Life Is On | Schneider Electric

How New Regulatory, Financial and Technology Bold Ideas Can Grow Microgrid-driven Access to Energy

Executive summary

Access to energy in the rural, remote parts of Africa, Asia and Latin America drives both economic development and higher standards of living. Until recently however, progress in rural electrification has been slow as one in seven global citizens still lack adequate access to electricity.

Fortunately, progress in four key areas—government regulation, financing, technology, and training—have now opened the doors to accelerated rural electrification, especially through microgrids. A key driver for accelerating Access to Energy, the United Nations Sustainable Development Goal 7 (SDG 7), serves as a guidepost for ensuring access to affordable, reliable, sustainable and modern energy for all. This paper reviews both methods and cases that are now driving Access to Energy project best practices.

Introduction

Advancements in off-grid electrification have opened up new possibilities for the 1.1 billion people worldwide who still have no access to electricity.[1] This shocking number is nearly the equivalent of the U.S and European's populations combined. However, new, digitalization-driven business models are now making it more feasible and affordable for electrification projects to be implemented in those regions of the globe that have, until now, been cut off and left to fend for themselves.

In fact, it is projected that by 2030 there will still be 674 million people without access to energy.[2] It is for this reason that the United Nations Development Program has established Sustainable Development Goal 7 (SDG 7) as a key initiative for ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. This paper proposes methods for achieving that goal and for overcoming the Access to Energy gap, so that no one is left behind. In fact, we believe that the goal can be attained if the right combination of technologies, modernized regulatory and financial business models, and local training is implemented. In this paper, four "bold ideas" are presented as critical steps in improving energy access. These ideas are supplemented by actual case studies that we hope will inspire readers, influencers and stakeholder to work together towards changing lives and improving communities.

"Access to Energy initiatives are now ushering in a new era of advanced electrification."

A new future where access to energy empowers many more human beings and enables both prosperity and a higher quality of life is now within our grasp. This paper will review how specific "Access to Energy" initiatives–driven by a combination of simple-to-implement governmental programs, innovative business and financing models, digitalization technologies, and associated locally-based training programs–are now ushering in a new era of advanced electrification. The global goal of Access to Energy is to provide sustainable, reliable, green and safe energy access to all individuals living on the planet.

Energy is a basis of economic development and opens up new doors that facilitate access to healthcare, agriculture and better overall living conditions. From a business perspective, increased standards of living are economic drivers that facilitate the conversion of economically disadvantaged populations into large pools of new customers and consumers.

Figure 1

Renewable electrification efforts are enabling new segments of the world population to improve their quality of life.

[1] IEA, Energy Access Outlook, 2017.

[2] Ibid

Global targets for energy access as documented by the United Nations Sustainable Development Goal (SDG) 7 call for universal access to affordable, reliable and modern energy services by 2030.[3] The goal must also be reached in such a manner that the renewable and sustainable energy share of the energy mix are increased and that the energy efficiency of energy generation, transmission and consumption processes be optimized. In fact, 1.1 billion people will need to be added as energy consumers *without* increasing the level of CO_2 emissions. In addition, modern and sustainable energy services in developing countries must be made available by the 2030 target date.

Today, most of the populations without access to electricity (which still amounts to one in seven people) live in rural areas mostly in sub-Saharan Africa, Latin America and Southeast Asia. The situation in Africa is particularly acute, because ongoing population growth will swell the numbers of people without access to electricity, unless more aggressive actions are taken to improve electrification rates. **In addition, that population growth will be characterized by a drastic increase in youth between 15 and 30 years of age (this segment will represent 50% of the region's population by 2050). However, this will actually present a huge opportunity for job creation through training in a decentralized energy sector**. Training initiatives will develop skilled technicians and entrepreneurs who will contribute significantly to reaching the universal energy access goal.

What is a Microgrid?

A microgrid is an energy system that can generate and store power independently from any main power grid.

Microgrid benefits include:

- Optimization of self consumption of locally produced renewables.
- Provision of energy to remote areas where access to a traditional grid has never been possible.
- Effectiveness at minimizing cost and maximizing efficiency and uptime.

Until recently, providing those living in rural areas with access to a traditional grid was cost prohibitive. **Now, new technology trends surrounding small off-grid / microgrid solar systems (often referred to as decentralized solar systems), are driving down prices and are prompting a reexamination of how access to energy can be quickly and cost effectively spread to those areas of the globe in need**.

According to IEA Energy Access Outlook 2017, **microgrids are becoming the most cost-effective way to expand energy access in remote areas**. Under current scenarios, the IEA also predicts that by 2030, 25% of people gaining access to electricity in developing countries will be powered by microgrids, fueled by renewable energy sources such as solar. However, this will still leave 674 million people without access to electricity.[4]

Current energy market trends favor microgrids and solar–a common driver of microgrids. Lower electricity generation prices make microgrids increasingly cost effective to operate. Prices are also declining for electric energy storage, allowing for more effective self-consumption of solar energy. Microgrids are also broadening their influence and are allowing for the emergence of a new class of operators and owners of generation, storage, and load controls on the demand side of the meter. These new players and prosumers are moving in to fill voids in the marketplace. This type of energy consumption behavior increases the overall social benefit to the community of consumers.

For the time being, the energy made available to most end users in areas where electrification is scarce (and where individual incomes are typically less than $1.50 a day), only allows access to basic services such as mobile phone charging and LED lighting. **Precise load management and metering, as well as real-time monitoring and analytics, are needed to maximize the efficiency of the new generation of Access to Energy projects**, to improve Operation & Maintenance, and to guar-

[3] SEforALL, Global Tracking Framework, 2017

[4] IEA, Energy Access Outlook, 2017

antee that the users of these new energy resources can thrive and grow. In fact, deployment of new digitalization technologies can help to decrease installation and support costs by up to 80%.

There are good reasons for new optimism. Much in the same way the cellular or smart phone revolution enabled communication to rural and remote areas without having to build in expensive land line infrastructures, new energy-related digitalization technologies will enable regions isolated from cities and their infrastructure-heavy centralized grids, to forgo the expensive proposition of having to build out a traditional grid and leapfrog directly into a new era of off-grid solar and energy storage.

New microgrid technologies and solar home systems make it possible for residents in these remote areas to gain access to energy in new and more affordable ways. A wide variety of solar products including lanterns, street lights, water pumps and home systems are now available. Compact and lightweight solar products that require just a few watts of power can be obtained from photovoltaic arrays and can be applied across a wide range of small and portable applications. Microgrids can now be delivered in pre-assembled, pre-packaged containers that can be installed easily and managed remotely.

"New microgrid technologies and solar home systems make it possible for residents in these remote areas to gain access to energy in new and more affordable ways."

Over the years, most electrification efforts have been placed on national grid improvements and extensions managed through national policies and funded through international bodies. Overall, this traditional approach has proven to be expensive and not extremely successful. More recently, Solar Home Systems (SHS) have proven that remote populations can be reached and supplied with affordable energy devices (in a deregulated market).

The next step is the rapid expansion of the use of microgrids. In fact, this next phase has already started. With a sustained effort, microgrids can provide affordable electrification to 25% of the remaining population who are still seeking access to energy. But the goal of providing energy access to 1.1 billion people by 2030 will not be reached without proper and adequate training to build local skills.

This paper reviews the linkages between the key enablers of Access to Energy–government regulation, financing, technology and training–and highlights key initiatives that are driving the modernization of rural Access to Energy implementations.

Bold ideas for enabling access to energy

In order to achieve success in converting those segments of the sizable population still in need of energy access to more prosperous, energy consuming citizens, a multi-pronged approach is required. Only then can the proliferation of economically sustainable microgrids enable a more decentralized, less expensive, and more accessible energy solution. The effort will require appropriate government regulation; innovative financing schemes; the deployment of new technologies, and the implementation of robust training programs.

When compared to the efforts of prior decades, the **new access to energy projects must be more economically sustainable and less costly to implement**. Energy tariffs must be affordable, yet Energy Service Companies (ESCOs) must be fairly compensated. Also, the decentralized energy solutions that are installed in remote locations need to severely limit or even totally eliminate greenhouse gas emissions and operate without endangering the life or health of those humans living nearby.

The bold ideas that enable successful execution of Access to Energy projects–government regulation, financing, technology and training–are analyzed in the paragraphs below.

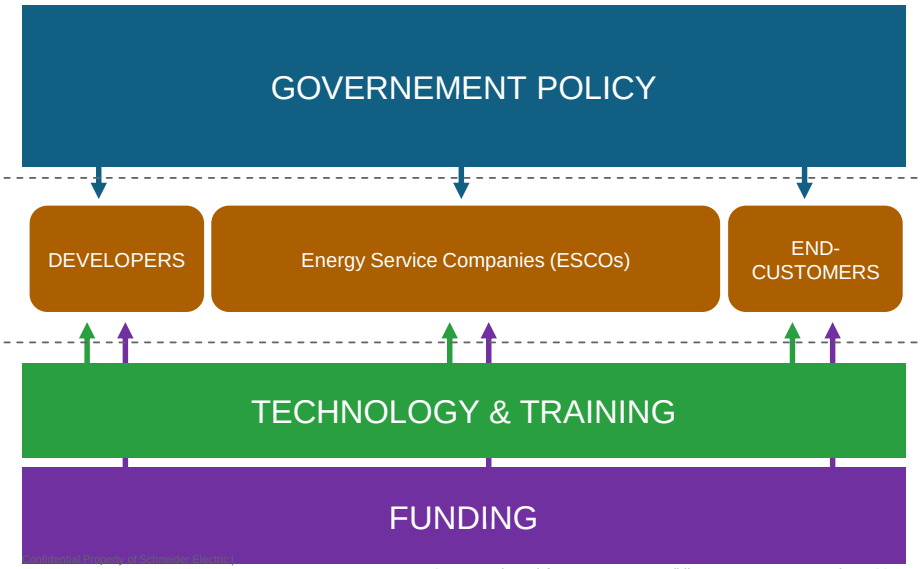


Figure 2

Microgrid electricity market map ecosystem

Source: Adapted from EUEI PDF, *Building Energy Access Markets*, 2015

Bold idea 1: Promote government regulatory policies that facilitate progress

At a high level, **governments in those regions where access to energy is problematic must embrace reforms that encourage a wide range of solutions and business models, avoid erecting barriers to new entrants, and facilitate rural electricity access** by creating suitable conditions for off-grid investment. In addition, provisions should be made for subsequent grid connection of decentralized solutions. The energy efficiency of those solutions should also be mandated. A wholistic approach reflected through clear energy production targets and fair energy access policies should also encourage development of productive applications of electrification that should result from new-found energy access.

"Predictable outcomes that involve fair compensation for loss of productive assets when a transition to a main grid occurs will encourage many more businesses to engage in Access to Energy projects."

We are seeing evidence of progress in this area. In April of 2017, African energy ministers, in a promising gesture, endorsed the AfDB's *Africa Strategy for Green Minigrids*. Their endorsement can be summarized in the following series of policy reforms and recommended actions:

- **Simplified licensing requirements and procedures** – Until now, when a local company applied for a project and sought permission to act as a local operator in a specific village, they were forced to navigate through a maze of administrative procedures. In order to simplify this process and save time and money, actions will be taken to design streamlined microgrid licensing requirements and procedures for legitimate microgrid service providers. This will include preparation, on the part of regulators, of mini-grid standards that ensure the required quality, safety and consumer protections.

- **Up front communication of planned main grid expansion to microgrid locations** – When governments publish expansion plans for the main grid and update those plans regularly, the element of risk for energy services corporations (ESCOs) is reduced. The firms can execute their long-term business

plans knowing the answers ahead of time to important questions like what the transitional tariff strategy will be and what happens to vendor assets in the village if and when connection to a larger grid occurs. Predictable outcomes that involve fair compensation for loss of microgrid productive assets when a transition occurs will encourage many more businesses to engage in Access to Energy projects.

- **Appropriate tariff structures and public funding** – Until recently, kilowatt hour tariffs for off-grid access to energy operations were mandated to be reflective of national grid tariff rates. This made it more difficult for ESCOs and operators of microgrids in remote villages who had higher built-in operational costs. Now, a renewed emphasis will be placed on developing legal provisions that permit the application of reasonable, cost-reflective consumer tariffs, or the provision of consistent compensatory subsidies for microgrid operations.

Use case: The Myanmar microgrid that cuts resident energy costs 50%

The Myanmar Department for Rural Development (DRD) has identified 40 000 villages to be electrified through microgrids. Planned in partnership with Schneider Electric, who worked with local organizations to design, engineer and commission microgrid systems, pilot villages have been identified and new technologies implemented.

One of these villages, on Kenti Island, was previously dependent upon a private owner with a diesel generator. At that time electricity was available only from 6 to 10 PM at a cost of 700 MMK (≈ 0,43 €) per kWh to small segments of the population.

The Schneider Electric local technology partner, Techno Hill Engineering, won a project from DRD, and thus benefited from the 60% subsidy financing program backed by the World Bank to electrify the Kenti Island village.

The new microgrid solution installed included a hybrid solar (63 kWp) and diesel genset (68,5 kVA) microgrid composed of charge controllers, inverters, a battery bank, switchgear and circuit protection as well as remote monitoring capabilities. The new microgrid currently provides power to 300 households, public buildings and several micro-businesses as well as powering local street lights.

The financing framework enables Techno Hill Engineering to acquire up to 20% of the CAPEX funding from the community itself. For the lowest income households, an NGO Pact is providing micro-loans at a 0% interest rate in order to help the poorest families access the microgrid.

Thanks to the newly installed microgrid, the entire village now benefits from a 24/7 safe and reliable electricity at a cost of only 350 MMK (≈ 0,22 €) per kWh, almost half of what they paid for their energy prior to the arrival of the microgrid.

Based on the success of this first phase of electrification, Techno Hill Engineering has been granted the permission to double the installed capacity of the microgrid in order to supply the increased demand from fishermen and farmers as well as new inhabitants attracted by the supply of electricity.

Thus, regulators now accept that local ESCOS in the villages sell electricity at a higher tariff than in cities and facilitate development of cost protective tariffs that make projects more attractive from an economic standpoint for potential investors. Such an approach saves money in the long run by encouraging the

substitution of more expensive diesel generator-based solutions for less expensive and less CO_2-intensive microgrids.

- **Integrated national energy planning** – Concerted efforts are also being made to implement national energy planning processes that explore lower cost options for centralized grid and decentralized solutions. For example, regulators are more inclined to communicate their future grid extension plans to potential project operators. Also, efforts are underway to make sure that national energy diversification plans are well understood by the various government ministries that have influence over energy expansion projects in order to avoid any potential complications that could delay Access to Energy implementations.

- **Increased capability to support microgrid implementation** – Energy ministers also agreed to promote the establishment of centers of excellence in order to enhance the microgrid capabilities of government officials and private sector service providers.

This African strategy for microgrids, once adopted by energy ministers, will provide a solid foundation for microgrid sector growth and investment and will represent a crucial step forward in fostering sustainable development and achieving universal access to electricity.

Bold idea 2: Adopt innovative financing mechanisms that accelerate electrification investments

Annual financial commitments for electrification projects in the 20 countries that require it the most averaged $19.4 billion over 2013 and 2014, among which only 1.3% were dedicated to decentralized renewable energy solutions. This falls well short of the estimated $45 billion needed annually to achieve universal electricity access by 2030, for which decentralized solutions should represent close to 70%.[5]

"Traditional microgrid project costs were too high and payback periods for the technology providers and energy services organizations involved were too long."

In order for this gap to be addressed, a transition toward more private and commercial capital needs to be accelerated. In parallel, governmental subsidy schemes should be generalized to develop cost-reflective tariffs compared to national grid tariffs or to compensate fossil fuel subsidies, particularly in the case of lower economically productive or simply lower-income communities. In most cases, today's microgrid project costs are too high and payback periods for the technology providers and energy services organizations involved are too long (12 to 15 years on average). However, new, more creative financial scenarios are beginning to emerge that are enabling a transition to more sustainable and less costly projects. By instituting mechanisms that lower the cost of capital, the cost of energy to people without current access can be lowered.

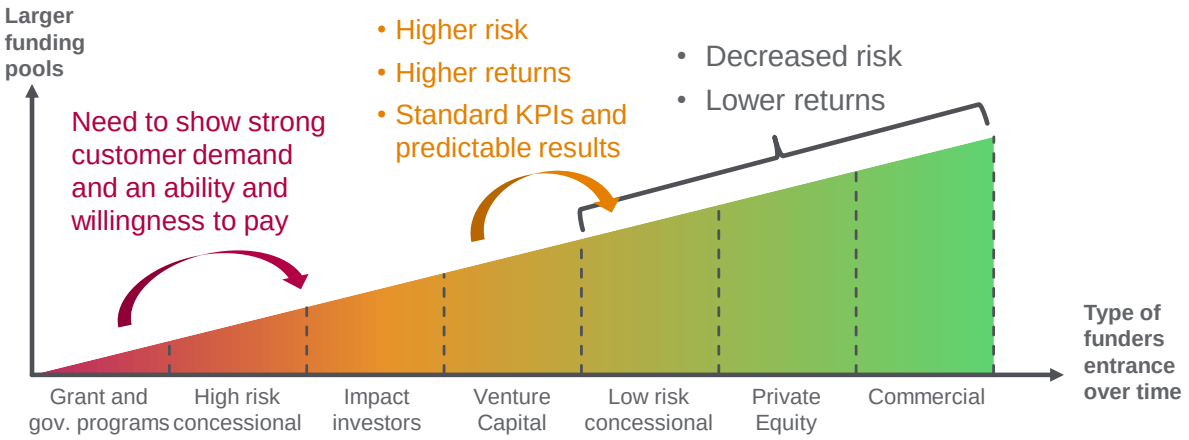
In order to increase the variety of funding pools, efforts are underway to diversify from government subsidy dependent projects to more blended capital schemes, including private and commercial scenarios. In this way, Access to Energy business models become more attractive as risks are spread across more stakeholders and benefits multiply as electrification ushers in more prosperity within the local economy. Until now most efforts have been concentrated on grants and government programs which have long implementation times and small pools of funding. As technology prices decrease and regulatory flexibility continues to increase, funding of Access to Energy initiatives become more creative. Now, instead

[5] SEforALL, Energizing Finance Report Series, 2017

of a funding mechanism that is reliant on subsidies alone, concessional financing scenarios, where repayment schedules are extended for longer periods of time at lower interest rates, provide an environment where capital investments have more time to bear the financial fruit.

Figure 3

Diversification of financing options along the microgrid sector maturity



Source: Adapted from Rocky Mountain Institute, *"20 by 20": A Design Charrette to Achieve $0.20/kWh"*, Lagos, Nigeria, 6-9 March, 2018

With each progressive step in the financing evolution (see **Figure 3**), the validity of the new business model (towards more private and commercial funding) gets stronger as risks are lowered. During this evolutionary process, performance KPIs are established and standardized and the level of predictability increases thereby opening the door to a broader audience of financing and technology players.

"With fundamental billing and collections processes now being automated, stakeholders experience a much lower risk of default."

Drivers that are enabling the evolution in financing include the commoditization of low energy-consumption appliances and cost efficient solar home systems. Decreased cost of revenue collection through mobile payments and remote monitoring capabilities of billing and collection systems also greatly facilitate the process. Service levels are improved and happy customers have more of a tendency to pay on time. Customer data management is much more advanced which allows for more accountability to take place across the multiple steps of the financing and collections process.

New funding mechanisms that include microfinancing microleasing, remittances, crowdfunding, pay-as-you-go and mobile platforms, or expansion of cash sales of products through microconsignment and/or agent distribution models are emerging. This is enabled through advancements in connectivity technology that greatly simplify the management of such programs. With fundamental billing and collections processes now being automated, stakeholders experience a much lower risk of default.

For example, financiers can minimize the cost of collections by automating the receipt of payments, while remote rural customers are granted immediate access to basic electricity without having to secure a bank loan. Public finance from development finance institutions (DFIs) like the African Development Bank, or Green Climate Fund can play a key role in growing a "pay as you go" (PAYG) solar energy related microgrid business model.

DFIs have long relationships and active lines of credit with banks throughout Kenya and Tanzania. Thus, they can spur commercial banks to make debt capital available in the local currency to entrepreneurs. Their involvement could include providing dig-

itally-driven guarantee schemes or lines of credit to local banks, channeling investments through investors, or investing in PAYG companies' marketing and distribution strategies.

Use case: Nigerian microgrid makes life more comfortable and prosperous

Bisanti is a rural community in Nigeria that is serviced by a mosque, a school, a youth lodge and a security post. The people of Bisanti are farmers and traders. They are an industrious and a quiet people. The local economy has not seen much in terms of growth in recent years. This economic stagnation is largely due to the lack of an access to electricity. Because of the remote location, the gasoline prices in the area are almost 72% above market rate while kerosene sells for about 300% above market price.

In 2015, Green Village Electricity (GVE) Projects Limited a local partner of Schneider Electric, successfully commissioned a 24kWp microgrid solar plant in Bisanti. GVE has been offered a concessional funding by the Bank of Industry, itself backed by the United Nations Development Program through a debt and equity scheme. The solar solution is comprised of Schneider Electric's Conext XW+ power conversion package. A pay-as-you-go prepaid metering solution is also setup at Bisanti. This system is similar to that used by mobile phone operators.

A resident of Bisanti sheds light on how this microgrid solution has impacted his life: "Before now, we relied on basic local means like kerosene lanterns, candles and, at the rare times, 'I pass my neighbor' generators to provide light. Normally, we would go to the village market center to pay and charge our phones. Since GVE came in, these are struggles of the past."

"Before now, I spent about 450 naira (about $2.25 USD) daily for three liters of fuel, but now I spend about 200 naira for better value. I have longer hours of electricity, without generator noise and fumes. My children can read in the evening, after school. I do not travel to charge my cell phone, which allows me to spend more business hours at my shop. The benefits are too many to count. Compared to how much I spent on fuel and alternative sources before GVE came to our community, the service is really affordable."

The system supplies electricity to around 280 residential and commercial clients across several communities through a 2km 230VAC, 50Hz microgrid electricity distribution network. With an average household size of seven, the estimated direct impact of the project is about 7,000 people, while an additional 500 people will be impacted indirectly through the cottage businesses and street lighting components that are associated with the project.

Bold idea 3: Leverage technological innovation to drive electrification and business growth

"Key technology breakthroughs include scalable modular systems, plug and play containerized systems, and cloud-based remote monitoring software."

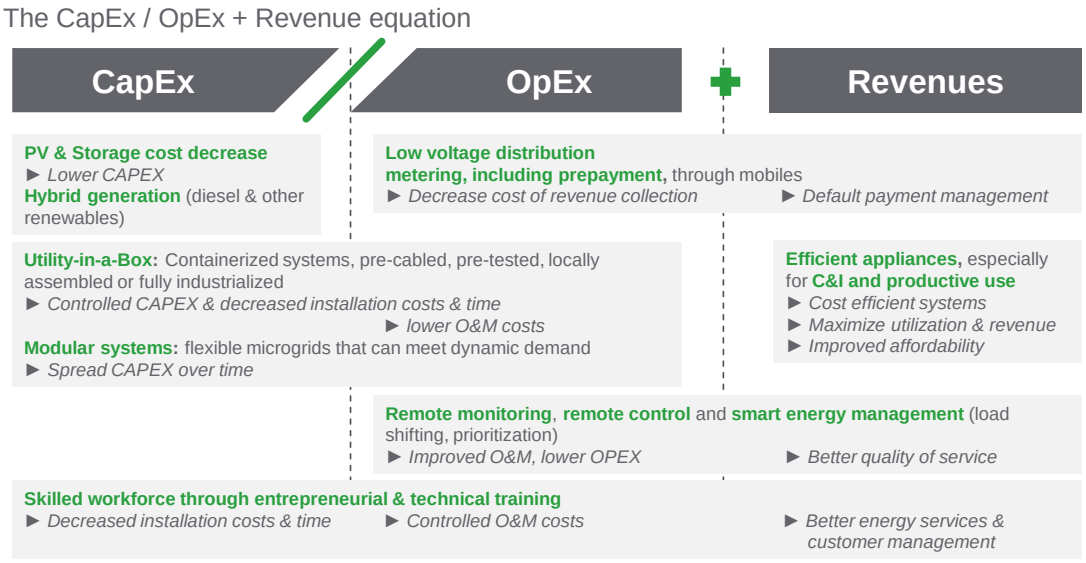
Technology plays a significant role in improving Access to Energy business models. Declining solar PV and storage battery prices and enhanced software-driven management functionality enable evolution from highly subsidized and high risk concessional funding schemes, to faster, more streamlined, less costly Access to Energy deployments. From a microgrid perspective, key technology breakthroughs include scalable modular systems, plug and play containerized systems, and cloud-based remote monitoring software.

Figure 4 illustrates how technology improvements can drive growth. As technology prices are decreased or controlled over time, the amount of investment (CapEx) required to implement an Access to Energy project is decreased. The lower cost of installation is coupled with decreased operation and maintenance costs (OpEx). In

parallel, improved quality of electricity supply coupled with the use of efficient appliances – especially for production and Commercial & Industrial use – increase the revenues for the systems operators.

Figure 4

Technology drivers and levers on microgrid economics



Such technology improvements are attractive across all markets–from mature industries in the US to the remote locations of Sub-Saharan Africa and Asia. New technology innovations, as they apply themselves to microgrids, are driving worldwide economies of scale that, in turn, will further lower overall costs.

Listed below are examples of three important technological developments that are facilitating the virtuous cycle of lower CapEx, lower OpEx and higher revenues though the deployment of microgrids:

Plug and play containerized systems – New containerized "microgrid-in-a-box" solutions are equipped with pre-configured inverters, switches, cables, circuit breakers, PV panels, batteries, and other electrical and mechanical devices that arrive on site, enclosed in a container which offers protection and security from the outside elements. Cost optimization and schedule optimization are two significant advantages of the containerized approach. The delivery of a pre-built, pre-tested self-enclosed unit avoids a situation where multiple contractors need to be dispatched to the remote site, all scrambling to finish their piece of the project. This results in fewer project scheduling interdependencies and higher safety and efficiency.

The responsibility for the proper configuration, testing, delivery, installation, and commissioning all lies with the manufacturer of the container and his local partner. Planning for mechanical, electrical, and systems interoperability is simplified. **Shorter delivery times, fewer people in the field and pre-fabricated design are all elements of this new plug-and-play deployment mentality.**

Scalable/modular systems - Modularity is loosely defined as a technique that builds large systems out of smaller subsystems, where the subsystems have well defined rules for interfacing to each other. Modularity also suggests a simplified approach to installation or replacement, ideally with "plug in" of modular elements that require simplified commissioning. Reduced total cost of ownership, increased flexibility, reduced deployment time, and improved efficiency are all benefits of modular scalable designs. Modular batteries and electrical panels that make up the core infrastructure of many microgrids provide a scalable base from which to build upon

when demand grows. For instance, microgrid modules can be added to a base configuration to accommodate expansion. Deployment of such technologies can help to decrease installation and support costs by up to 80%.

"Reduced total cost of ownership, increased flexibility, reduced deployment time, and improved efficiency are all benefits of modular scalable designs."

Cloud-based monitoring systems – The advent of cloud-based monitoring represents a huge decrease in operational expense. Once a microgrid is installed the systems that support the microgrid can be remotely monitored and controlled. Advancements in digitalization allow for performance data to be gathered automatically so that the operator, in real-time, knows what is happening at the site level. As the gathered data is analyzed operators are in a much better position to anticipate the maintenance that will be required and when it will be best to perform that maintenance. In this way, system downtime is minimized and power continues to flow to the residents.

A new solution from Schneider Electric, called EcoStruxure for Energy, for example, provides metering, analytics and reporting capabilities to microgrid projects. **The software monitors site performance, and reports household load balance and energy credit in real time, all while gathering trend data to improve operational efficiency.** Such tools allow for the evolution and scalability of microgrids driving the customization of business models as the amount of available energy grows. Benefits include increased OpEx savings, a more efficient payment system, and increased peace of mind for operators. Despite all of these technology breakthroughs, however, the benefits will not accrue to the local consumers if the systems are not properly maintained by local men and women who also need to play an important role in interacting with local end customers. Therefore, adequate technical and vocational training and education (TVET) programs need to be developed that will build the capacity of local ESCOs as well as the technical and business skills of their staffs on the ground.

Use Case: New "Multi-energy" Plant Transforms Agri-business in West Africa

Along with the West African Economic and Monetary Union and the African Biofuel and Renewable Energy Company, Schneider Electric is developing a "multi-energy" plant for irrigation, fish farming, and farming transformation. This solution, called Villaya Agri-Business, uses a solar thermal and photovoltaic power plant to capture and store energy and to reuse it to produce electricity and heat simultaneously. It can supply micro-industries in rural areas, especially food production, processing and storage plants. This multi-energy plant stores energy in batteries with a 10-year lifespan.

The project will be implemented over a two-year period, involving feasibility studies, equipment installation, and user training. It will progressively offer up to 100,000 people access to electricity for irrigation, lighting, fish farming, farming transformation, and the provision of drinking water without CO_2 emissions.

Bold idea 4: Leveraging vocational training and entrepreneurship to bolster microgrid-driven economic activity

The importance of the use of training to build a local pool of skilled technicians that support microgrids cannot be underestimated (see Schneider Electric white paper "Developing the Skills in Energy for Emerging Economies through TVET"). By training local people in energy management, the local populace actually creates new opportunities for themselves. Energy empowers people to join in the kinds of activities that drive development and create new life living options, such as facilitating the ability to study and work before sunrise or after sunset, and enabling both use cell phones, and access to the Internet.

By empowering the local populations to maintain the sustainability of the new technologies, new economic activities can begin to thrive. A huge job creation opportunity exists provided that governments support the ability of the local people to build human resource capacity (see Schneider Electric white paper "Addressing the Needs of Micro and Social Entrepreneurs in the Energy Field in Developing Countries"). The global community can contribute by developing knowledge and interest in the distributed renewable energy (DRE) sector, along with vocational training and education (TVET), to create the workforce needed—or we will be unable to fulfill the promise of the UN Sustainable Development Goals (SDGs).

Technology improvements will prove to be useless unless investments are made in the locally-based men and women. The TVET programs that will build capacity of local ESCOs, as well as technical and business skills of their staff on the ground, are now emerging as critical success factors. In our pursuit to reach universal access to energy before 2030, up to 20,000 decentralized renewable energy companies will be needed to support the Access to Energy aims of SDG7 by 2030.

Much work needs to be accomplished because, as of today, the majority of renewable energy jobs are outside of low energy access countries (e.g., less than 1 percent in Africa).[6] Yet, the potential for great success is within our grasp. According to the International Renewable Energy Agency (IRENA) the entire DRE value chain—including sales, installation, service, appliances, operations and management—is projected to create 4.5 million jobs globally by 2030. These millions of jobs are likely to spread across thousands of small and medium-sized businesses.

Conclusion

Access to sustainable modern energy services underpins health, education and livelihoods and increases resilience to climate change – yet millions of people still have no access to electricity and use dangerous and unhealthy fuels for lighting and cooking.

However, the prospects for rapidly improving access to energy are encouraging. On the regulatory front, governments are reevaluating traditional approaches to electrification and are opening up lines of communication with energy service providers and financial institutions so that decentralized electrification projects are more predictable and easier to approve, deploy and manage. In addition, more players are involved in financing as the momentum shifts from government subsidy-based models to a more hybrid model involving third-party commercial interests and innovative financing schemes.

Technological breakthroughs are also greatly enhancing affordability of renewables-based electricity generation. **New digital energy services are driving easy, low cost remote operation and monitoring of microgrid systems that are now being delivered pre-built and pre-tested. In addition, these systems are now being maintained more and more by trained, skilled local operators.** As a result, CapEx and OpEx are reduced while revenue streams are increasing. Much in the same way that cell phone technologies have allowed remote regions of the world to communicate without having to build costly carrier cable infrastructures, energy digitalization and renewable energy technologies will allow these regions to leapfrog the challenge of a traditional grid and to head straight to mass adoption of the new digitization and energy management technologies.

[6] IRENA, Renewable Energy and Jobs, 2017

The technology innovation is also driving the emergence of new governmental and private enterprise business models. Investor interest is on the rise because modern microgrids are enabling stable cash flows and increased credit-worthiness as energy fuels growth in the local economy.

Companies like Schneider Electric have already installed over 350 stand-alone off-grid electricity systems (with a capacity of <4kWp) and 600+ microgrids in off-grid areas worldwide (equivalent to over 23.5 MWp of power) over the past four years. Momentum is clearly building.

Organizations wishing to initiate electrification projects should assess the technologies and financial instruments that are available to support their initiatives. Once a viable project is identified, a technology partner with experience in rural environment microgrid deployments should be consulted. This approach will build confidence and support for future electrification-related projects.

About the authors

Schneider Electric launched its sustainability approach in 2002. Since then, the company has grown to be a global leader, widely recognized as one of the most respected, ethical, and sustainable companies in the world.

The Schneider Electric **Access to Energy program was created in 2008 and actively involves local stakeholders, including residents and customers, for the purpose of bringing safe, clean, sustainable electricity to communities all over the world.**

In 2017, we expanded the availability **of p**ower-related **products, solutions, and services t**o **communities that lack access to energy — from individual lighting to community services and collective electrification. We're committed to providing innovative solutions that ensure Life Is On for everyone, everywhere, at every moment. This is our promise and our mission.**

By 2020, we are committed to supporting the UN Sustainable Development Goals, of "Ending poverty in all its forms everywhere" and "Ensuring access to affordable, reliable, sustainable, and modern energy for all". We monitor, o**n a quarterly basis, two key success indicators that we plan on achieving by 2020:**

1. **First, a 4x increase in delivery of Access to Energy-related program products - This includes tracking in Africa, Asia and South America, of those products and solutions which contribute to providing access to modern energy for populations living in rural and peri-urban areas. Examples include individual lighting, individual and collective electrification, energy services and training equipment and training contracts.**
2. **Second, the training of 350,000 underprivileged people in energy management - The objective of our training programs is to enable these populations to acquire skills to pursue a career that offers them, as well as their families, the means for a decent standard of living.**

Learn more at www.se.com/sustainability.

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