Closing Statement and Conference Summary

– from the organizers of MES-BREG 2014 –

Jonas van der Straeten
Sebastian Groh
Brian Edlefsen Lasch
Dimitry Gershenson

What's moving the off-grid world? A status quo analysis.

At the beginning of the 21st century, the global energy landscape is changing profoundly. Rapidly improving technologies for decentralized electricity generation are challenging the centralized topology and markets of the energy sectors– and not only in the Global North. They also provide new perspectives for access to modern energy in the Global South. In the World Energy Outlook 2011 the International Energy Agency presented a scenario for universal modern energy access by 2030. In this scenario 70% of rural areas are either connected with mini-grids or with small, stand-alone off-grid solutions. In the past decade, we have seen a surge of interest globally in this topic of energy access, among academics as well as practitioners, investors, and politicians. This could be seen in the small symposium our California-Germany team planned this past April at UC Berkeley, which quickly turned into a fully-fledged conference event with 100 participants from all over the world and presentations covering the whole gamut of innovations in rural energy access.

"From the bottom up" – the decentralized track of electrification

As national governments are becoming increasingly aware of the limits of top-down, supply-driven electrification approaches, the political landscape is changing as well. "From the bottom up" – the title of a recent World Bank publication by Tenenbaum et. al. (2014)is programmatic for the current shift in electrification policies all over the world. There is an increasing political support for the "decentralized track" of electrification, defined as "a bottom-up approach in which grid electrification occurs through the creation of isolated or connected mini-grids operated by private, cooperative, or community-based organizations". This can be seen for example, in in the fact that the decentralized track appears as a recommendation in virtually every national electrification strategy across Sub-Saharan Africa (ibid, p.1).

The future of rural electrification – learning from Bangladesh

For small, stand-alone off-grid solutions we are no longer in need of proof that they can provide sustainable green electricity to millions of people – we have it! The rural electrification of Bangladesh,

where Solar Home Systems are installed at a rate of around 50.000 per month, is a well-known success story. In his presentation at the MES-BREG conference, Professor Rezwan Khan illustrated that success story and gave us an outlook into the future of rural electrification in Bangladesh and potentially many other countries of the Global South: new uses of solar PV for irrigation and cold storage of agricultural products, the clustering of PV panels and the establishment of DC-nanogrids, and ultimately the connection of SHS clusters and stand-alone grids to the national grid system.

The future of rural electricity use

As profound as the changes of the supply side of rural electrification may seem – the changes of electricity uses over the last decade deserve similar attention. Innovation, efficiency gains and rapidly falling prices for end-user devices, above all for mobile phones, solar panels and LED lamps, have changed the off-grid world more than any extension of national grids. For more than a hundred years, telecommunication and sufficient lighting have been a privilege for urban elites in countries of the Global South but are now becoming accessible and affordable to large numbers of rural off-grid and low-income clients. In the first decade of the 21st century, the number of mobile phone users in Africa has risen from 16 to 650 million (Etzo & Collender 2010, 659). For the second decade, the commercial breakthrough of off-grid solar lighting in Africa is predicted. The Lighting Africa initiative of the World Bank and IFC forecasts 20-28 million cumulative sales of solar lighting products in Africa by 2015 (Lighting Africa 2012).The rapid spread of these small and mobile electrical appliances leads to the fact that being connected to a grid or even owning a larger solar home system or diesel generator is no longer a necessary precondition for two key uses of electricity: communication and lighting.

Innovative approaches for new markets

As demand and willingness to pay for off-grid electricity grows, regulatory frameworks are becoming more favorable. Likewise, as synergies with growing markets like the ICT sector evolve, an increasing number of companies and start-ups are looking to enter the off-grid market. They have developed a range of new innovative business and implementation models during the last years. In doing so, they have come up with creative ways to overcome the biggest barriers for the dissemination of small-scale energy systems in rural areas. For example, our panelist from Angaza Design has shown potentials to lower the high transaction costs for distribution, service and maintenance by using mobile payment and remote monitoring. The second track of electrification is getting faster – there is definitely some momentum in the off-grid energy sector.

What does that mean for academia? Insights from the conference

What do these changes mean for us as academics then? What are the questions that need to be addressed by researchers in the next years? The paper presentations, the keynote speeches and discussions of this conference have revealed a number of fields for future research:

Energy and ICT

Mobile connectivity has grown beyond the electricity grid in most emerging markets. As we have learned in our session on ICT and Energy, there are more than 643 million people worldwide covered by mobile networks but without access to electricity, representing up to 53% of the global off-grid population. The mobile industry is pushing the demand for decentralized electricity supply in remote areas – it also provides a range of new channels for innovative energy business models and projects: the off-grid telecom tower infrastructure, mobile operators distribution networks, machine to machine

connectivity, mobile payments and mobile services. Much more research is needed to explore the synergies between the ICT and energy sectors, but also the challenges e.g. in regard to privacy and consumer protection.

The nexus of energy and Big Data

The increasing use of mobile payment and remote monitoring in off-grid energy business models offer new potentials for the collection and management of user data, for example energy usage profiles or payment track records. What can and should this data be used for? This was the central question of our panel on Innovating at the Nexus of Big Data and Energy Access this morning. Our panelists, Kate Steel from Google, Lesley Marincola from Angaza Design and Michael Nique from GSMA all agreed on the value of this data but raised the questions: who gets access to it, for what purpose, and how to monetize it? These questions need to be answered in the coming years as well as a number of other questions, some of them critical: What happens when hundreds of thousands of off-grid users become more "legible" to big companies and potentially governments? What are the dangers of the ability toremotely control the usage of energy and mobile payment services?

Minigrids, microgrids

Some purport that minigrids and microgrids hold the promise of becoming the most cost-efficient technology for the "decentralized track" of electrification. Still, as we learned from case studies from Bangladesh, India and Malaysia at our conference, there are still some major challenges to overcome during the next years: the inability to attract private investors, the slow dynamics of matching the supply and demand of a particular site, and the dilemma between affordability of energy access versus a sustainable business model. Some presenting authors have come up with important design considerations for mini-grids, as well as innovative participatory approaches for design and planning of micro-grids. Others have tackled the problem of matching supply and demand on the level of electrical devices by presenting a way of optimizing device operation with a local electricity price.

Paradigm change ahead? Bottom up vs. top down; AC vs. DC

Some authors go as far as suggesting a complete paradigm shift. Instead of a top-down planning and operation, Sebastian Groh and his colleagues have suggested the concept of Swarm Electrification, a bottom-up approach for building up micro-grids by interconnecting existing small-scale generation units, mostly Solar Home Systems. This also allows for making use of the excess energy that remains unused during the daytime, the hidden resources in Solar Home Systems, as Hannes Kirchhoff has described and quantified them in his presentation. Building rural electrification upon the existing power sources and end-user devices brings back into question a transmission technology that hasn't been seriously debated for more than a hundred years: In an inspiring special paper presentation titled "The Battle of Edison and Westinghouse Revisited: A Comparative Analysis of AC/DC Micro-grids for Rural Electrification", Brian Edlefsen Lasch and his colleagues made a powerful argument for DC transmission technology. This was supported by Rezwan Khan in his paper presentation on DC Nanogrids: A Low Cost PV Based Solution for Livelihood Enhancement for Rural Bangladesh. In 15 to 20 years, he predicted in his closing keynote, Bangladesh will have converted its national grid to DC. Paul Savage from Nextek Power Systems, vividly illustrated in his keynote speech that not only researchers working in the Global South should have DC technology on their radar–80% of all electricity worldwide is used by native DC power electronics, and DC domain segments are rapidly expanding.

Financing access to sustainable energy

Access to sustainable energy largely remains a financing problem. For this reason we are enthusiastic and grateful that ADA has supported this conference as the lead sponsor and brought their worldwide microfinance expertise to the table. Their commitment exemplifies yet again that the microfinance sector has begun to understand its crucial role for the transition to a green economy – a particularly challenging hurdle for countries in the Global South. Appropriate finance mechanisms to overcome the investment barrier for sustainable energy technologies and climate adaptation on the level of households as well as micro, small and medium enterprises are still largely underdeveloped. For this reason, Natalia Realpe presented a paper on the question of how to scale up green microfinance loans, and Satish Pillarisetti presented innovative products through group approaches in the session on energy and microfinance**.** Still, research on the potentials and impacts of green finance instruments is still in its infancy. Future projects need look into the appropriate design of green finance tools to support value chains for energy efficiency, renewable energies and other climate mitigation and adaptation initiatives.

The demand for energy loan products and their role in value creation processes

For the development of energy microfinance loans it is crucial to look into a number of context-specific preconditions: What is the willingness and ability to pay for sustainable energy or energy efficiency? What existing sources of energy are used and can potentially be substituted? What is the role of energy in local value creation processes? These remain the major questions that all business and project developers have to deal with. The conference provided a number of valuable contributions to the debate on the right approaches and methods to answer these questions: Two papers on demand assessments were presented, one on the financing needs for thermal insulation measures for housing in Kyrgyzstan and one on the demand for Solar Home Systems in Pakistan. Other authors focused on productive uses of energy. Henrik Beerman proposed an innovative conceptional framework for energy based upgrading in agricultural value chains and illustrated it the example of rice farming in the Philippines. Using the case of rural India, Suresh Kumar introduced methods of advanced solar irrigation scheduling. Robert Aitken contributed with a presentation on the potentials of solar powered LED lights improve the profitability of night fishing on Lake Tanganyika in Tanzania.

End of life – Looking at what will be left from the SHS boom

For a long time, the question of the disposal of small-scale energy technologies has been neglected in academia. Today, as the first solar program in Bangladesh reached a scale of millions and installation rates are steadily growing, it can be no longer ignored, as Alexander Batteiger convincingly argued in his contribution. Between 800,000 and 1.2 Million lead-acid batteries equaling an amount of 6,000 to almost 10,000 metric tons of lead per year are estimated to enter the Bangladeshi waste management system in 2016. In his presentation, he proposed an analytical framework and next steps towards a waste management system for solar home systems in Bangladesh. More academic research is not only needed to assess the environmental impacts of decentralized energy systems (using methods such Life-Cycle Assessment or Material Flow Analysis), but also to develop appropriate concepts for disposal and recycling.

What's next?

Next steps for the energy access research community

As we have seen from this conference, many potential research questions remain to be addressed by the international research community on energy access and decentralized energy systems. Having emerged as a rather interdisciplinary, problem-focused and practice-oriented field of research, we need the support of the established disciplines to tackle the above mentioned challenges. For this reason the empirical problem– the lack of access to sustainable energy worldwide– needs to be introduced and emphasized in the mainstream theoretical debates in these disciplines. 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. We shall stay connected and continue the discussions we had at this conference at other forums and events, at the latest during our next MES conference in Spring 2015.

Rewriting the history of electrification?

In the western world today, there is a common narrative of the history of electrification at the end of the 19th and the beginning of the 20th century. It is a story of how gradually every household and every company in Europe and the US were electrified through the extension of centralized grids. By today, the ubiquitous supply of electricity has become self-evident and sometimes passes for a barely noticed feature of peoples' daily lives in the industrial world. For many countries in the Global South, however, there is still a long way to go. 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 can't know the story yet – but as a research community we all have the opportunity to make our contribution to it.

Thank you

We have received overwhelming positive feedback from the participants of this conference. Thank you very much for that highly encouraging response, which will set the tone for us leading the way towards the next MES conference in spring 2015. Our sincere gratitude goes to our distinguished Scientific Committee that took the time to review these papers and provide authors with valuable feedback. We are extremely grateful to continue to count on MicroEnergy International, this time side-by-side with BREG in leading the conference management. The Berlin based MEI consultancy provides an example for us all with their determined pursuit of the energy for all mission. Further, we thank ADA as our partner in this endeavor, the Luxemburg NGO dedicated to microfinance, for their generous support to the symposium and dedication to enable researchers to publish their findings on the intersection of microfinance and the environment. We would also like to express our thanks to the Hans-Böckler Foundation for their continuous financial support of MES, as well as to GIZ/Bangladesh, the Pakistan Poverty Alleviation Fund and to REEEP for their financial support for researchers from the Global South to be able to come to Berkeley. We thank BERC and Trojan Batteries for their financial support in hosting the cocktail reception and poster session. Finally, we are very grateful to energypedia, our official media partner for this event, making sure that the main take-aways remain accessible for the wider community around the world.