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Preparing hydropower projects for the post-Paris regime: An econometric analysis of the main drivers for registration in the Clean Development Mechanism

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ABSTRACT

The 2015 Paris Climate Accords promises to reign in a new era in the fight against global climate change. The Agreement supports the establishment of new cooperative approaches including internationally transferred mitigation outcomes, through which individual countries can meet their nationally determined contributions. Hydropower projects, however, are in danger of being left out in the new regime mainly due to its dubious position as a renewable energy source. Hydropower in the Clean Development Mechanism (CDM) has been criticized for non-conformance to additionality and sustainability objectives originally set out in the Kyoto Protocol. To confirm such issues, and to provide recommendations that may mitigate them, this study conducted an econometric analysis of 2717 hydropower projects in the CDM pipeline leading up to 2016. Specifically, a logit model was constructed to identify the main drivers for registration success. Results of the analysis showed the capacity and expected carbon credits of hydropower projects to be the dominant factors for registration, rather than their financial requirements or technological barriers. Most problematically, large scale projects not requiring carbon credits were registered, while their social and environmental impacts have not been extensively scrutinized. Policy recommendations to rectify the verification process are proposed, so that when implemented, the right hydropower projects may be included in the new market mechanisms of the post-2020 regime.

1. Introduction

The 2015 Paris Climate Accord is viewed as a watershed moment in the global effort to combat climate change. With 195 nations having agreed by consensus to adopt the Agreement, it is the world's first comprehensive climate agreement in the goal of reducing global warming. Each country is individually required to undertake 'Nationally Determined Contributions (NDC)" of their own choosing, which represents "ambitious" targets "with the view to globally achieving the purpose of the Paris Agreement [1]."

Taking effect in 2020, the Conference of the Parties (COP) is in the process of elaborating new rules, modalities and procedures pertaining to international market mechanisms as a tool for countries to fulfill their NDCs. One such mechanism expected to emerge is an amended form of the Clean Development Mechanism (CDM) [2]. Referred to as the "Sustainable Development Mechanism (SDM) [1]" or "CDM+," it is expected to expand CDM's role as a centralized mechanism that provides industrialized countries flexibility in reducing emission reduction targets by implementing projects in developing countries.

To be viable, however, the new crediting mechanism must address and resolve many of the issues that have troubled CDM and consequently has limited its impact. Most notably, it needs to reevaluate which sectors (i.e., project types) truly qualify as a renewable energy source and thereby are eligible for carbon financing in the post-2020 regime.

Hydropower projects, in particular, will be scrutinized extensively. Existing studies have noted that many registered hydropower projects in the CDM do not adhere to additionality requirements and sustainability objectives set out in the Kyoto Protocol. Schneider [3] assessed that carbon credits were not vital for hydropower projects and would have been implemented regardless of the added income. Haya and Parekh [4] noted that projects with severe, negative social and environmental impacts have been registered as legitimate CDM projects. As early as 2004, dam opponents have argued for the total

Abbreviations: CDM, Clean Development Mechanism; CERs, Carbon Emission Credits; COP, Conference of the Parties; DOEs, Designated Operational Entities; GHG, Greenhouse Gas; JI, Joint Implementation; NDC, Nationally Determined Contributions; PDDs, Project Design Documents; SDM, Sustainable Development Mechanism; SHP, Small-scale Hydropower Plant; UNFCCC, United Nations Framework Convention on Climate Change; WCD, World Commission on Dams

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exclusion of large scale hydropower projects from CDM.

Such controversies have resulted in banning hydropower from global trading platforms, and consequently increasing hydropower's risk of being "locked out" from the post-Paris regime's new market mechanisms altogether [5]. Yet, with 70% of hydropower projects worldwide still needing development [6], especially in emerging economies, selective inclusion of hydropower projects seems to be a more practical intervention.

This study performed an econometric analysis of 2717 hydropower projects in the CDM pipeline leading up to 2016. Specifically, a logit model was constructed to identify the significant factors driving CDM registration, as successful registration, by definition, reflects confirmation of their additionality and conformance to sustainability goals.

The objective of the analysis was twofold. First, it provided empirical evidence of the main drivers used to register projects, and thus enabled confirmation of the assertions made for and against the legitimacy of CDM hydropower projects. Secondly, the results provided the basis for improvements in CDM's hydropower selection process, so that such reforms may be adapted by the new mechanisms of the post-2020 regime, and ultimately enable the prudent selection of sustainable hydropower projects.

The remainder of this article is organized as follows: Section 2 provides a brief review of CDM's current status, the major issues pertaining to CDM hydropower projects, and factors impacting registration. Section 3 introduces the data and methodology used to construct the logit model. Section 4 provides discussions and extended analysis based on the results, while Section 5 summarizes the main policy recommendations going forward.

2. Research background

2.1. Limitations of CDM and opportunities in the Paris Agreement

The CDM allows Annex I countries to meet part of their emissions reduction commitments by buying Certified Emission Reduction (CERs) units from greenhouse gas (GHG) abatement projects in non-Annex I countries [7]. Besides Emissions Trading and Joint Implementation (JI), the CDM is the only flexible mechanism that provides incentives for emission reduction projects in developing countries [8]. In addition to saving abatement costs, the CDM promotes sustainable development in non-Annex I countries [9], and is also considered by many as a key means to boost technology transfer and diffusion [10,11].

Lately, however, CDM has encountered shrinking participation, in major part due to the collapse of CER prices in the EU-ETS in the post-2012 regime [12]. The reliance on the EU-ETS as a sole source of demand, where low economic growth and few restrictions placed on the types of credits, has created a generous oversupply of CDM credits. The CDM has also been criticized on multiple fronts [13] including, the apparent leniency on sustainable development goals [9,14]; the unequitable distribution of regional and sub-regional projects [6,15,16]; and paradoxically, being marginal in terms of its financial impact for the more commercially challenged projects [17–19]. The market failure coupled with these challenges has resulted in a drastic reduction of post 2012 CDM activities.

In this regard, the Paris Agreement provides a crucial opportunity to revitalize the core features and role of CDM. The new mechanism, i.e., "SDM", defined in Article 6.4 [1], promises to extend and expand its predecessor's scope, while creating liquidity of tradable units multilaterally, ensuring environmental integrity, and fostering engagement. The COP recommends that the CMA[1] adopt "rules, modalities, and procedures" for the new mechanism at its first session, while learning from past experiences of JI and CDM.

The Agreement gives individual countries a green light to develop carbon markets domestically and even trade emissions reductions internationally, enabling an international market where demand is not restricted to the Annex I countries, relaxing the pressures from the oversupply of carbon credits.

However, the Agreement also frames environmental integrity on a par with emission reductions, so parties may require measured sustainable development outcomes to be eligible for crediting. In this regard, the new market mechanism must address the limitations of CDM by ensuring that truly additional and sustainable projects are selected. This research strived to provide recommendations in this regard, with specific focus on hydropower projects.

2.2. Controversy over CDM hydropower projects

Hydropower projects have been a major and integral part of the CDM portfolio. As of 2015, hydropower constituted 20.14% of all CDM projects in the pipeline database, totaling 2717 projects, with a total of 342,706 kCERs for expected issuance of CERs. Large hydro projects have received the largest confirmed carbon offsets in the CDM pipeline, and if emissions reductions continue as the pipeline implies, hydropower will overtake industrial gas projects as the largest mitigation tool under the CDM by 2020 [5].

However, there has been extensive criticism in the literature about the validity of hydropower as a clean and renewable source of energy and in meeting sustainability objectives.

The CDM requires each approved project to be 'additional': that it only went forward because of the extra financial support from the sale of carbon credits and would not have gone forward otherwise. However, Haya [20] showed that 35% of all "carbon-offsetting" dams registered until 2007 have already been completed at the time of being registered. Schneider [3] demonstrated that 40% of all registered hydropower projects are likely to be non-additional and would have been implemented anyway. Such evidence implies that the sale of carbon credits from CDM hydropower projects are in many cases an "additional income" that is not vital for the origination of additional projects [21].

Additionality testing also requires demonstrating that projects contribute to the transfer and dissemination of new low-carbon technologies through a common-practice-analysis. However, most forms of hydropower generation are technologically mature and widespread over the world [22]. Countries such as China and India, where three quarters of CDM dams are located, have included hydropower development in their national agenda since the 1960s. It is paradoxical to say that CDM provides the impetus for new technologies, when these countries have already built some of the largest dams in the world.

In terms of sustainable development, hydropower projects can have negative and severe impacts on ecosystems, displace communities, loss of agricultural land and decline in biodiversity [20]. Moreover, reservoir dams can generate methane, a greenhouse gas (GHG) 25 times the global warming potential to carbon dioxide, effectively "squashing" the green credentials of hydropower [23].

The European Union consequently requires that dams larger than 20 MW must comply with World Commission on Dams (WCD) environmental and social standards if their CERs are to be traded within the Union. However, Pittock [24] noted that there is no convincing case of WCD compliance by any CDM hydropower project [17], and that the CDM is providing incentives for hydropower projects with few environmental constraints.

This is particularly relevant for large scale hydropower projects, as realizing sustainability objectives usually requires additional investment, thus rendering them more expensive. This leads to a "race to the bottom" to yield more projects with the cheapest abatement costs, which is achieved by setting lower sustainability standards [14]. This also disadvantages small scale projects that only generate a small

[1] CMA refers to the Conference of the Parties serving as the meeting of the Parties to this Agreement.