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BLOCKCHAIN AND AGGREGATING MICROGRID PROJECTS IN DEVELOPING NATIONS

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The world's emerging economies are growing at a rapid rate and economic development is lifting millions out of poverty. However, more than one billion people still lack access to electricity, mostly in rural, hard to reach regions.[1] Most of these communities use diesel generators, the only reliable source to keep the lights on at night.[2] But diesel is expensive, dirty, and very inefficient. Recent technological developments have allowed for an alternative solution of solar powered microgrids, small independent electricity networks, to become more affordable for implementation in these markets. Although these projects are gaining attention, there still is room for increased efficiency and feasibility. Exciting new tools such as blockchain provide an opportunity to help energy projects get the sufficient support and attention to aggregate the implementation of sustainable electrification.

Blockchain is a transparent, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way.[3] With this technology, opportunities for development abound; financing models could become more flexible, renewable energy projects could become more attractive to a wider group of investors, and smaller scale market models could become more viable. The energy industry needs to adopt innovative ideas and bring in a new generation of entrepreneurs to meet the challenges of sustainable economic development head on. Blockchain can provide the opportunities for all this and more.

Blockchain allows for microgrids to perform more efficiently. Microgrids are self-contained grid systems that can produce electricity while connected to either the central system or independent from it. The microgrids enjoy great flexibility and their ability to run independently from the central grid makes them a desirable facet for last-mile communities where central grid expansion may not make economic sense. Both attributes can help developing areas address the widespread issue of inability to access a reliable and resilient source of energy.

However, the smaller scale of these projects brings their own issues. For one, they rarely work as a for-profit model, relying instead on government subsidies or multilateral funding. The projects, and to an extent the community, are thus tied to the will of a third actor. Furthermore, to take full advantage of the flexi-

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bility aspect of the microgrid, there need to be trained personnel on site to manually adjust the capacity of the grid, which increases costs and opportunities for meter tampering.[4] There are many examples of how a lack of continued oversight after a project is completed severely limits the reliability and longevity of the project.[5] A blockchain platform, in conjunction with microgrid systems connected over the Internet and sharing data (Internet of Things, or IOT), can make use of automated transactions tracked by blockchain, called smart contracts, and turn a microgrid into a smart system, without in-person oversight.[6] Smart contracts can modify the grids production level in conjunction with the central grid to increase resilience.[7] IOT allows live tracking of consumption and production levels, which offers direct control to users.[8] Blockchain thus could allow microgrid adoption in emerging markets to be aggregated, through increased near-instant control, tracking, and transparency, of both project production levels and revenue streams.

Finally, the entire funding structure of such microgrid projects could be fundamentally altered to permit a more diverse pool of investors to increase project durability. Traditionally, funding such projects often requires large amounts of capital upfront and offers a slow rate of return.[9] When investing in emerging markets, transaction costs and intermediary services occupy a large portion of the project costs, leading to lower rates of return and prohibitive costs. Blockchain tracks these transactions and verifies ownership nearly instantly and securely. Additionally, the technology promotes financing ventures that are crowdfunded and widely distributed, easing the burden of high up-front costs. Projects deemed to be higher risk, such as solar farms, could be funded from foreign investors into emerging markets, and ownership could be traced to such minute levels that distributed ownership of individual solar panels would become possible. There are examples of companies implementing this technology, like the Israel-based Solar DAO, which uses blockchain platforms to crowdfund solar farm construction in Kazakhstan.[10] From its distribution of cost and reduced intermediaries bringing down prices, to the secure nature of the technology preventing misallocation of funds, blockchain provides a cost-efficient and hassle-free solution for the development context.

There are two caveats about the adoption of blockchain. First, political will for transparency is necessary.[11] For blockchain to succeed, governments must be willing to transfer some direct control to an automated process and fully embrace transparency, as the transaction ledger will be accessible to all. Many governments have pledged to fight corruption, modernize, and ensure inclusive

economic growth. The use of blockchain as discussed here could be linked to such political commitments. For example, the Chilean government has moved to adopt blockchain to track energy use and bolster cybersecurity infrastructure.[12]

Second, developing nations often lack the necessary digital infrastructure for the technology to work in conjunction with IOT. However, the lack of existing infrastructure actually makes technological leaps more feasible since communities would have to make fewer transitions to catch up. Something similar happened with mobile phones and data penetration in developing countries, which both rose to exceptionally high levels bypassing landlines completely.[13] Furthermore, firms also have shown that they are willing to invest in such projects, and multiple startup companies are utilizing the technology for microgrid and clean energy integration in developing communities. Some companies, such as Danish startup M-PAYG, have used blockchain platforms to create phone payment systems to fund solar panel installations in near-grid-edge communities in Kenya.[14] Others, such as the Canadian renewable energy cooperative Solarshare, use blockchain platforms to allow peer-to-peer transactions of electricity produced by solar panels in communities in Bangladesh.[15]

Now is the perfect time for actors in the energy sector to seriously consider adopting blockchain technology in their project planning. The industry is ripe for disruption. Emerging markets are experiencing a boom in economic growth, driving demand for energy at a faster pace than a centralized grid can keep up with.[16] Sufficient political will does exist to allow piloting and testing blockchain at a scale difficult to reproduce in developed markets. Blockchain has the capacity to provide answers to the problems of electrification for all. It could encourage diversified financing. It could allow a larger portion of the private sector to engage in the industry, making it more attractive to a more varied group of investors, such as startups and tech companies. And it could make energy projects more transparent, democratizing energy and allowing local communities greater control over their own electricity. International organizations and governments should seriously consider blockchain platforms as a potential solution to aggregate renewable energy projects in developing nations while also creating an attractive landscape for foreign, direct investment.

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ENDNOTES

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