# Legacies of a Past Modernism
## Discourses of Development and the Shaping of Centralized Electricity Infastructures in Late- and Postcolonial Tanzania

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### ABSTACT

As the UN has declared the years 2014-2024 the "Decade of Sustainable Energy for All", countries in Sub-Saharan Africa struggle with the transition towards more sustainable and more inclusive energy infrastructures. In many rural areas, electrification rates remain as low as 1-2%. For many countries, one of the main barriers for rural electrification is the legacy of a model of top-down planning, large-scale power generation and a centralized topology of the electricity infrastructure. Nonetheless, historiography on electricity infrastructures in Africa is nearly non-existent. At the example of Tanzania this paper shows, that the centralized power models which dominate the continent today were shaped by modernization and development discourses during the late colonial and post-independence period. Because of its particular characteristics, electricity lent itself perfectly to the goal of making development measurable — a goal which was essential to a "high modernist" vision of development, advocated by new nation states as well as international funders. The paper illustrates how large hydropower projects proved successful in expanding generation capacities and urban electrification rates, but failed in providing electricity to rural areas and created path-dependencies which have led to dead ends in the last 20 years.

**Keywords:** Legacy Infrastructure, Sub-Saharan Africa, Centralized Power Systems, Development Discourses, High Modernism

### SUBHEAD REQUIRED

While Europe and other post-industrial economies are struggling with the transition to more flexible and adaptable low-carbon electricity infrastructure, much of the developing world faces challenges on a much more basic level. In Sub-Saharan Africa (excluding South Africa) for example, only 14 percent of rural households have access to any electricity at all, according to a widely cited estimate.[1] As in Europe however, the legacy of inadequate past electricity infrastructure remains one of the main barriers for the transition towards a more sustainable, more flexible and especially in the case of Sub-Saharan Africa, a more inclusive energy system. Most African countries have inherited a model of top-down planning, large-scale generation (mostly through hydropower plants) and centralized transmission, which "focuses on large-scale energy consumers whose activity influences macro-economic indicators like GNP, and labels a broad range of domestic and rural electricity benefits and beneficiaries as 'uneconomic' or expensive social welfare" (Showers 2011).[2] The long-term neglect of participatory, bottom-up and decentralized approaches is not

1 IEA (International Energy Agency), Energy for All. Financing Access for the Poor. Special early excerpt of the World Energy Outlook 2011, Paris 2012. (online). http://www.worldenergyoutlook.org/resources/energydevelopment/accesstoelectricity/.

2 Kate B. Showers, Electrifying Africa: an environmental, history with policy implications', in: Geografiska Annaler: Series B, Human

only due to the legacy of existing physical infrastructure, but also due to the interests of national policy institutions, international donor relations and a governing paradigm of centralized power systems. It has only been recently acknowledged by some African governments that there is a centralized power model crisis[3], leading them to integrate a "decentralized track"[4] into their national electrification strategies, promoting small power producers and mini-grids in rural areas.

At the same time, it seems that big and mega-engineering projects for electricity generation and transmission continue to dominate the political agenda throughout Sub-Saharan Africa. Posing as an alleged single technological fix for a country's unreliable and insufficient electricity infrastructure, these projects prevail in the debate on how to prioritize needs for investment in the competition for scarce capital. The absence of historians and of historical perspective in this debate is particularly noteworthy. Except for a few laudable exceptions[5], works that treat the history of electricity in Sub-Saharan Africa (except for South Africa) are rare and studies with a focus on infrastructure history are non-existent. It shall be argued in this paper, that the detailed knowledge of how the centralized electricity infrastructures, which dominate on the continent today, have historically emerged is not only a valuable but essential aspect of this debate, as a glance to the industrialized West shows.

Historiography of electricity in Europe and the United States has contributed much to widening the traditional "engineering perspective" and enabling a much deeper understanding of the social complexity which underlies electricity infrastructure. For example, Gilson has shown that in Germany in the first half of the 20th century a pressure group made up from political institutions, large-scale electro-industry and financial capital played an essential role in establishing a "dogma of the economic superiority" of the centralized power model in academia.[6] This inherent superiority has been convincingly questioned by Stier.[7] The concept of decentralized cogeneration of heat and electricity was discussed at an early stage of German electrification as an option with a higher overall efficiency than single-purpose electricity generation. It was only dismissed because economists and engineers of the time had a narrow focus on electricity generation. Models of "decentralized and customer-oriented, cost-effective and democratically controlled power supply" existed in some regions but fell victim to the drastic centralization policy of National Socialism. Some authors have gone as far as to radically deconstruct structuralist approaches. In his study on Switzerland, Gugerli has argued that its electrification was essentially a result of societal communication about the potentials and consequences of electricity.[8] One doesn't have to follow the radical nature of his thesis to acknowledge the importance of historical discourses in shaping electricity infrastructures.

Using the example of Tanzania, this paper therefore looks at the historical discourses associated with the emergence of centralized power models in Sub-Saharan Africa in the late colonial and early post-independence era. It is firstly argued that it was not only due to advances in long-distance electricity transmission or an inherent technical or economical superiority that was the main driver for the emergence of the centralized power model. Instead the centralized power models were the result of a particularly sweeping vision of development, using benefits of technical and scientific progress and measuring progress in technical and economic indicators. This vision was derived from the historical industrialization in the West, inspired by large-scale river basin development projects like the Tennessee Valley Authority (TVA) and advocated by the newly emerging interventionist development states as well as international organizations. Secondly, it will be shown that because of its particular characteristics, electricity perfectly lends itself to this vision of development. Thirdly, the role of the different decision makers in establishing the centralized power model will be discussed. It will be argued that hydropower development in postcolonial Africa was not primarily an attempt of authoritarian national states to engineer their environments as described in James C. Scotts widely acknowledged

Geography 93,3 (2011), 193–221.

3 Stephen Karekezi, Renewables in Africa – meeting the energy needs of the poor, in: Energy Policy 30, 11–12 (2002), 1059–1069; C. M. Haanyika, Rural electrification in Zambia: a policy institutional analysis, in: Energy Policy 36, 3 (2008), 1044–1058.

4 Bernard William Tenenbaum, Chris Greacen, Tilak Siyambalapitiya, James Knuckles, From the bottom up: how small power producers and mini-grids can deliver electrification and renewable energy in Africa . Washington, D.C. 2014.

5 Catherine Coquery-Vidrovitch, Electricity Networks in Africa: A Comparative Study, or How to Write Social History from Economic Sources, in: Toyin Falola/ Christian Jennings (eds.), Sources and Methods in African History, 2003, 346-360; Ghanadan, Rebecca, Public Service or Commodity Goods? Electricity Reforms, Access, and the Politics of Development in Tanzania. Unv. Diss, University of California, Berkeley, USA 2008; Shower, Electrifying Africa.

6 Norbert Gilson, Konzepte von Elektrizitätsversorgung und Elektrizitätswirtschaft: Zur Entstehung eines neuen Fachgebietes der Technikwissenschaften zwischen 1880 und 1945. Stuttgart 1994.

7 Bernhard Stier, Staat und Strom: die politische Steuerung des Elektrizitätssystems in Deutschland 1890 – 1950. Ubstadt-Weiher 1999.

8 Gugerli, David, Redeströme: Zur Elektrifizierung der Schweiz 1880-1914. Zürich 1996.

book “Seeing like a state”, but was largely driven by interests of foreign industry, development aid organizations and international funding agencies such as the World Bank.[9] It will finally be shown that this legacy of a centralized electricity infrastructure, which almost exclusively relied on hydropower until 2002, left the Tanzanian energy sector badly positioned to deal with the challenges of the late 20th and early 21st century: The need for flexibility, adaptability to changing demand and the urgent need to attract private capital for modernization and expansion.

The paper is based on preliminary results of an ongoing research project on the history of electrification in Tanzania. The project makes use of written sources from the British mandated Tanganyika Territory and post-independence Tanzania, planning documents and reports from the state utility, international consultants and organizations associated with early development funding and assistance as well as contemporary academic literature. Archival work will be supplemented by expert interviews and has been carried out in the national archives of Tanzania and the UK, and at the Tanzanian national electricity utility Tanesco. At the methodological level the project seeks to explore ways of writing a history of electrification in Sub-Saharan Africa, given that written sources are scarce and dispersed amongst the archives of a multitude of national and international actors– a research challenge that Tanzania generally shares with many other former colonies in Africa.

From the turn of the 20th century, when a private German company installed the first wood-fired steam turbines for power generation Dar es Salaam until the early 1930ies, electricity in Tanganyika was supplied by a few isolated small-scale generators and hydro-power plants.[10] In Dar es Salaam and a few cities along the railroads they supplied power to the colonial administration, European and some Asian city-dwellers, providing them with the amenities of domestic and street lighting. Africans were not considered eligible as customers nor thought to be able to pay for electricity. Nevertheless, the British administration was aware of the potential of electric power to increase productivity and profitability of the colonial extractive industries. A report from 1928 described electricity as the most effective form of power for machinery at the plantations for sisal, the colony’s major export commodity.[11] Consequently, Tanzania’s first medium-sized hydroelectric plant, which started operation in 1936 at Pangani Falls, supplied the local sisal industry through a 400 km transmission system. Still, in 1955 the country’s total installed capacity was at 29 MW only.[12]

In the first two decades of British colonial administration, the economic policy of Tanganyika was mainly focused on extractive industries. This changed after World War II, when colonial administrations shifted to a concept of integrated social-economic development. The 1946 Colonial Development and Welfare Act emphasized “native development” and “social welfare” as a part of broader economic considerations. This program was accompagnied by the rise of of the interventionist development state and a “particularly sweeping vision of how the benefits of technical and scientific progress might be applied-usually through the state in every field of human activity”, which James Scott has called “high modernism”. It implies the administrative ordering of nature and society to make them “legible” to central authorities, manipulating complex circumstances into simplified and aggregated data. When this ideology results into attempts authoritarian states to engineer their social environments it can become lethal – especially when a “prostrate civil society” lacks the ability to resist the governments plans.[13]

Under the British mandate, Tanganyika proved to be one of the most fertile grounds for the high modernist ideology. During World War II the British Colonial Regime began planning large-scale agricultural development projects and mobilizing the necessary labour. The most ambitious was the gigantic groundnut scheme, which failed due to its narrow agronomic and abstract design, and the planners “blind faith in machinery and large-scale operation”.[14] After independence Julius Nyerere adopted the colonialist view that successful economic development requires a strong state. Consequently, Tanzania’s natural, industrial, and communications resources were nationalized in the Arusha Declaration in 1967. Tanzanias “ujamaa” villagization program in the early 1970s sets a classical and well-documented example of state-initiated social engineering. In the course of the campaign more than 5 million Tanzanians were resettled in villages where the layouts, housing designs, and local economies were planned, partly or wholly, by officials of the central government. Nyerere’s argument for the ujamaa villages was the following:

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9 James C. Scott, Seeing like a State – How Certain Schemes to Improve the Human Conditions Have Failed. New Haven/London 1998.

10 H. A. Byatt, From H. A. Byatt, Administrator, Dar-Es-Salaam to Principal Secretary of State for the Colonies, London, 9th June 1920, Tanganyika Territory No. 224. Public Record Office, Kew. PRO T 161-1049. Tanzania was a German colony before World War I.

11 SPARKS&PARTNERS, Report by Messrs. SPARKS&PARTNERS 1928, Colonial Office, Kew. CO 691-98-3.

12 John Frederick Rowland Hill, Tanganyika: A Review of Its Resources and Their Development. Dar es Salaam 1955.

13 Scott, Seeing like a State.

14 Scott, Seeing like a State, 229.

*"And if you ask me why the government wants us to live in villages, the answer is just as simple: unless we do we shall not be able to provide ourselves with the things we need to develop our land and to raise our standard of living. We shall not be able to use tractors; (…) it will be quite impossible to start small village industries, and instead we shall have to go on depending on the towns for all our requirements; and if we had a plentiful supply of electric power we should never be able to connect it up to each isolated homestead."*[15]

The pursuit of electricity as a modernizing and developmental force for state-led development coincided with the global rise of an ideology of multipurpose river basin planning.[16] This was the idea of managing an entire river for human benefit, for hydroelectric power production, navigation, irrigation and flood control. The success of the TVA, "the granddaddy of all regional development projects"[17], following its formation in 1933, inspired visions of river basin planning as a global tool for development in the 1950s.[18] In addition, technological advances in long-distance transmission made centralized generation more economically viable and opened up prospects for mineral exploitation using cheap electricity from hydropower. Colonial governments all over the African continent commissioned hydropower surveys and started large dam projects, which were readily continued by the new states after independence. The exported model of river basin planning, however, was more focused on industrial and agricultural growth rather than on regional needs for social development. Rural Electrification, job creation and the provision of infrastructure services was given low priority.[19]

Despite its African socialists' rhetoric of local small-scale development, the model of river basin development was as attractive to Tanzania's post-independence government and to internatoinal funders. Encouraged by the World Bank the Swedish Institute for Development Assistance (SIDA) began working on the Great Ruaha river basin during the 1960s. Kidatu, where constructions began in 1969 and were completed in 1980, became the first large-scale hydropower project in Tanzania, paving the way for the beginning of the big dam era. The debates associated with the project firstly exemplify the rationale underlying the planning and construction of big dams for hydropower generation and in turn the emergence of centralized power infrastructures in many African countries, which could be rightfully called "high modernist".[20] Secondly, they show that it was less the authoritarian state, as suggested by Scott, but international development organizations that advocated and enforced the mega-engineering of natural environments for the single purpose of hydropower generation for industry and urban areas and to the detriment of rural development. This was partly made possible by the change of power relations between local actors and different international actors in the context of the postwar shift from bilateral colonial relationships to the multilateralism of development assistance. On a formal level, sovereignty turned these relations into one among equals; but, as Cooper has lately suggested, "independence turned entitlement into supplication".[21] This became apparent when interests conflicted in regard to the purpose of large dams. The Tanzanian government, the water authority and President Nyerere were in favour of a multipurpose project. Drawing on the British colonial plans for agricultural development, they had made irrigation an important part of the five-year plan of 1964. In contrast, the World Bank changed from supporting large-scale irrigation to supporting large-scale power production during the 1960s. Comparative studies, giving no space to irrigation benefits provided the necessary arguments for Tanzania's government to change its opinion. Consequently, plans for a multipurpose project at Wami River were given up in favour of the single-purpose Great Ruaha Project.

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15 Julius K. Nyerere, "President's Inaugural Address" (December 10, 1962), quoted from Scott 1998, 230

16 Patrick McCully, Silenced Rivers: The Ecology and Politics of Large Dams. London 1996.

17 Scott, Seeing like a State, 6.

18 In 1956, the UN Secretary General declared that "River basin development is now recognized as an essential feature of economic development (UN EcoSoc Council Office Record 21st Session, 1956, quoted in: Heather J. Hoag, Transplanting the TVA? International Contributions to Postwar River Development in Tanzania, in: Comparative Technology Transfer and Society 4, 3, (2006), 247–267, 253.

19 The Volta River Project in Ghana for example, one of the first and most prominent examples for river basin planning in Africa, was mainly built to produce power for processing Ghana's bauxite deposits into aluminum. Its centerpiece, the 80-meter Akosombo Dam was heralded as "a solid symbol in the dream of prosperity" upon commissioning in 1966 (Nkrumah switches on Volta River power" (1966, January 24). The Nationalist; quoted from Hoa, Transplanting the TVA, 249).

20 The debates have been well documented in: May-Britt Öhman, Taming Exotic Beauties: Swedish Hydropower Constructions in Tanzania in the Era of Development Assistance, 1960s – 1990s. Unpubl. Diss, Royal Institute of Technology, Stockholm, Sweden 2007.

21 Frederick Cooper, Writing the History of Development, in: Corinna R. Unger, Stephan Malinowski and Andreas Eckert (eds.), Modernizing Missions: Approaches to 'Developing' the Non-Western World after 1945 special issue, Journal of Modern European History, 8, 1 (2010), 5–23.

Hydroelectricity generation perfectly lended itself to the high modernist goal of making development "legible", giving it the decisive advantage over other development goals like irrigation. For Great Ruaha, one contemporary consultant pointedly stated that only power generation could provide the fixed values that the World Bank needed for their calculations:

> *"Money should be made to talk: each one of the parties should be made to weigh the money value of their wishes against the costs to be covered. – In this respect power seems to be superior. Opinions are divided as to the relative benefits in the future, but one thing is absolutely certain: plans for power are much more definite and much more accessible to assessments of costs and benefits, in a word much more tangible, than plans for flood control and irrigation; however important the latter may be in the future, they are at present, to say the least of it, slightly vague. The important thing is that money should be permitted to talk and to dictate decisions, and so it does: it talks to Tanesco the way it always talks to power enterprises."*[22]

The Kidatu and Mtera plants in the Great Ruaha river basin were the largest of about half a dozen hydropower projects which substantially transformed the Tanzanian electricity infrastructure. At the time of independence it consisted of a few isolated grids in larger cities and a low-voltage grid supplying hydropower from Pangani Falls to the sisal plantations in the north. In 1990 high voltage transmission lines connected the key hydropower sites at Pangani and Greater Ruaha rivers with the coastal grid system around Dar es Salaam and most of the bigger cities in the northern part of the country.[23] Hydropower development dramatically increased the country's total installed capacity, which had been below 50 MW in 1960 – a low figure even for a developing country.[24] Between 1960 and 1990, 380 MW of hydropower were added to the grid, about 200 MW of which from Great Ruaha, and by 1990 hydropower contributed 95% of the countries total electricity generation.[25]

The effects of this increase of this transition of the generation and transmission system on service provision show an ambivalent picture. On the one hand, it allowed for an increase of the number of connections from 11,000 in 1950 to 156,000 in 1990, further rising to about half a million in 2000.[26] It is one of the major accomplishments of state-led development, to deepen access to electricity in the urban areas beyond colonial service provision. Being a privilege a nearly exclusive privilege for the European and Asian population in colonial times, it became available to a base of urban African electricity users. By 2000, coverage had expanded to 59% of Dar es Salaam residents and around 30% in other urban areas. On the other hand, benefits of electricity access remained comparatively low on national scale and were unevenly distributed between urban and rural areas:[27] In 2000 still only 10% of households in Tanzania had access to grid electricity and a mere 1% of households in rural areas.[28] In regard to electricity provision, African socialists' promise of rural development was not fulfilled. At Kidatu, for example, electricity leaves the hydropower site on 220 kV high-voltage transmission line, passing numerous unelectrified villages and going directly 300 km to Dar es Salaam and the Ubungo control center for further distribution into the national grid. This picture seems to illlustrate, what Showers has conceptualized as an "urban exploitation of distant (invisible) ecosystems that accompanied expanded transmission capabilities", connecting "widely separated islands of Neo-European technological modernity over the heads of excluded African majorities".[29]

Its patterns of physical infrastructure was not the only feature of centralized power model, which made an extension of service provision to rural areas a particularly challenging undertaking, but also the associated monopolistic structures, tariff systems and planning processes. During colonial times, tariffs were sectorally and regionally highly differentiated and reflected local loads and generation costs. Two years after its nationalization in 1964, Tanesco

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22 World Bank consultant John Fletcher, quoted from Öhman, Taming Exotic Beauties, 186. As a closer look on the appraisal futhermore shows that it was the only World Bank's methods of economic calculation, the "discounted cash flow" method and credits at a low rate of interest through which SIDA and the World Bank which made the Great Ruaha power project a it better alternative from a cost aspect compared to a diesel plant (Öhman, Taming Exotic Beauties)

23 Still, some cities especially in the western and southern parts of the country are not connected to the national grid and are supplied by isolated grids.

24 Hans Amann, Energy Supply and Economic Development in East Africa, London 1969.

25 Ghanadan, Public Service or Commodity Goods, 59.

26 Ghanada, Public Service or Commodity Goods.

27 Björn Kjellström, Maneno Katyega , Henry Kadete, Dolf Noppen, Abu Mvungi, Rural electrification in Tanzania. Past experiences – New Approaches. Stockholm 1992.

28 Ghanadan 2008.

29 Showers, Electrifying Africa, 215, 207.

adopted a model of four standardized national tariffs. It was praised by contemporary experts for its simplicity, equal treatment of sectors and regions and increase of revenues but rendered isolated systems and rural electrification projects highly uneconomic. Except for a few projects, which were highly subsidized by the government, "RE (rural electrification - author's note), remaine[d] in a very early stage of development which must be characterized as being just a wish or hope, formulated as a consequence of a rural-production-oriented development policy of "self-reliance".[30] In reality, electricity policy and -planning was largely centrally administered, expert driven and emphasized macro-level objectives. The Power System Master Plan focused on generation and transmission up to the level of substations and was more or less detached from local distribution planning, which was done on branch level.[31]

Besides the structural imbalance, giving advantage to urban areas, the transition to a centralized power infrastructure also lead to some inherent problems related to its high dependence on large hydropower plants. These problems became apparent when in 1992 a combination of factors, including of shortcomings of the Great Ruaha projects' design, mismanagement and a natural drought led to a dramatically decrease in generation which affected the whole centralized national grid. For two years electricity had to be rationed in Dar es Salaam. With the first free elections shortly ahead in 1993, this supply crisis put the ruling *Party of the Revolution* under enourmous pressure to act. In the hectic attempt to expand power supply, the monopoly of Tanesco in electricity generation was lifted to invite private investors to build new power plants. Two Independent Power Producers were hastily contracted and started to build a new "emergency" power plant each, one was run with diesel, the other with gas. When the diesel plant was finally connected to the grid in 2002, it was among the most expensive projects of its kind on the continent.[32] It is not without a certain irony that the construction of a large hydropower plant which was not least motivated by the prospect of getting independent from diesel imports, finally lead to a chronic contractual dependency on an expensive diesel-powered plant. Whenever water levels are low at Mtera, Tanesco enters into a "financial limbo", buying electricity at rates between 34-50 US cents from the independent power producers and selling it at around 12 US cents.[33] It has only been recently that efforts to escape this dead end – through tariff increases, a number of new generation and transmission projects which are financed either by the state or by public-private-partnerships, and a progressive regulatory framework for Small Power Producers – have delivered first successes.

30 Amann, Energy Supply and Economic Development, 126, 164.

31 It is only at present, that efforts are being made to merge both plans, as the former director of Tanesco's research department stated in an interview.

32 Rebecca Ghanadan, Connected geographies and struggles over access: Electricity commercialisation in Tanzania, in: David A. McDonald (eds.), Electric Capitalism: Recolonising Africa on the Power Grid. Kapstadt 2009, 400-436; Michael Degani, Emergency Power: Time, Ethics, and Electricity in Postsocialist Tanzania, in: Sarah Strauss/ Stephanie Rupp/ Thomas Love (eds.), Cultures of Energy. Walnut Creek (2013), 177-193; Martin Walsh, The not-so-Great Ruaha and hidden histories of an environmental panic in Tanzania, in: Journal of Eastern African Studies 6, 2 (2012), 303–335.

33 Quoted from a keynote of theTanzanian Minister of Energy and Mines 2014 at the Powering Africa, Tanzania conference from in January 2014 in Dar es Salaam.