

Mapping Renewable Energy Projects in Southern Africa

This policy brief presents the results of a statistical analysis conducted to understand the relationships and patterns of associations between variables like technologies, financing patterns, countries involved in a database of 150 renewable energy projects from Mozambique and South Africa. This included the relationships between the roles that rising power countries – China, Brazil and India– play in these 150 projects. For this, the relative frequencies of the variables were extracted which was followed by detailed association analysis.

The analysis reveals the priority areas for the various rising power countries – China prefers to focus on technologies and India on project development while Brazil's focus is distributed. It also reveals that renewable energy development in South Africa is mainly focused on grid-connected, MW scale projects based mainly on Solar (PV and CSP) and wind technologies while in Mozambique its mainly sub-MW, off-grid solar technology projects.

Our Research: The Rising Powers, Clean Development & the Low Carbon Transition in Sub-Saharan Africa funded by the Economic and Social Research Council (ESRC): ES/J01270X/1. Fieldwork for the project was undertaken in Mozambique, South Africa, China, India and Brazil between 2012 and 2014 and involved a combination of semi-structured interviews and community-based research methods. Our research also involved the creation of a database of clean energy projects and investments in South Africa and Mozambique.

What are the Rising Powers doing?

Out of 150 projects in the database, the rising power countries are involved in 109 projects (73%). In contrast, the other two groups of countries – one we called 'African countries' and a group we termed 'others' – are involved in 148 projects each. The 'African countries' investing in these projects consisted only of the two host countries – Mozambique and South Africa – in which the fieldwork was conducted. The 'others' consisted mainly of European countries and the World Bank, all of which have a long history of involvement in development and infrastructure projects in Africa. The substantial – 73% - involvement of the rising power countries in these projects differs from the other two groups because they are neither driven by state responsibility – as in case of the Mozambique and South Africa – nor by historical path dependency – as in case of the 'others'. We examined the different roles that rising power countries were playing in these projects: as technology manufacturer; as technology provider (sourcing it from someone else); as project owner; as project developer; and as finance and investment provider. The analysis revealed variations in the approach of the rising power countries but also indicated correlations between roles which actors from each country were adopting.

China

The analysis of projects with Chinese involvement reveals that China's main focus is in the technology space. China also leads in the overall technology space among the rising powers. However, this is based on its strong focus in South Africa. In Mozambique, where India leads the technology space, China has minimal presence. Relationship analysis reveals that the presence of Chinese technology does not depend on any role other than the presence of Chinese technology providers - 96% projects with Chinese technology have a Chinese technology provider (Figure 1) – in the projects.

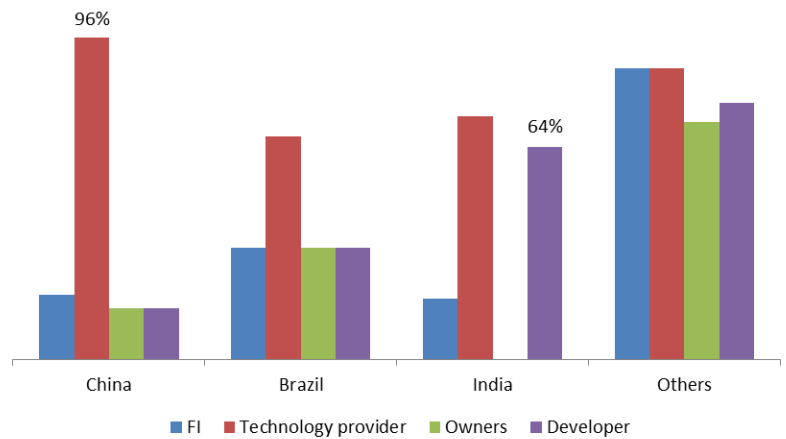


Figure 1: Country wise relationships between technology and other criteria

However, both Chinese ownership and finance are associated with Chinese technology. There is a strong relationship between Chinese ownership and finance with 100% Chinese owned projects having Chinese finance and 83% of the projects with Chinese finance having Chinese owners. However, this also means that Chinese ownership has a greater dependence on Chinese finance compared to Chinese finance's dependence on ownership.

Brazil

Brazil's involvement is limited to very few projects although it spreads across various categories. Like China, ownership and finance show strong relationship with 100% Brazilian owned projects having Brazilian finance and vice versa.

India

India's main involvement is as a project developer, closely followed by a focus in the technology space. However, the other variables do not show as strong a relationship as in the Chinese case. Most significant among these is the relationship between the project developer role and technology and that between ownership and finance. 64% projects with an Indian technology have Indian developers and 50% projects with Indian developers having Indian technology. All projects with Indian ownership have Indian finance (Figure 2) but only 60% projects with

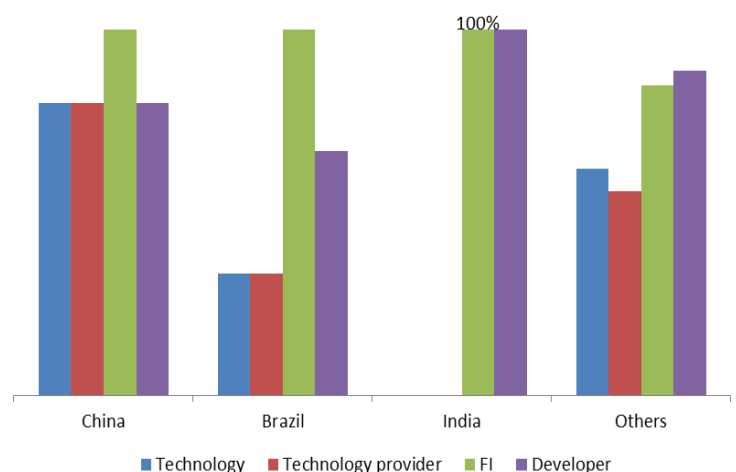


Figure 2: Country wise relationships between project ownership and other criteria

Indian finance have Indian ownership. With no overlap of projects between the two categories ownership and technology show no relationship for India. Similarly, Indian technology and finance have no relationship as 40% Indian financed projects use India technology but only 18% projects with Indian technology have Indian finance.

What is happening in South Africa and Mozambique?

Project Technologies

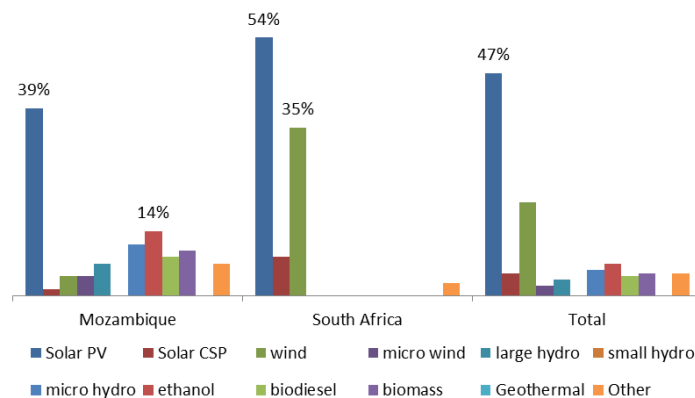


Figure 3: Technology distribution in the projects in Mozambique and South Africa

Solar PV is the most dominant technology in both countries whereas wind and ethanol are the second most frequent in South Africa and Mozambique respectively (fig.3). It is interesting to note that there is a higher level of variety in the technologies being deployed in Mozambique than in South Africa only solar (PV & CSP) and wind are present.

Project size and grid connectivity

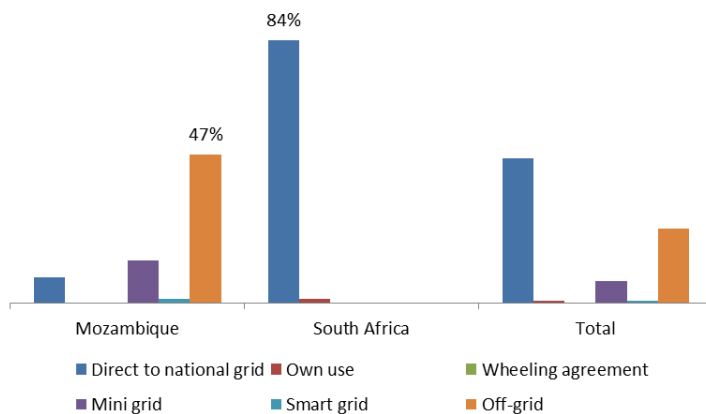


Figure 4: Grid connectivity status of the projects in Mozambique and South Africa

The projects in South Africa are predominantly of MW scale projects while in Mozambique sub-MW scale. Often larger projects are easier to connect to the grid than cater to the local demands through micro/mini grids or individual consumption. The opposite is true for micro scale projects. They are difficult to synchronise with the grid and thus connecting them to the national grid become difficult. Thus, they may be better suited to local supply through micro/mini grids or individual consumption. This reflects in the grid

connectivity status of projects in South Africa – predominance of the projects supply electricity directly to the national grid – and Mozambique – predominance of non-national grid connected projects.

The relationship between grid connectivity and project size is well established in the case of South Africa. Here, 100% MW scale (1-100 and 100-500MW) projects are grid connected. Conversely, 97% of the grid connected projects fall in this category (fig.4). This shows a strong relationship between project size and grid connectivity status. In Mozambique within the sub MW category 60% projects

are either off-grid or based on mini grids. However, enough data is not available to conduct the converse analysis and thus the relationship cannot be fully established.

Key Findings

Although the rising power countries are involved in fewer projects compared to the groups we termed 'African countries' and 'other', their involvement is still substantial. We found they had a role to play in 73% of the projects we identified. The extent of involvement and roles taken vary depending on the rising power country and the host country.

The dependencies and relationships between the various roles adopted by the countries are complex. There is no simple relationship between particular technologies, host countries, forms of finance provision, ownership and so on. Nonetheless, we find that organisations based in India and China have a more extensive set of roles in relation to the development of renewable energy projects than those based in Brazil.

The analysis also reveals the existence of two distinct models of renewable energy projects connected to the forms of electricity provision that dominate each country. With mainly sub MW scale and off grid projects, Mozambique follows a 'stand-alone' model in which projects are based on the provision of basic energy services at the domestic scale. In contrast, in South Africa projects are mainly MW scale and grid connected with renewable energy projects intended to provide electricity for grid-scale provision that may or may not translate into the development needs of the poorest.

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Please visit our project website: <http://www.dogweb.dur.ac.uk/the-rising-powers/>

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