set of tools to interact with the (existing) energy market layers. The idea is that a local community produces their own electricity for self-consumption or is mutually exchanged, settling the energy price immediately. While stimulating smart usage of the self-generated energy, there is also the option to buy or sell the energy on the wholesale market when this is financially more beneficial.

Local energy markets can only participate if they comply to the market processes. LES therefore applies the same market phases as the wholesale markets do: planning, operations and settlement. By using artificial intelligence and smart forecasting techniques, processes can be automated to support the residential consumer. A regular consumer will not be interested in real-time forecasting for example (*planning*).

In addition, a local smart buffering system prevents mismatches between demand and supply (*operations*). When energy demand is high at a time when supply is low, the residential consumer can either use his own stored energy or monetize the surplus of energy by exchanging it within the community or with the wholesale market.

“Technology is not the problem, it is the market model that is not sustainable.”



A possible surplus of the local energy community can be traded on the energy market. When self-production falls short, energy can be bought from the grid through the use of flexibility or ancillary (grid) services. Flexibility has a financial value and works as an incentive for all layers.

LES is originated with the idea that the technology is already there to facilitate a sustainable energy ecosystem. Technology is not the issue in the energy transition – it is all about providing the right incentives for technology to make it happen, also on a local level.

Based on this philosophy, Energy21 and Quantoz explored the idea of a local energy market. E.ON Agile already looked into the concept in 2017.

With Stedin (one of the three largest grid operators in The Netherlands) Energy21 and Quantoz further explored the concept of local energy markets and LES – in this case specifically with incentives to prevent local grid congestion. This joint effort has led to a proof of concept in Hoog Dalem, a local energy community in The Netherlands.

Other pilot projects are set up to expand the concept from a local energy market to a local grid capacity market. The first results suggest LES is a very effective way to involve local communities in countering local grid as well as national energy system issues. A very important aspect in LES is that it is not aiming for autarkic communities, but for local markets that still have an open link to the current energy markets.

Blockchain in LES

LES stimulates all stakeholders like grid operators, suppliers, end users and technology/IT providers to participate in a local energy

Lessons learned so far include that by setting the right incentives and putting the right market processes in place, distributed renewable production and smart flexibility like batteries can provide a sharable value for the community. At the same time it can provide grid operators a tool to mitigate for example local grid congestion. While the processes are further crystalized, another important lesson learned is that blockchain technology proved to be a reliable and low-cost enabler for these local energy markets.



BLOCKCHAIN TECHNOLOGY

Quantoz, founded in 2015 and based in Utrecht, the Netherlands, focuses on the development of blockchain technology-based applications. Besides the development of the LES model together with Energy21, Quantoz has built POCs and live applications with industry leaders like BASF, Porsche and UniCredit. Quantoz currently has 14 employees.

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ENERGY EXPERTISE & DATA MANAGEMENT SOLUTIONS

Energy21 provides consultancy and IT solutions to the largest stakeholders in the energy sector for more than 23 years. Bridging the gap between operational data processes and the energy value chain, Energy21 knows what it takes to keep an energy system running.

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