Sustainable Energy Technologies and Assessments 25 (2018) 75–98

Contents lists available at ScienceDirect

Sustainable Energy Technologies and Assessments

journal homepage: www.elsevier.com/locate/seta

# A blue energy option for the Mekong River Basin. An international law analysis on Asian regional cooperation in pioneer osmotic power projects

Rafael M. Plaza[1]

*School of Public Administration, China University of Geosciences (CUG), Wuhan, Hubei, PR China*

ARTICLE INFO

*Keywords:*
Blue energy
Osmotic power
Mekong
Environmental law
Project
Asia

ABSTRACT

Based on existing institutional and financial frameworks, the paper foresees Southeast Asian countries jointly tapping salinity gradient through a pilot project on the Mekong Basin. The paper delves on environmental, regulatory and economic challenges of introducing clean cutting-edge blue energy. It aims at encouraging the Mekong River Commission as regional cooperation framework to include it in its development strategy as a means to create a critical mass for cooperative R&D, take advantage of synergies among countries' power generation and environmental conservancy plans, as well as to create opportunities for business, consumers and local authorities to partake in Asia's low-carbon transition.

## Introduction

The Earth is warming more quickly today than it has for 50 million years. International initiatives such as Sustainable Energy for All (SE4ALL),[2] the United Nations Framework Convention on Climate Change (UNFCC) and the Paris Agreement[3] pursue efforts to limit the world's rise in average temperature, to achieve universal access to sustainable energy, and double the share of renewable energy in the global energy mix by 2030.

Asia, as the most populated and fastest growing continent on Earth, has a part to do in the low-carbon transition and protecting world's biodiversity. However, a large share of its population still lacks access to modern energy: 2 billion people have no access to non-fossil fuels; and 400 million people have no electricity. Due to lack of infrastructure and capital investment, most Asian countries experience energy shortages that constrain business activities, research and ultimately development.

In turn, Southeast Asia is geographically divided into two sub-regions, namely, mainland Southeast Asia and maritime Southeast Asia, this latter comprising the South China Sea. Vietnam and Malaysia have integral rivers that flow into the South China Sea. One of these is the Mekong River, the so-called hydrologic backbone of mainland Southeast Asia and – according to this survey – a potential massive contributor to achievable sustainable development for the sub-region.

### *Scope, thesis and methodology*

Our survey refers to mainland southeast Asia, the continental portion lying east of India and south of China, bounded by the Indian Ocean to the west and the Pacific Ocean to the east and, specifically, to

*E-mail address:* rplaza_cl@yahoo.com.

[1] Rafael M. Plaza possesses vast professional experience on Energy, Natural Resources and Environmental Law. He holds a PhD and an LL.M. from the University of Melbourne (UNIMELB) as well as an LL.M. from the New York University (NYU). Dr. Plaza is Research Fellow at the University of Chile (U) and recently conducted post-doctoral research in China. He was Visiting Research Fellow at the Lauterpacht Centre for International Law of the University of Cambridge (CAM) and first A. Watts Research Fellow of the British Institute of International and Comparative Law, in London. He is member of the Centre for Resources, Energy and Environmental Law (CREEL) and Melbourne Academy for Sustainability & Society (MASS). His PhD thesis on transnational power transmission networks turned into a book published in Germany; and he has also published in the UK, Australia, Chile, and Qatar. This paper is the outcome of the two-year post-doctoral stay as visiting scholar in the School of Public Administration of China University of Geosciences (CUG) in Wuhan, Hubei, of the Peoplés Republic of China, after being awarded by the Government of Chinás Scholarship Programme. The author also expresses his gratitude to the Law School of the University of Chile (U) for supporting this project. Last, but not least, the author deeply thanks Prof. Tu Yinan, researcher of the Key Laboratory of Law Evaluation Engineering of the Ministry of Land and Resources of China and lecturer at CUĠs School of Public Administration for her support, kindness, and inspiration along the course of this research project.

[2] Sustainable Energy for All (SE4ALL) at http://www.se4all.org/ (accessed on 19.12.2016).

[3] The Paris Agreement was opened for signature on April 22nd, 2016 and entered into force on November 4th, 2016. It is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) which, in turn, was opened for signature on June 4th, 1992 and entered into force on March 21st, 1994.

https://doi.org/10.1016/j.seta.2017.11.002
Received 14 August 2017; Received in revised form 19 October 2017; Accepted 20 November 2017

the so-called Greater Mekong Sub-region comprising Vietnam, Laos, Cambodia, Thailand, Myanmar, the Yunnan province in South China and West Malaysia. In terms of area, it represents approximately 1,56 percent of the earth's surface, yet home of more than 280 million of inhabitants.[4]

In such context, this paper addresses environmental and energy regional integration of interest to Cambodia, China, Laos, Myanmar, Thailand, and Vietnam all sharing the Mekong basin. It explores international environmental law and financial aspects of a regional cooperation framework for introducing a cutting-edge, $CO_2$ emissions-free, renewable energy technology on the Mekong: the salinity gradient power, a blue source of energy driven by the osmotic pressure difference occurring when fresh and sea water naturally mix, as in deltas and estuaries.

In terms of methodology, firstly, the papers deals with pressing environmental issues in Southeast Asia as to air, natural resources, and biodiversity as well as to essential technical explanations on salinity gradient, an osmotic power-based energy option. Next, it gradually moves on narrowing down the scope of the legal analysis: from international water law general rules to international environmental legal frameworks on international river basins, and then to international cooperation in the Mekong Basin and the interaction between riparian countries through the Mekong River Commission, considering all along China's stance as main Dialogue Partner[5] on Mekong's up – and downstream resources management. Since neither domestic regulations nor clean energy strategies of the riparian countries deal with osmotic power, the paper then goes on critically analyzing the conditions needed for a blue energy international cooperation framework. Finally, the research looks at financing schemes for osmotic power plants in the region, most particularly, under the recently opened for business Asian Infrastructure Investment Bank.

## I. Environmental issues in Southeast Asia

Nowadays, Southeast Asia faces a bunch of urgent environmental issues. Data for comprehensive ecosystem assessments have gradually become more available and very-well researched local studies around Southeast Asia have contributed to refine the regional environmental outlook.[6] Unfortunately, in some cases, they also have revealed the nature and extent of a serious environmental issues that, over time, have been (or not) adequately addressed by the corresponding governments; needless to say that initiatives of regional engagement are relatively new, and not always effective.

### *I.1. Atmospheric pollution*

The air pollution is a severe problem for public health and, as such, has received considerable scientific attention,[7] particularly in China. Air pollution causes urban and regional haze but also can be transported over long distances, and has the potential to significantly contribute to climate change through augmenting the atmospheric "greenhouse" radiation.[8]

In countries and areas with booming economies, such as China and India,[9] it is common to observe a strong increase in nitrogen dioxide, sulfur dioxide, ozone, and particulate matter $\leq 10\,\mu m$ in aerodynamic diameter ($PM_{10}$),[10] mostly attributable to fossil fuel and coal combustion for power generation, the metallurgical industry and the manufacturing of sulfuric acid in many cities of the developing world. In addition, photochemical smog – induced primarily from traffic – is also becoming an additional source of concern for air quality in megacities.[11] For instance, China has pledged that its greenhouse gas emissions will peak around 2030[12] and, accordingly enacted the Prevention and Control of Atmospheric Pollution Act in 1987, amended in 1995, and then revised in 2000.[13]

According to a Harvard report,[14] Southeast Asia's electricity demand is projected to increase by 83% between 2011 and 2035. A few main reasons for this staggering increase in energy demand are fast economic development, population growth and urban migration. Unfortunately, this demand is still likely to be met by coal-fired power plants rather than renewable energy sources.

The science has observed an association between significant decreases in nitrogen dioxide and other pollutants emissions and the implementation of air pollution controls for power plants,[15] not to mention substitution by renewable energy sources.

Although in China and India alternative electric generation is being installed – mostly wind and solar – which has great potential in helping clean up air pollution, in other coal-reliant emerging Southeast countries much progress in this matter is still to be achieved. For instance, the number of coal-fired power stations in Myanmar is expected to grow more than five times, from three to sixteen by 2030. In Vietnam even a larger increase is expected. Naturally, all this must be seen in perspective, since China consumes many times the coal than Southeast countries do.

In any case, the impacts of planned coal power expansion in Southeast and East Asia might be lessen should alternative power generation be taken into consideration and, within this context, blue energy arises as a timely and suitable option.

[4] According to the Department of Economic and Social Affairs, Division of Population of the United Nations, in 2015, the world population was 7.3 billion and is expected to reach 8.5 billion by 2030. 2015 Population Report, at http://www.un.org/en/development/desa/news/population/2015-report.html (accessed on 09/04/2017). See also UN World Population Prospects: 2015 revision, at http://esa.un.org/unpd/wpp/. The current population of China is 1,38,68,63,060 people whilst mainland Southeast Asia region is home to estimated 280.560.943 million inhabitants. At http://www.worldometers.info/world-population/china-population/ (accessed on 09/04/2017).

[5] In the context of the MRC 1995 Agreement, China and Myanmar are Dialogue Partners. In other words, upstream countries which are third parties to the 1995 Agreement, but whose cooperation is vital for the sustainable management of the Lancang-Mekong basin. Since 2002 China has entered into several Memorandums of Understanding (MOU) with the MRC covering data exchange and technical cooperation.

[6] For instance, the work of Prof. Fujimoto on mangrove areas in the Asia-Pacific region, where the proliferation of low-yield shrimp farms has destroyed large extensions of mangrove forests. Fujimoto, K., Below-ground carbon sequestration of mangrove forests in the Asia-Pacific region (2004). In Vannucci, M. (ed.) Mangrove management and conservation workshop (2004), Okinawa, Japan.

[7] Wong, Chit-Ming; Vichit-Vadakan, Nuntavarn; Kan, Haidong; Qian, Zhegmin, and the Public Health and Air Pollution in Asia (PAPA) project team. *Public Health and Air Pollution in Asia (PAPA): A Multicity Study of Short-Term Effects of Air Pollution on Mortality*. Environmental Health Perspectives; Research Triangle Park116.9 (Sep 2008): 1195–202.

[8] Molina Mario J. & Molina Luisa T., *Megacities and Atmospheric Pollution*, Journal of the Air & Waste Management Association, (2004) 54:6, 644–680, DOI: https://doi.org//10.1080/10473289.2004.10470936. p. 652.

[9] The two biggest economies in the Asia-Pacific area.

[10] Institute for Environmental Physics (IUP), at http://www.iup.uni-bremen.de (accessed on 24.03.2017).

[11] Vid n. 8.

[12] Chinese President Xi Jinping's statement at the November 2014 APEC summit.

[13] The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution was adopted at the 22nd Meeting of the Standing Committee of the 6th National People's Congress on September 5th, 1987; amended according to the Decision on revising it adopted at the 15th Meeting of the Standing Committee of the 8th National People's Congress on August 29th, 1995; and finally revised at the 15th Meeting of the Standing Committee of the 9th National People's Congress and promulgated by Order No. 32 of the President of the People's Republic of China on April 29th, 2000.

[14] Environmental Science & Technology. Burden of disease from rising coal-fired power plants emissions in Southeast Asia (ACS Publications, 2017). See also Perry, Juliet, Southeast Asia air pollution deaths could triple, news report available at CNN at http://www.cnn.com/2017/01/12/asia/southeast-asia-pollution-coal-report/ (accessed on 24.03.2017).

[15] Although regulations governing new power plants have led to significant greenhouse gases emissions reduction in China, many old plants still in operation in Southeast countries remain large sources of air pollution.