

Preface by Microenergy Systems Research Group

In 2001, at the Technische Universität Berlin Institute for Energy Technology, two young researchers, Noara Kebir and Daniel Philipp, traveled to Bangladesh to explore a seemingly simple question: How is it possible that in a country like Bangladesh solar energy is implemented on a sustainable basis, whereas in Germany it is considered a mere fancy dream? Intrigued by the example of *Grameen Shakti*, which since its founding in 1996 continues to successfully expand the dissemination of solar home systems in rural areas of Bangladesh, they founded a new research focus at their University, which they named *Microenergy Systems (MES)*.

Microenergy systems can be defined as *decentralized energy systems based on small energy appliances, which provide households, small businesses or farms with locally generated energy, enabling a spatial link between energy demand, supply and generation*. The systems provide solutions for single households or micro-enterprises (e.g., solar home systems, irrigation pumps, biogas plants) as well as technologies for several interconnected households or communities (e.g., mini-grids). In recent years there have been growing expectations that microenergy systems can play an important role in shifting energy policy as well as creating co-benefits where development goals (e.g., reducing poverty) are combined with climate mitigation and adaptation actions.

A systemic perspective on microenergy systems stresses the need for a holistic and rigorous interdisciplinary research methodology, including feasibility analysis, product development, manufacturing, planning, implementation, servicing, and use of decentralized energy systems, combining different perspectives stretching from end-users to policy decision-makers. Therefore, the term “Microenergy System” refers to a broader understanding of the respective technical artifact in interrelation with its natural conditions, social context, economical system, organizational structures, and political framework. The introduced research concept is demand-driven and deduced from practical needs rather than a product of pure theoretical consideration, and consequently exists outside the purview of any individual discipline.

We find that there is a strong need to consolidate the knowledge accumulated in the various overlapping fields of research focused on such solutions, through regular exchange as well as through joint exploration and education. The aim of these efforts is to enable the transfer of strategies, programs, and tools that can be tailored to the diverse myriad of local conditions. This was the original goal of the founders of MES and continues to be our driving force for our ongoing activities including the third event we have organized on decentralized energy supply: the MES-BREG symposium held at the University of California, Berkeley, Berkeley, in 2014.

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Preface by Daniel M. Kammen

After what seems like years of slow and uneven action in the off-grid and remote energy sector, there are dramatic signs of innovation. One only needs to assess the progress of mobile phone coverage across the Global South to see new technologies, business models, and modes of commerce and governance. At the same time, the global energy sector is scattered, and lacks rigorous efforts to support innovation to build greater sustainability in the services that are made available—generally as commercial products—to billions of people. For much of the last century, the energy sector was dominated by monopolies with partial or complete ownership of the regional grids and large-scale power plants. Research has shown that in areas with these monopolies the metrics of energy sector innovation are markedly low, perhaps because such monopolies are not motivated to disseminate results, or that they patent defensively, or simply underinvest in new scientific, technical, and business models. This raises a red flag if we are to employ an innovation-based strategy to confront the major energy-related challenges facing our society today.

Thankfully the energy field overall has seen more change and innovation over the past decade than arguably at any time in the last 100 years. New large-scale energy technologies and practices are only part of that change. The rapid evolution of decentralized approaches to energy access has been dramatic. Increasingly, bottom-up business and community-based efforts are playing important roles in changing the types and quality of energy services available worldwide. Today, a genuine hope for energy inclusion has gained momentum. This new paradigm is visible in high-level United Nations and national development efforts, through a vibrant private sector, and through the expectations that a diverse provider and consumer community brings to the equation. The value of diversity and the demand for quality service has been instrumental in driving innovation.

It is in this spirit that last year's symposium had *innovation* as its focal point. *Innovating for Energy Access* set out to bring together leading experts in the field to share their experiences on innovative approaches and to jointly drive new thought. The idea that innovative approaches can work with previously underutilized or unrecognized resources is central to this symposium, as this may lead to circumstances or cues for the development of successful and sustainable energy access

programs. Such untapped resources may be seen in the discovering of synergies within areas such as pre-existing service infrastructures, supply chain and value chain management, natural resource availability, financing schemes, leap frog technologies, and more.

I particularly thank Microenergy Systems from the Technische Universität Berlin and the Berkeley Rural Energy Group for their efforts in making this symposium a success. A vision of an inclusive, service-driven, and innovating energy sector will enable this moment of hope to be seen as part of a wave of change. This symposium and the resulting volume of collected papers will hopefully be one important contribution to that evolution.

With best regards, to all those who read and benefit from these case studies and assessments.

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Preface by the Organizing Team

The Western world lives by a paradigm of electrification that was formed at the end of the nineteenth and the beginning of the twentieth century. The story revolves around the extension of transmission and distribution infrastructure and the development of large-scale centralized generation. Today, the ubiquitous supply of electricity has become self-evident in much of the US and Europe, and sometimes passes for a barely noticed feature of peoples' daily lives in much of the industrial world. However, for many countries in the Global South, electricity is a luxury for the few. We do not know today what historians in 100 years will write about the path to universal access to modern energy in South Asia or Sub-Saharan Africa. Maybe they will write about the technology transfer of mobile payment and DC grids—from the Global South to the North. We cannot know the story yet—but as a research community, we all have the opportunity to make our contribution to it.

The following pages are a compilation of the research that was presented at the jointly organized *MES-BREG Symposium, Innovating Energy Access for Remote Areas: Discovering untapped resources*. The event was a resounding success, and it is our great pleasure to share the presented works with the general public. We hope that the publication of this knowledge will motivate the energy access research community to come together for future conferences, develop stronger collaborations, and more freely exchange knowledge and ideas.

The MES biannual conference events began in 2011, but this year marks the first collaborative symposium, which was organized in partnership with the Berkeley Rural Energy Group (BREG). MES and BREG are excited by the outcome of this collaboration, and we hope that this is just the first in a series of many smaller themed symposia that will take place in new locations around the globe, staggered year-for-year with our major Berlin events.

The MES-BREG event showed us that there remains a plethora of research questions that needs to be addressed by the international research community on energy access and decentralized energy systems. As the field is rather interdisciplinary, problem-focused, and practice-oriented, we need the support of the traditional established disciplines to tackle the remaining challenges. For this reason, the empirical problem—the lack of access to sustainable energy worldwide—needs to

be introduced and emphasized in mainstream theoretical debates. At the same time, we need to maintain our close connection to the practitioners in the field, the entrepreneurs, the consultants, and to the decision makers.

The event held at Berkeley marks a few developments of which we are particularly proud. First, we are extremely grateful to *ADA*, the Luxembourg organization dedicated to inclusive finance, for its generous support of the symposium as well as for its continued dedication to helping researchers publish their work on the relationship between microfinance and the environment. Second, the symposium was also organized in coordination with *Environmental Research Letters*, which will publish extended versions of select papers. Finally, as in the previous years, we thank our conference organization partner *MicroEnergy International (MEI)*, a Berlin-based consultancy active in Africa, Latin America, and Asia, aiming for the provision of fair and sustainable energy for all. Without their continuous support, these events would not be possible.

We also would like to thank the authors who submitted more than 70 papers on innovations in energy access from across the world. Our sincere gratitude also goes to our distinguished Scientific Committee that took the time to review and provide feedback on these papers. We would like to thank the *Hans-Böckler Foundation* for their continuous financial support to MES, as well as *ADA*, *GIZ/Bangladesh*, and the *Pakistan Poverty Alleviation Fund* for providing scholarships for researchers from the Global South to come to Berkeley. We are also very grateful to *REEEP* for supporting a workshop during the symposium. We also thank *BERC*, the *Trojan Battery Company*, and *SEA-RAE* for their financial support in hosting the poster session networking event and reception. Finally we are also grateful to *energypedia*, our media partner for this event, for making sure that the main conference takeaway messages are accessible to the global energy access community.

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Addressing Energy Poverty Through Innovation

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