The uptake and diffusion of solar power in Africa: Socio-cultural and political insights on a rapidly emerging socio-technical transition

This special issue focuses on the now rapidly growing solar photovoltaics markets across various geographies and scales in Africa. Herein we summarise the contributions of the component papers and position them within the context of the sustainable energy access literature. We argue that there is an urgent need for greater attention to the neglected socio-cultural and political dimensions of sustainable energy access, dimensions that are vital to understand if ambitious global commitments to sustainable energy for all by 2030 are to be achieved. Included in this special issue are papers on the systemic and socio-technical nature of energy access transitions; their politics and political economy; gendered dimensions; critiques of their technologically determinist framing and the implications for marginalising local actors; and, perhaps for the first time in the energy access literature, application of social practice perspectives to the energy access challenge. The result is a diverse range of empirically-grounded, theoretically and methodologically novel approaches, providing new insights into and understandings of the neglected socio-cultural and political dimensions of sustainable energy access.
Off-grid access to electricity innovation challenge

General information
State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership, The Energy and Resources Institute (TERI)
Contributors: Nygaard, I., Hansen, U. E., Larsen, T. H., Palit, D., Muchunko, C.
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Research output: Research - peer-review » Report chapter – Annual report year: 2018

Renewable electrification and local capability formation: Linkages and interactive learning
This paper discusses the prospects for developing production and innovation capabilities arising from renewable electrification efforts. This discussion falls at the intersection of several literatures within innovation studies and development studies. It requires a combination of ideas from across several academic fields of study. This paper focuses on value chain linkages and interactive learning. Because this is largely unexplored terrain, the paper seeks to provide conceptual framing based on insights from the literature and it discusses whether linkages within the global South offer specific advantages over North–South linkages. It then uses this conceptual framing to draw insights from the case of renewable electrification with wind and solar PV in Kenya. It ends by identifying key avenues for promoting interactive learning in this context.

General information
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Organisations: Department of Management Engineering, UNEP DTU Partnership, African Centre for Technology Studies, Aalborg University, Moi University
Contributors: Lema, R., Hanlin, R., Hansen, U. E., Nzila, C.
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Web of Science (2017): Impact factor 4.039
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Scopus rating (2016): CiteScore 4.49 SJR 2.197 SNIP 1.985
Web of Science (2016): Impact factor 4.14
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.98 SJR 2.287 SNIP 1.762
Web of Science (2015): Impact factor 3.045
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.62 SJR 2.143 SNIP 1.892
Web of Science (2014): Impact factor 2.575
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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.74 SJR 1.891 SNIP 2.168
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.52 SJR 1.75 SNIP 2.042
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.35 SJR 1.578 SNIP 1.934
Web of Science (2011): Impact factor 2.723
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.478 SNIP 1.845
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BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.379 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.207 SNIP 1.614
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.29 SNIP 2.136
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.822 SNIP 2.138
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.637 SNIP 1.635
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.909 SNIP 1.747
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.739 SNIP 1.674
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.607 SNIP 1.568
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.525 SNIP 1.623
Sustainability transitions in developing countries: Stocktaking, new contributions and a research agenda

An increasing number of studies have analysed the scope for, and the barriers to, transitions toward sustainability in the context of developing countries building on analytical perspectives from the sustainability transitions literature. This paper introduces a special issue on sustainability transitions in developing countries, which takes stock of this emerging field of research and presents new empirical research that contributes to further advancement of our understanding of the conditions in which sustainability transitions are likely to take place in developing countries and what is involved in these transformative processes. This introductory paper presents the five papers contained in the special issue. The first paper comprises a review of the existing literature on the subject, and the other four papers present new empirical research. The key findings of the papers are discussed in relation to previous research in the field specifically related to four crosscutting themes: (i) global-local linkages and external dependencies; (ii) stability and non-stability of regimes; (iii) undemocratic and non-egalitarian nature of regimes; and (iv) nurturing the development of niches versus the execution of individual projects. The introductory paper concludes by presenting a research agenda, which aims to provide promising avenues for future research on sustainability transitions in developing countries.

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Organisations: Technical University of Denmark, Department of Management Engineering, UNEP DTU Partnership, Eindhoven University of Technology, Delft University of Technology, Wageningen University & Research
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 3.9 SJR 1.677 SNIP 1.581
Web of Science (2016): Impact factor 3.751
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.83 SJR 1.613 SNIP 1.467
Web of Science (2015): Impact factor 2.972
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.02 SJR 1.812 SNIP 1.814
Web of Science (2014): Impact factor 3.018
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.08 SJR 1.687 SNIP 1.957
Technological shape and size: A disaggregated perspective on sectoral innovation systems in renewable electrification pathways

The sectoral innovation system perspective has been developed as an analytical framework to analyse and understand innovation dynamics within and across various sectors. Most of the research conducted on sectoral innovation systems has focused on an aggregate-level analysis of entire sectors. This paper argues that a disaggregated (sub-sectoral) focus is more suited to policy-oriented work on the development and diffusion of renewable energy, particularly in countries with rapidly developing energy systems and open technology choices. It focuses on size, distinguishing between small-scale (mini-grids) and large-scale (grid-connected) deployment paths in renewable energy. We explore how the development and diffusion of solar PV and wind technology evolve in these sub-sectoral systems. We find that innovation and diffusion dynamics differ more between small and large than between wind and solar. This has important analytical implications because the disaggregated perspective allows us to identify trajectories that cut across conventionally defined core technologies. This is important for ongoing discussions of electrification pathways in developing countries. We conclude the paper by distilling the implications of these findings in terms of the requirements and incentive mechanisms that shape different pathways.

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Organisations: Department of Management Engineering, UNEP DTU Partnership, Aalborg University, Moi University
Pages: 13-22
Measures for diffusion of solar PV in selected African countries

This paper investigates how African governments are considering supporting and promoting the diffusion of solar PV. This issue is explored by examining so-called ‘technology action plans (TAPs)’, which were main outputs of the Technology Needs Assessment project implemented in 10 African countries from 2010 to 2013. The paper provides a review of three distinct but characteristic trajectories for PV market development in Kenya (private-led market for solar home systems), Morocco (utility-led fee-for-service model) and Rwanda (donor-led market for institutional systems). The paper finds that governments’ strategies to promoting solar PV are moving from isolated projects towards frameworks for market development and that there are high expectations to upgrading in the PV value chain through local assembly of panels and local production of other system elements. Commonly identified measures include support to: local production; financing schemes; tax exemptions; establishment and reinforcement of standards; technical training; and research and development.
Toward Technology-Sensitive Catching-Up Policies: Insights from Renewable Energy in China

The voluminous literature on industrial catching-up in Southeast Asian countries has regularly argued that successful catching-up largely depended on a committed state, which orchestrated industry development with a relatively uniform set of policies, including R&D support, subsidies, trade restrictions, and local content requirements. In contrast, recent contributions from the technology lifecycle literature have argued that policies should be tailored to differing technological characteristics in industries for mass-produced standardized goods, complex engineered products, and—as we argue—complex product systems (CoPS). In this paper, we extend this argument by introducing a set of separate policy mixes for each industry type, which appears most capable of providing the key resources required for catching-up: knowledge, market access, financial investment and technology legitimacy. This framework is used to analyze catching-up patterns in China's wind, solar PV, and biomass power plant industries, drawing mainly on policy documents and 106 interviews with key industry actors. We find that traditional top-down catching-up policies played a decisive role in the development of China's wind industry, but were of limited importance in the early solar PV industry, and resulted only in a limited period of rapid growth in the biomass power plant industry. The relative progress achieved in these three industries is not related to top-down policy guidance alone, but also to private sector initiative, international interdependencies, and flexibility in adapting policy mixes to each industry's technological characteristics. These results suggest that policy makers in newly industrializing countries (NICs) should avoid drafting generic sector plans, but should tailor plans to individual industries, and respond to changing policy support needs as technological capacities and global competitiveness develop.
Exploring product development possibilities and alternative uses of PV solar cells in Ghana

General information
State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership, Department of Energy Conversion and Storage, Secretariat, IT, Ashesi University, Kwame Nkrumah University of Science and Technology
Publication date: 2016

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Electronic versions:
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Source-ID: 126116516
Research output: Research › Report – Annual report year: 2016

Niche development and upgrading in the PV value chain: The case of local assembly of PV panels in Senegal

General information
State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership
Contributors: Nygaard, I., Hansen, U. E.
Number of pages: 2
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Title of host publication: EU-SPRI Conference Lund 2016 : Book of abstracts
Outsourcing and Offshoring R&D in Green Technology to Emerging Economies: Opportunities and Challenges for Europe

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Organisations: Department of Management Engineering, UNEP DTU Partnership
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The emerging market for pico-scale solar PV systems in Sub-Saharan Africa: From donor-supported niches toward market-based rural electrification

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Organisations: Department of Management Engineering, UNEP DTU Partnership
Contributors: Nygaard, I., Hansen, U. E., Larsen, T. H.
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Publication date: 2016

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Electronic versions:
Market_Pico_Solar_WEB.pdf
Source: PublicationPreSubmission
Source-ID: 127271024
Research output: Research - peer-review › Report – Annual report year: 2016

Upgrading to lead firm position via international acquisition: learning from the global biomass power plant industry

This article examines the case of a Chinese firm that has upgraded to lead firm position in the global biomass power plant industry mainly through acquisitions of technological frontier firms in Denmark. Sustaining the lead firm position was, however, challenged by difficulties in developing innovative capability. Drawing on the literature on (i) firm-level technological capability and (ii) knowledge transfer in international acquisitions, we explain the reasons for insufficient innovative capability building. Based on these empirical findings, we suggest maintaining the existing upgrading framework but applying it analytically in a more flexible manner that avoids linearity, hierarchy and segmentation while stressing the co-existence of and inter-relationships between the different types of upgrading.

General information
State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership, University of Copenhagen, Lund University
Contributors: Hansen, U. E., Fold, N., Hansen, T.
Vertical and horizontal dimensions of upgrading in global value chains: insights from the establishment of local manufacturing of wind turbine components in South Africa

General information
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Organisations: Department of Management Engineering, UNEP DTU Partnership
Contributors: Larsen, T. H., Hansen, U. E.
Number of pages: 3
Pages: 205-207
Publication date: 2016

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Keywords: Global Value Chain, Industrial policy, Wind turbine industry, South Africa, Upgrading
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Governance, enabling frameworks and policies for the transfer and diffusion of low carbon and climate adaptation technologies in developing countries

General information
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Scopus rating (2017): CiteScore 4.06 SJR 2.035 SNIP 1.554
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.52 SJR 1.978 SNIP 1.361
Web of Science (2016): Impact factor 3.496
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.67 SJR 2.166 SNIP 1.42
Web of Science (2015): Impact factor 3.344
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.31 SJR 2.44 SNIP 1.701
Web of Science (2014): Impact factor 3.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Overcoming Barriers to the Transfer and Diffusion of Climate Technologies

This guidebook provides practical and operational guidance on how to assess and overcome barriers facing the transfer and diffusion of technologies for climate change mitigation and adaptation. The guidebook is designed to support the analysis of specific technologies, rather than pursuing a sectoral (e.g. transport) or technology group (e.g. renewable energy) approach. Given that there is no single solution to enhancing technology transfer and diffusion policies need be tailored to country-specific context and interests. Therefore, the guidebook presents a flexible approach, identifying various assessment options and tools for analysts and decision makers. The guidebook has been developed through an experience-based approach during the first phase of the TNA, and has benefitted from feedback from national consultants and workshop participants alongside inputs from UDP staff and external reviewers. It should be noted that this second edition of the guidebook has undergone major changes with respect to structure and content for the benefit of the readers.

General information

State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership
Contributors: Nygaard, I., Hansen, U. E.
Number of pages: 92
Publication date: 2015
Review of solar PV policies, interventions and diffusion in East Africa

Previous research on the diffusion of solar PV in Africa has mainly focused on solar home systems (SHS) in individual countries and thus overlooked developments in other PV market segments that have recently emerged. In contrast this paper adopts a regional perspective by reviewing developments in supportive policies, donor programs and diffusion status in all PV market segments in Kenya, Tanzania and Uganda, as well as identifying the key factors put forward in the literature to explain differences in the diffusion of SHS in these three countries. The paper finds two emerging trends: (i) a movement from donor and government-based support to market-driven diffusion of solar PV; and (ii) a transition from small-scale, off-grid systems towards mini-grids and large-scale, grid-connected solar power plants. The paper points out three generic factors that have contributed to encouraging SHS diffusion in all three countries: (i) the decline in world market prices for PV modules; (ii) the prolonged support from international donors; and (iii) conducive framework conditions provided by national governments. The paper also identifies five key factors that have been elaborated in the literature to explain the higher level of SHS diffusion in Kenya compared to Tanzania and Uganda: (i) a growing middle-class; (ii) geographical conditions; (iii) local sub-component suppliers; (iv) local champions; and (v) business culture. Finally, the paper discusses the lack of attention in the literature given to analysing the amount, nature and timing of donor and government support across countries, processes of learning and upgrading in local PV industries and the interaction between the different explanatory factors.

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Contributors: Hansen, U. E., Pedersen, M. B., Nygaard, I.
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Scopus rating (2017): CiteScore 10.54 SJR 3.036 SNIP 3.594
Web of Science (2017): Impact factor 9.184
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.52 SJR 2.998 SNIP 3.501
Web of Science (2016): Impact factor 8.05
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 8.35 SJR 2.921 SNIP 3.368
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 7.79 SJR 3.03 SNIP 3.72
Web of Science (2014): Impact factor 5.901
Web of Science (2014): Indexed yes
The conceptual and practical challenges to technology categorisation in the preparation of technology needs assessments

The strong focus in climate negotiations on the transfer and diffusion of technologies as a means to mitigate and adapt to climate change has entailed various programs to promote the transfer and diffusion of climate technologies, including the Technology Needs Assessment project (TNA). Despite the technology focus in the project, practice shows that the questions of what a technology is and how the key concepts of technology transfer and diffusion should be understood and operationalized remain diffuse. This paper explores the reasons for this by analysing the experience of the TNA project in using a framework for categorizing technologies according to the types of markets and non-markets in which they are diffused. While the framework has contributed to a higher degree of ‘market literacy’ among national stakeholders, four challenges in categorizing technologies have been identified: i) technologies comprising varying degrees of software, orgware and hardware; ii) technologies appearing as whole systems of production; iii) technologies covering different application markets; and iv) technologies situated on a continuum between research, development and diffusion. These challenges are proxies for the challenges in formulating plans of actions for technologies. If, due to a lack of conceptual clarity, it is not clear to countries whether the diffusion of a specific technology should be implemented by a project or by means of an enabling framework, the measures proposed in the action plans may be misleading. We therefore call for an increased focus on clarifying the technology concept in the training for the next generation of TNAs.
Learning and technological capability building in emerging economies: The case of the biomass power equipment industry in Malaysia

There is increasing recognition that the transfer of foreign technology to developing countries should be considered in light of broader processes of learning, technological capability, formation and industrial development. Previous studies that have looked at this in the context of cleantech industries in emerging economies tend to overlook firm-level specifics. This paper contributes to filling this gap by utilising in-depth qualitative firm-level data to analyse the extent to which the use of different learning mechanisms can explain differences in the accumulation of technological capabilities. This is explored via an examination of eight firms in the biomass power equipment industry in Malaysia during the period 1970–2011. The paper finds that firms relying on a combination of learning from foreign technology partners and internal learning by planned experimentation make most progress in terms of technological capability. Nevertheless, local spill-over effects were found to be important for some firms who learned principally from imitation of local competitors, although significantly, firms learning from local spillovers failed to advance beyond extra basic operating technological capabilities. Those firms who proactively pursued learning from foreign partners, on the other hand, advanced further, reaching basic innovative levels of technological capabilities. These findings are relevant for a wider range of industrial sectors in emerging economies.
Measures for the Diffusion of Solar PV are Aligned in Technology Action Plans for Six Countries in Africa

Recently, development projects have provided support to governments to facilitate technology transfer for climate change adaptation and mitigation. These include the Technology Needs Assessment (TNA) funded by the Global Environmental Facility (GEF). In the TNA project, which was implemented in ten African countries from 2010 to 2013, dedicated government committees have prioritized climate change mitigation technologies and developed action plans for the diffusion of the selected technologies. The project results show that solar PV is high on the agenda in Africa. Six out of ten countries in the region prioritized solar PV, and action plans for the diffusion of solar home systems were put forward in Cote d’Ivoire, Kenya, Mali and Senegal, while the implementation of grid-connected systems was proposed in Rwanda, Mali and Senegal. The project reports and technology action plans prepared in these six countries are used as the basis for comparing how solar PV is perceived in these countries and how policy measures enabling environmental adjustments and investment programmes are being planned to promote diffusion of the technology in these different contexts.

General information
Prospects for investment in large-scale, grid-connected solar power in Africa

Solar power in Africa is on its way to becoming a market-based commodity, thus escaping the niche for individual electricity supply that is mainly supported by international donor organisations. Significant reductions in the cost of photovoltaic (PV) panels and a 400 percent increase in oil prices since the 1990s have changed the competitiveness of solar PV in all markets, ranging from individual households via institutions to mini-grids and grid-connected installations. In volume and investment, the market for large-scale grid-connected solar power plants is by far the most important, and as production costs are today competitive with large-scale diesel, this market is rapidly emerging. Donor-influenced plans and visions for solar PV development have often been optimistic with regard to the diffusion of solar PV in Africa, but the last three years of development, in terms of a number of large-scale investments in grid-connected solar power plants and local assembly facilities for PV panels, have exceeded even optimistic scenarios. Finally, therefore, there seem to be bright prospects for investment in large-scale grid-connected solar power in Africa.

Review of Solar PV Market Development in East Africa

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Organisations: Department of Management Engineering, UNEP Risø Centre
Contributors: Hansen, U. E., Pedersen, M. B., Nygaard, I.
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DOIs: 10.5071/1stAfricaPVSEC2014-3BV.3.2
Research output: Research - peer-review › Article in proceedings – Annual report year: 2014
Review of Solar PV Market Development in East Africa
While the diffusion of solar home systems in Kenya has been market-based for some years, the diffusion of PV in most other Sub-Saharan African countries has been driven by government and donor-supported projects aimed at serving specific needs for electricity while at the same time creating a national niche market for PV. This practice is rapidly changing and, as in industrialised countries, there is evidence of a transition towards more market-based diffusion and private-sector involvement for PV systems for private consumers, institutions and villages. This transition has been facilitated to varying degrees by conducive enabling frameworks comprising innovative financing schemes, exemptions from VAT and import taxes, standardised power-purchasing agreements and feed-in tariffs. Few analyses have so far been conducted on the effects of such measures. This paper aims to contribute to understanding these effects by reviewing the development of markets for solar PV in Kenya, Tanzania and Uganda, focusing on how the differences in market development have been explained in the literature. The paper finds that, although Tanzania and Uganda are rapidly catching up, Kenya is still leading the development of PV markets not only in terms of installed capacity and market volume, but also with regard to local industry and PV business development. The paper concludes by drawing attention to particular factors that have been used in the literature to explain disparities in market-development trajectories in the three countries.

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Organisations: Department of Management Engineering, UNEP Risø Centre
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Publisher: UNEP Risø Centre, Technical University of Denmark (UNEP Risø Centre Working Paper Series; No. 12).
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Research output: Research - peer-review \ Working paper – Annual report year: 2014

Sustainable energy transitions in emerging economies: The formation of a palm oil biomass waste-to-energy niche in Malaysia 1990–2011
The economic development in emerging economies in Southeast Asia has significantly increased the use of fossil fuel based energy. This has severe implications for global climate change, and against this background, scholars within the sustainable transition tradition have taken an interest in addressing how transitions towards more sustainable development pathways in this region may be achieved. This paper contributes to the abovementioned literature by examining the conducive and limiting factors for development and proliferation of a palm oil biomass waste-to-energy niche in Malaysia during the period 1990–2011. Rising oil prices, strong pressure on the palm oil industry from environmental groups, and a persisting palm oil biomass waste disposal problem in Malaysia appear to have been conducive to niche proliferation, and on top of this national renewable energy policies and large-scale donor programmes have specifically supported the utilisation of palm oil biomass waste for energy. However, in spite of this, the niche development process has only made slow progress. The paper identifies reluctant implementation of energy policy, rise in biomass resource prices, limited network formation and negative results at the niche level, as the main factors hindering niche development.

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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.97 SJR 1.994 SNIP 2.094
Web of Science (2017): Impact factor 4.039
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.49 SJR 2.197 SNIP 1.985
Web of Science (2016): Impact factor 4.14
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.98 SJR 2.287 SNIP 1.762
Web of Science (2015): Impact factor 3.045
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.62 SJR 2.143 SNIP 1.892
Web of Science (2014): Impact factor 2.575
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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.74 SJR 1.891 SNIP 2.168
Web of Science (2013): Impact factor 2.696
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.52 SJR 1.75 SNIP 2.042
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
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Web of Science (2011): Impact factor 2.723
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.478 SNIP 1.845
Web of Science (2010): Impact factor 2.629
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.379 SNIP 1.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.207 SNIP 1.614
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.29 SNIP 2.136
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.822 SNIP 2.138
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.637 SNIP 1.635
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.909 SNIP 1.747
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.739 SNIP 1.674
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.607 SNIP 1.568
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.525 SNIP 1.623
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Development of biomass power plant technologies in Malaysia: niche development and the formation of innovative capabilities

The objective of this thesis is to contribute to advance further the emerging research agenda on the transfer and diffusion of low-carbon technologies in developing countries by adopting a study of the development of biomass power plant technologies in Malaysia. The main research question addresses the main factors influencing the transfer and diffusion of biomass power plant technologies in Malaysia. This question is explored in the four papers comprising the thesis, which are based on analyses of qualitative data, mainly in the form of interviews, documents and observations collected during successive periods of fieldwork in Malaysia.

The thesis conceptualises the diffusion of biomass technologies in Malaysia as a niche development process and finds that the development of a palm oil biomass waste-to-energy niche in Malaysia has only made limited progress despite a period of twenty years of niche formation. The thesis identifies the reluctance to implement an efficient energy policy as the main limiting factor for niche development in this case. Although a number of donor programs have advocated the introduction of a stronger enabling framework for niche development, they have generally had only a limited impact on policy development. This was mainly attributed to the strong opposing interests of key actors in maintaining the existing situation, particularly the national electricity utility company in Malaysia, which deliberately obstructed niche development over an extended period because it was against their economic interests. When the government decided to improve incentive structures through a reduction in fossil fuel subsidies and by introducing a feed-in tariff system, the niche development momentum had already been lost because investors had limited confidence in project investments. Since many planned plants were never put into operation and those that were constructed generally showed only poor performance, the lack of investor confidence was due mainly to the largely negative results from experimentation activities in the niche. Moreover, a number of alternative biomass waste utilisation options gained increasing interest in the Malaysian palm oil industry, which were considered more commercially attractive compared to energy generation. On top of this, the increasing interest in these alternative usages of palm oil biomass waste led to a significant rise in biomass resource prices, which meant that it became difficult to negotiate long-term biomass fuel contracts. These factors turned out to be detrimental for niche development.

The transfer of technology is understood in this thesis as the exchange of knowledge through international inter-firm linkages, which contribute to enhancing the technological capability of the recipient firms, thus enabling them to engage in innovation. The thesis considers whether the use of different learning mechanisms could explain differences in the accumulation of technological capabilities in the biomass boiler and power plant supplier industry in Malaysia. It is found that not only is differences in the levels of technological capability achieved by individual firms influenced by the specific combination of learning mechanisms the firms employ, but also by the differences in the relative levels of resources dedicated to exploiting these learning mechanisms. Firms relying on a combination of learning from foreign technology partners and internal learning by planned experimentation make most progress in terms of technological capability. Firms using a combination of learning by imitating national competitor firms and internal trial and error also made advances in technological capability although to a comparably lesser extent. The thesis also finds that CDM projects implemented in Malaysia played a limited role in stimulating the introduction of new technology and knowledge to Malaysian biomass boiler and power plant equipment suppliers. Their involvement in CDM projects did not add anything above and beyond what was already encompassed in the existing relationships between the firms in question.

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Transnational linkages and sustainable transitions in emerging countries: Exploring the role of donor interventions in niche development

Recent studies have found that further development of the MLP is needed to conceptualise and empirically assess the role of transnational linkages in niche development. This paper explores the factors that may explain the effect of twenty years of donor interventions as one form of transnational linkage in promoting the development of a palm oil biomass waste-to-energy niche in Malaysia. The paper contributes to the existing literature by a conceptual and empirical examination of this research question. With regard to its empirical findings the paper concludes: (i) that advice on energy policy had a limited impact mainly due to strong opposing interests in maintaining the existing situation; (ii) that creating the necessary conditions for transferring a private-sector model of electricity production to Malaysia remains a challenge; and (iii) that the short duration and unpredictability of interventions generally can be seen as an important impediment for programs in reaching their objectives.
An empirical case study of the transfer of GHG mitigation technologies from Annex 1 countries to Malaysia under the Kyoto Protocol’s Clean Development Mechanism (CDM)

This study assesses what role the CDM currently plays in relation to the transfer of GHG mitigation technologies from Annex 1 countries to non-Annex 1 countries. The study relies on multiple sources of qualitative data and is conducted as a case study of 13 CDM projects implemented in Malaysia. It focuses on the companies involved in the implementation of specific technologies in these projects and the channels that can facilitate the transfer process. In addition, the institutional CDM project approval process in Malaysia is taken into account. An analytical framework is put forward based on which it can be concluded that the CDM only plays a role in one out of the 13 projects examined. The study may contribute to provide a background for adopting future provisions concerning technology transfer in the CDM or other initiatives involving GHG mitigation activities in non-Annex 1 countries.

Diffusion of renewable energy technologies: Case studies of enabling frameworks in developing countries

General information
State: Published
Organisations: UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC), Systems Analysis Division, Risø National Laboratory for Sustainable Energy
Contributors: Hansen, U. E.
Number of pages: 176
Publication date: 2011
Peer-reviewed: Yes
Projects:

Trade in Environmentally Sound Technologies
The project aims to contribute towards sustainable, environmentally credible and inclusive value chain integration and trade in technologies, by providing support to developing countries to objectively assess and understand the opportunities, benefits and challenges of liberalized trade in environmentally sound technologies, including the EGA as an important means of implementation, and to host dialogues with a broad range of stakeholders to discuss EGA and environmental technology trade opportunities and perspectives in developing countries, and to build related capacities of developing country stakeholders.

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01/05/2017 → 01/06/2018

Collaborators: University of Malaya, African Centre for Technology Studies

Documents:
Est trade two pager

Project: Research

Kenya Miniwind: Supporting sustainable mini-grid development and local production of wind turbines using the case of Kenya
With the long-term objective to reduce poverty, stimulate economic growth and increased sustainable energy supply, the project aims to develop a market for low-cost, partly locally produced kW wind turbines for rural electrification. The project will demonstrate the technical, social and economic feasibility of integrating a kW wind turbine into a smart solar-powered mini-grid in Kenya, and aims to develop this concept into a viable business for the private companies involved, having the technical, economic and management capacity to exploit it. The expected long term impact of the project are (i) local jobs in production, installation, O&M of low cost kW turbines in mini-grids; and (ii) reduced cost of electricity provided by minigrids, benefitting disadvantaged communities. The project will bring together communities, public institutions and commercial companies.

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01/09/2017 → 01/09/2022

Collaborators: Sustainable energy, Kenya Climate Innovation Centre

Project: Research

TENTRANS: Tendering sustainable energy transitions
The overall objective of the project is to contribute to a transition toward sustainability in the energy sector of emerging economies, including sustainable development of local communities and local industries. The project will analyse the developmental implications of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) implemented in South Africa (SA) with a focus on the effects of wind power projects on local industrial development and socioeconomic development in local communities. The project will contribute to enhance the research capacity of the younger researchers involved. It will build upon and contribute to significantly advance the literature on sustainability transitions in developing countries through an innovative combination of complementary perspectives on institutional change, global value chains and infant industry development. It will draw on in-depth fieldwork carried out in SA based on qualitative research methods, such as interviews, documents, direct observations and project inventories. Through direct engagement with key policy makers and stakeholders, the project will seek to ensure that local developmental impacts are prioritized and ensured in renewable energy tendering schemes currently being implemented in SA, other countries in Sub-Saharan Africa (SSA) and internationally. The project will contribute to socially inclusive models of implementation by private companies involved in large-scale wind power projects by cooperating with the wind industry associations in Denmark and SA and through direct consultations. Finally, the project serves as a pilot research for a subsequent five year research programme, which will be up-scaled to include solar PV, concentrated solar power (CSP) and hydro-power, and additional countries in SSA, such as Ethiopia, Kenya, Ghana and Malawi.

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Project: PhD

The transfer of technologies for climate change mitigation and industrial development in developing countries
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Award relations: Donor Support for Sustainability Transition: The case of low-carbon development in the cement sector of Tunisia
Project: PhD

Activities:

Energy Research & Social Science (Journal)
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James Arthur Haselip (Editor)
Ivan Nygaard (Editor)
David Ockwell (Editor)
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