Fighting Energy Poverty Through Innovation

The Challenges

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The energy sector is currently undergoing a fundamental transition. Triggered by the idea of climate change mitigation and political discussions about a nuclear phase-out, the sector has experienced a pronounced shift towards CO2-neutral power generation and energy efficiency. The European Green Deal[1] published in December 2019, clearly mentions that the EU's energy supply needs to be secure and affordable for consumers and businesses and in order this to happen, it is essential to ensure that the European energy market is fully integrated, interconnected and digitalised, while respecting technological neutrality. In the same context the proposal for a regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law)[2] considers as important drivers for achieving the climate-neutrality objective the digital transformation and the technological innovation.Hence, global power grids are undergoing transformations for the application of smart technologies as a result of policies that encourage the use of renewable and distributed resources and increase the participation of electricity consumers to energy management and production. Thus, climate change constraints as well as the recent coronavirus 2020 crisis are putting the global energy sector under the pressure of evolving and modernising at a rapid pace and on an uncommonly large scale.

Energy poverty is a condition whereby people cannot secure adequate home energy services[3]. It is correlated with low household income, high energy costs, and energy inefficient buildings. The recent publication by the European Commission about Renovation Wave[4] identified it as one of the three top priorities, and housing renovation the key solution to tackling it. Energy poverty is affected by multiple factors like adequate warmth, cooling, lighting, and energy to power appliances. All of them are essential services that underpin a decent standard of living and health. The evidence-based, various effects of the aforementioned interaction are felt on social, environmental and financial levels. According to the International Energy Agency (IEA)[5], more than 1.1 billion people do not have access to electricity and consequently lack access to services and provisions that the rest of the population take for granted. The fact that approximately 20% of the global population is deprived of access to electricity reflects the prevalence of energy poverty on a global scale as well as the magnitude of the problems stemming from this predicament.

It is evident that in regions which experience a drastic and rapid transformation of established economic structures, for example those that are phasing out of coal as part of their energy transition, it becomes a challenge one cannot always address with conventional support schemes.

Regions that phase out coal face unique and complex challenges. They must go through a groundbreaking transformation that will change dramatically their economic and production models. In many cases this transformation is planned to be over in very tight timelines. Moreover, the EC has committed to tackle climate and environmental-related challenges through the European Green Deal by deploying growth strategies that aim to transform societies in a fair manner. This approach is expected to infuse the notion of resource efficiency into the existing economic models and make the EU a resource-efficient and competitive economy where there are no net emissions of greenhouse gases and where economic growth is decoupled from resource use.

Digitising the energy sector is a major step forward to that direction. In order to direct the EU's economy to operational models that display sustainability and low carbon dependency, successful solutions should involve diverse, cutting edge technologies that go far beyond the energy sector. Phasing out regions should be the driving force in implementing and cementing the policies that will deliver the Green Deal from regulation and standardisation to investment and innovation, national reforms, dialogue with social partners and international cooperation.

In order to comply with the public demands and requirements for change and modernisation, the energy sector will have to digitise, decentralise and decarbonise. Digitalisation of the energy sector can improve safety, increase productivity and reduce costs. Digitalisation is essential to integrate distributed energy resources (DERs), to unlock load flexibility, to increase variability in the system, to enable people to participate in the management of their energy supply, or help them become active participants in the energy system with their own projects, their own resources, and thus fighting energy poverty and achieving energy democracy. Energy democracy is an emerging social energy trend. The democratisation of energy goes further than the technology and ownership of power generation. It encompasses access to new communications technology and the exponential growth of emerging technologies and reduction in cost of several complementary technologies like photovoltaic systems, battery energy storage systems and other DERs. The goals of establishing energy democracy and reducing energy poverty, can be achieved through the utilisation of emerging technologies, such as the Internet of Things, blockchain, artificial intelligence, machine learning, big data, etc. These disrupting technologies will open the door to transition from energy monopoly to energy democracy. Such an “Energy Internet” will require automated communication between stakeholders and devices. For this to happen we need harmonised and interoperable standards, for example where network codes are concerned. Furthermore, we will need trusted data origins, in order to have a resilient and trustworthy foundation for the automatised communication. All these needs can be met by Distributed Ledger Technologies (DLT).

DLT technology is a digital way of recording transactions and storing a copy of the ledger in multiple sources at the same time without any central data or administration functionality. It can be applied in different sectors bringing great benefits to operations and lives, providing quicker reactions, greater transparency and enhanced security, improved traceability, increased efficiency and speed, or reduced costs, among other benefits. With the energy system fast transforming into one of the most decentralised industries on the planet, DLT could be seen as the missing link for other technologies, operations and practices in the energy sector (and not only) to be more efficient. It is a functional tool in digital transformation, helping other systems to scale up and down. DLT can ensure interoperability of such fragmented and diverse markets as the ones in Europe, making it easier to respond to long-term challenges such as energy poverty, or the sudden ones, such as COVID-19.

With the propagation of non-dispatchable renewable energy systems and the increased significance of post-industrial service provision companies, the old ecosystem with its centrally handled information flow no longer exists, and DLTs are a most suitable tool born out of this transition and fostering it at the same time. Moreover, real-time control and supervision play an important role in the smart energy grid's management. Due to the rapid growth in the deployment of distributed energy resources, the smart grid management problems can no longer be efficiently addressed using centralised approaches. Hence, the need for visionary decentralised approaches and architectures is widely recognised. DLT technology could facilitate a fully decentralised energy system.

Being aware of one's energy consumption behavior has become an important tool to optimise it and "*make more with less*", which lies in the core of improving energy efficiency and reducing the respective costs. The latter becomes crucial when it comes to those who are exposed to the effects of energy poverty, who unfortunately are estimated to be more than 34 million households across Europe, according to the newly published Renovation Wave.

Although there has been a global hype about DLTs in the past few years, this technology is still in its infancy. It has been deeply tested in terms of what it can do for the finance sector, privacy and data management, social impact in terms of charitable efforts, and even for the energy sector. Although some use cases utilise DLT to tackle energy poverty in the world (e.g. micro-grids in rural India), there has been very little research done on the topic of utilising DLT in vulnerable regions in the context of the energy transition topic as a whole. The lack of information and demonstrations in a form of real world use cases is only one of the challenges that the deployment of DLT is facing when trying to use the technology to mitigate major global problems.

Major challenges for the deployment of DLT:

1. REGULATORY AND LEGAL

The key for the successful adaption to the new technological conditions is the ability of governments to adopt the right policies. As emerging technologies, such as DLT or blockchain, drive new business and service models, governments must rapidly create, modify, and enforce regulations, standards and even certification programs in order not only to regulate these new technologies and create a legal framework for them, but also to protect the people and ensure fair markets while letting innovation and businesses flourish, which is hardly the case at the moment. More research on the existing regulatory frameworks is still needed, as well as access to real-life regulatory sandboxes. Regulations should target the unclear legal situation concerning the use of external data, data protection, confidentiality and legal concerns of providers, manufacturers and other stakeholders.

2. LEGACY SYSTEMS AND INFRASTRUCTURE
It is a challenge to integrate DLT solutions with existing market roles, their functions and responsibilities in liberalised energy markets. As many grids and networks are still awaiting rollout of smart devices, outdated energy sector infrastructure can heavily impede DLT implementation. The economics of DLT are also at times add odds with established business models and cannot produce real return on investment for all the stakeholders (resulting in e.g. stranded assets) when operating within the legacy systems.

3. EDUCATION AND INFORMATION FLOW, KNOWLEDGE SHARING AND EXPERTISE BUILDING
The lack of expertise and practical knowledge of the technology's mechanisms, dynamics as well as nuances (e.g. private/permissioned vs. public/permissionless) is a key impediment in many sectors, including energy. A great care needs to be taken to also break mental barriers about the technology, prevent disinformation about it, its capabilities or lack thereof, to increase trust in the technology and differentiate it from the stereotypical notion that "DLT means bitcoin".

4. FINANCIAL
There is no flexible and agile funding for the technology to aggregate partners and showcase demonstrations, since Europe is very much behind the amount of funding that goes into these innovative technologies e.g. in the USA or China.

5. INTEROPERABILITY
DLT technology suffers due to missing layers of interoperability between systems as well as conflicting standards, resulting in technological silos.

6. DATA AND PRIVACY
GDPR compliance is one of the key data and privacy related challenges that needs to be worked on.

7. SCALABILITY
Achieving performance and scalability of the DLT technology is considered another challenge.

8. ACCESS
Access to data, decentralised resources and facilities has been identified as one of the challenges to DLT implementation, especially in situations where established stakeholders hold a monopoly.

In order to utilise innovative technologies, such as DLT, to fight energy poverty, it is necessary that the technology triggers energy savings and reduces costs, triggers renewable energy production, reduces greenhouse gas emissions, increases investments in sustainable energy, and facilitates behavioural change. DLT technology has the potential to deliver more efficient, transparent and near real time transaction platforms that will unlock new business models. In the energy industry, this promise is particularly compelling when applied at the grid edge, as greater market participation and transparency are sought.

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Sources

1. *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions the European Green Deal (2019). Available at https://bit.ly/393rLCU* ↑

2. *Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law) (2020). Available at https://bit.ly/en-pov-dlt2* ↑

3. *Commission Recommendation of 14.10.2020 on energy poverty {SWD(2020) 960 final. Available at: https://ec.europa.eu/energy/sites/ener/files/recommendation_on_energy_poverty_c2020_9600.pdf* ↑

4. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662* ↑

5. *World Economic Forum (2018): Article "1.1 billion people still lack electricity. This could be the solution". Available at https://bit.ly/en-pov-dlt3* ↑