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Behind an ambitious megaproject in Asia: The history and implications of the Bakun hydroelectric dam in Borneo

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ABSTRACT

Using a case-study, inductive, narrative approach, this article explores the history, drivers, benefits, and barriers to the Bakun Hydroelectric Project in East Malaysia. Situated on the island of Borneo, Bakun Dam is a 204 m high concrete face, rock filled dam on the Balui River in the Upper Rajang Basin in the rainforests of Sarawak. Bakun Dam and its affiliated infrastructure could be the single largest and most expensive energy project ever undertaken in Southeast Asia. Based on data collected through site visits, original field research in Sarawak, and more than 80 research interviews, the article begins by teasing out the complex history and drivers behind the Bakun project before identifying a set of potential social, political, and economic benefits the project could deliver. It then delves into six sets of barriers in the technical, economic, political, legal and regulatory, social, and environmental realms. We find that Bakun illustrates how centralized energy megaprojects, while ostensibly championed for reasons of economies of scale and the ability to bring about transformational change in the shortest period of time, often fail to address broader development goals such as fighting energy poverty and improving the livelihoods of the local communities they are supposed to serve.

1. Introduction

This article explores the dynamics of the Bakun Hydroelectric Project (BHP) in East Malaysia. Situated on the island of Borneo, the BHP is a 204 m high concrete face, rock filled dam on the Balui River in the Upper Rajang Basin in the rainforests of Sarawak. By some metrics, BHP and its affiliated infrastructure could be the single largest and most expensive energy project ever undertaken in Southeast Asia.

Based on data collected through site visits, original field research in Sarawak, and more than 80 research interviews, the article begins by teasing out the complex history and drivers behind the Bakun project before identifying a set of possible benefits the project could deliver. It then delves into six sets of challenges the project either had to overcome or still has to overcome. Technical challenges include the unique hydrology of the site, lack of supporting infrastructure in Sarawak, excavation and construction, and shortages of personnel. Economic challenges include cost overruns, financing, settling the power purchase agreement, and community welfare. Political challenges include the cancellation of the undersea cable to Peninsular Malaysia, inadequate planning, corruption and nepotism, and political literacy. Legal and regulatory challenges include a restrictive land code, lack of a national energy policy, lawsuits filed over the Environmental Impact Assessment (EIA) process, and a lingering government commitment to fossil fuels. Social challenges include community relocation and resettlement, boom and bust towns from construction, community livelihood, and unfair compensation. Environmental challenges include deforestation, greenhouse gas emissions, changes to hydrology and water quality, and aluminum smelting. The article concludes by offering implications for those wishing to promote other large-scale, hydroelectric projects or other energy megaprojects throughout the world.

The importance of the article is threefold. First, and most specifically, the Bakun Hydroelectric Project (BHP) is at the cornerstone of the Sarawak Corridor of Renewable Energy, or SCORE, an ambitious plan to develop dozens of dams to attract energy-intensive industries, create jobs, and grow the economy. Sarawak has 155 potential dam sites and the potential to develop 80,000 MW of hydroelectric capacity with an annual output of 340,000 GWh per year, though commercially achievable potential is closer to 28,000 MW (Sovacool and Bulan, 2011). At the time of writing, the SCORE Master Plan calls for developing up to 51 of these sites into 20,000 MW of capacity that will produce 87,000 GWh per year, with the first 12 of those dams constituting 7000 MW depicted in Table 1 (Suhakam, 2009). In essence, SCORE would increase generating capacity from 966 to 12,000 MW and

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Table 1
Proposed Hydroelectric Projects under the Sarawak Corridor of Renewable Energy. *Source*: Suhakam (2009); Chang (2009).

Project	Capacity (MW)	Date operational
Bakun	2400	2011
Murum	944	2013
Baram	1000	2015
Limbang	200	2015
Lawas	105	2015
Baleh	1400	2017
Linau	320	2020
Belaga	260	2020
Tutoh	160	2030
Belapeh	140	2030
Batang Ai	80	2030
Ulu Air	54	2030
Total	7063	

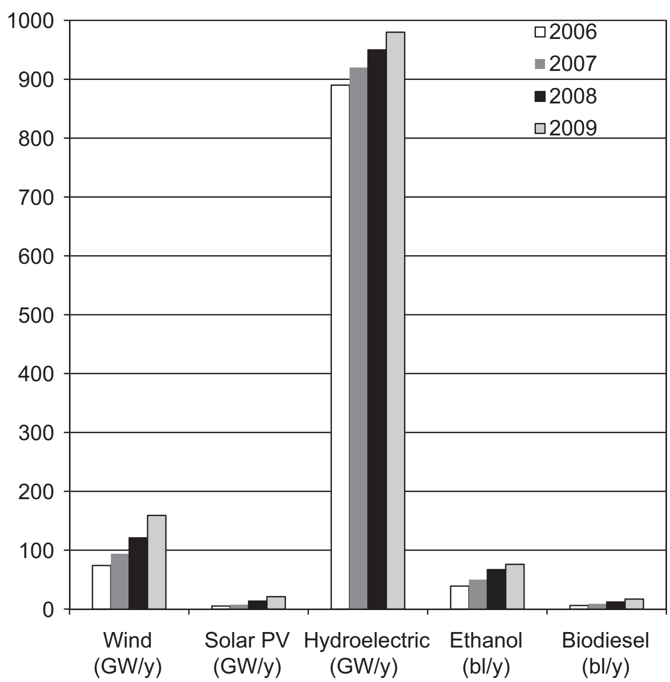

Fig. 1. New global installed capacity for select renewable energy systems, 2006–2009.

20,000 MW by 2020 and 2030, respectively, if all goes as planned. No work in the academic community has yet focused on the full broader implications of Bakun, however, and the most recent research from Choy (2005a, 2005b) is now more than 6-year old. Furthermore, unlike studies using predominately economic approaches to explore Bakun (and other dams), we rely on a grounded case-study approach that has archival value, for which we have collected primary data directly from indigenous communities. In sum, our piece offers a much-needed update about Bakun, and it is likely that the lessons learned from it will be applicable to the other dams planned for SCORE.

Second, and more generally, although hydroelectric dams are one of the oldest forms of generating electricity, they have recently become attractive alternatives to carbon-belching fossil fueled power stations and prohibitively expensive nuclear power units. Wind turbines and solar panels have become iconic symbols of new investments in renewable energy, yet 31 GW of hydroelectric capacity was added in 2009, an increase in capacity second only to wind power among all sources of renewable energy. Fig. 1 also shows how total installed capacity and investments in hydropower dwarfed that of all other major renewable sources of energy. China roughly doubled its hydroelectric capacity from 2004 to 2009 and significant expansion is expected in Brazil, India, Russia, Turkey, and Vietnam (REN 21, 2010). Yet despite this investment, 1 billion people still lack adequate supplies of drinking water and accelerated agricultural production has stressed the need for greater irrigation and flood control, creating an intense drive for more dams (Khagram, 2005). Every year about 4 million people are displaced by activities relating to hydroelectricity construction or operation, and 80 million have been displaced in the past 50 years from the construction of 300 large dams (Mamit, 2010; Jehom, 2008). How hydroelectric facilities are constructed and managed, the strength (or weakness) of environmental and social impact assessments, determines the extent of their social and economic impacts (Swain and Chee, 2004; Lee, 2002). Our article brings into focus the challenges involved with building large dams, challenges that can help inform the global debate concerning dams and development.

Third, and most broadly, to deal with rapidly rising demand for energy, especially in developed countries, policymakers have come to rely more on megaprojects. Megaprojects typically involve large, multi-billion dollar forms of capital intensive infrastructure such as dams, pipelines, nuclear power plants, and interstate electricity transmission networks. Driving forces behind energy megaprojects include perceived economies of scale, the stockpiling of resources, the crafting of multilateral consortiums to achieve synergies, and engendering a sense of shared vulnerability to the risk of accidents and disruptions that can promote "coordination and cooperation" (Sovacool, 2010b). By focusing on one such megaproject in Asia our study delves intimately and intricately into the factors that can promote or constrain them.

2. Research and conceptual methods

To explore the drivers, benefits, and barriers to the BHP, we relied primarily on original data collected through research interviews along with site visits and field research, supplemented with a review of the academic literature.

The authors conducted 85 semi-structured, open-ended, and grounded interviews with participants from 37 institutions involved with the BHP over the course of March 2010–July 2010. Those interviewed were selected to represent the diverse array of stakeholders involved with the BHP, and included members of:

- Engineering and construction firms such as Alstom Hydro, Sarawak Hidro, and Snowy Mountains Engineering Corporation;
- Government ministries at the federal level, including the National Economic Advisory Council, Economic Planning Unit in the Prime Minister's Department, the Public Private Partnership Unit of the Prime Minister's Department, the Ministry of Energy, Green Technology and Water, and the Ministry of Natural Resources and the Environment;
- Regulatory agencies at the state level, including the State Planning Unit of the Sarawak State Government, Sarawak Rivers Board, Natural Resources and Environment Board Sarawak, and the Regional Corridor Development Authority;
- Energy companies and electric utilities, including Petronas, Sime Darby, Tenaga Nasional Berhad, Sarawak Energy Berhad, and Syarikat Sesco Berhad (formerly the Sarawak Electricity Supply Corporation);
- Human rights organizations including the Bar Council of Malaysia, Human Rights Commission of Malaysia (SUHAKAM), and Suara Rakyat Malaysia (SUARAM);
- Research institutes and civil society organizations, including the Center for Environment, Technology, and Development