

# Mekong Environmental Resilience Week

13 September 2023



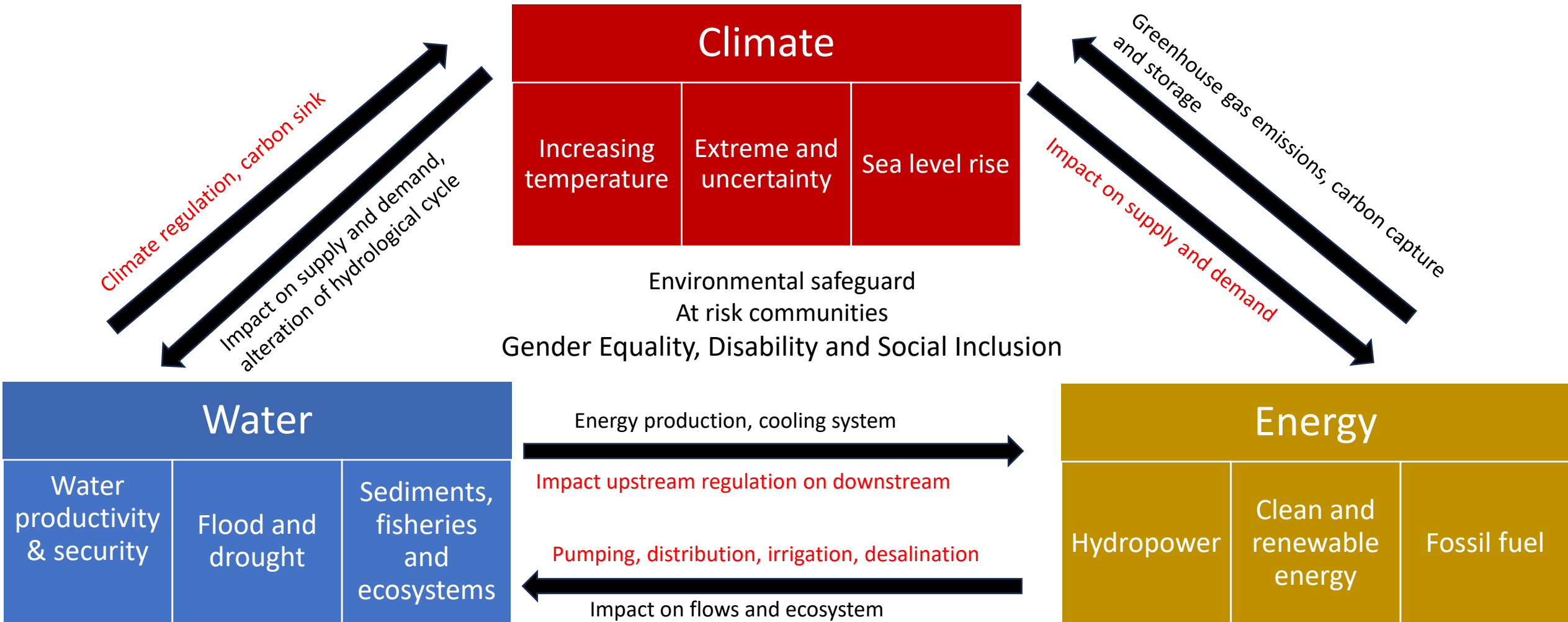
## Sustainable and Resilient Water-Energy-Climate Nexus in the Lower Mekong: Critical Knowledge Gaps

Dr. Thanapon Piman  
Water Cluster Lead/Senior Research Fellow, SEI Asia

Eastin Grand Hotel Sathorn  
Bangkok, Thailand



# Water-Energy-Climate Nexus in the Mekong



# Existing knowledge



Alexander Smajgl  
John Ward

## The Water-Energy Nexus in the Mekong

Assessing Development Sustainability Considering Cross-Sectoral Transboundary Impacts

MEKONG RIVER COMMISSION

### THE COUNCIL OF MINISTERS

The Study on the Sustainability of the Development of the Mekong Basin including Impacts of Major Projects

Cumulative Impacts  
Key Findings

Prepared by: The Council of Ministers  
December 2014

ÉTUDES DU CQEG

## EAST AND SOUTHEAST ASIA TRANSITION AND CUMULATIVE IMPACTS

Jérémy JAMMES, Frédéric LASSERRE, Édouard LÉVESQUE

The Nam Gouang Dam on the Nam Ou River

PHOTO: Eric Baran/Flickr/Licence CC BY-NC-ND 2.0 (<https://www.flickr.com/photos/ericbaran/>)

ÉTUDES  
Juillet 2021

Asia focus

CQEG  
Conseil québécois  
d'études géopolitiques

ÉTUDES DU CQEG

## Earth's Future

RESEARCH ARTICLE  
10.1029/2020EF001814

Special Section:  
Modeling MultiSector Dynamics in Hung Adaptive Pathways

**Key Points:**

- Extreme weather events doom long-distance power transfers between Laos and Thailand to temporary failures
- Regional droughts increase power production costs and CO<sub>2</sub> emissions by about US\$ 120 millions and 2.5 million metric tonnes per year
- The influence of El Niño Southern Oscillation trickles down from summer monsoon to power system behavior

**Supporting Information:**

- Supporting Information S1

**Correspondence to:**  
S. Galelli,  
[stefano.galelli@sutd.edu.sg](mailto:stefano.galelli@sutd.edu.sg)

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**AGU** ADVANCING EARTH AND SPACE SCIENCE

### The Greater Mekong's Climate-Water-Energy Nexus: How ENSO-Triggered Regional Droughts Affect Power Supply and CO<sub>2</sub> Emissions

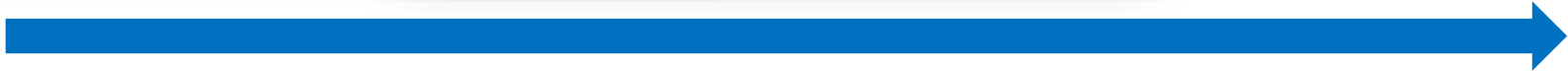
A. F. M. Kamal Chowdhury<sup>1,2</sup>, Thanh Duc Dang<sup>1</sup>, Hung T. T. Nguyen<sup>1</sup>, Rachel Koh<sup>1</sup>, and Stefano Galelli<sup>1</sup>

<sup>1</sup>Pillar of Engineering Systems and Design, Singapore University of Technology and Design, Singapore, Singapore, <sup>2</sup>Environmental Studies Department, University of California Santa Barbara, Santa Barbara, CA, USA

**Abstract** The Greater Mekong Subregion is a transnational area bound together by the Mekong River basin and its immense hydropower resources, historically seen as the backbone of regional economic development. The basin is now punctuated by several dams, successful in attracting both international investors and fierce criticisms for their environmental and societal impacts. Surprisingly, no attention has been paid so far to the actual performance of these infrastructures: is hydropower supply robust with respect to the hydroclimatic variability characterizing Southeast Asia? When water availability is altered, what are the implications for power production costs and CO<sub>2</sub> emissions? To answer these questions, we focus on the Laotian–Thai grid—the first international power-trade infrastructure developed in the region—and use a power system model driven by a spatially distributed hydrological–water management model. Simulation results over a 30-year period show that production costs and carbon footprint are significantly affected by droughts, which reduce hydropower availability and increase reliance on thermoelectric resources. Regional droughts across the Mekong basin are of particular concern, as they reduce the export of cheap hydropower from Laos to Thailand. To put the analysis into a broader climate-water-energy context, we show that the El Niño Southern Oscillation modulates not only the summer monsoon, but also the power system behavior, shaping the relationship between hydroclimatic conditions, power production costs, and CO<sub>2</sub> emissions. Overall, our results and models provide a knowledge basis for informing robust management strategies at the water-energy scale and designing more sustainable power plans in the Greater Mekong Subregion.

**Plain Language Summary** The development of hydropower dams in the Mekong River basin has historically been seen as a means to support economic growth in Southeast Asia. Because water availability varies on both seasonal and interannual time scales, we hypothesized that an unstable supply of hydroelectricity may temporarily increase reliance on gas and coal, thereby affecting power production costs and carbon footprint. To verify this hypothesis, we developed a coupled water-energy model of the Laotian–Thai grid, the largest power infrastructure in the region. The model represents the relationship between hydroclimatic conditions, water availability, and power system behavior. Simulation results show that prolonged droughts in the Mekong basin reduce hydropower production by about 4,000 GWh/year, increasing the annual production costs and CO<sub>2</sub> emissions by about US\$ 120 millions and 2.5 million

2014



2021

# Critical knowledge gap (1)



How to enhance renewable energy transitions for the poorest, marginalized, and climate-vulnerable groups, including women and children, people living with disabilities.

But while reducing water insecurity in a changing climate?



# Critical knowledge gap (2)



Ways to **balance infrastructure and nature-based water storage management options** for multiple purposes (water supply, energy production, fisheries, ecotourism, etc.) to **enhance equitable benefit sharing and reduce climate risks.**



Sirindhorn Dam, Thailand

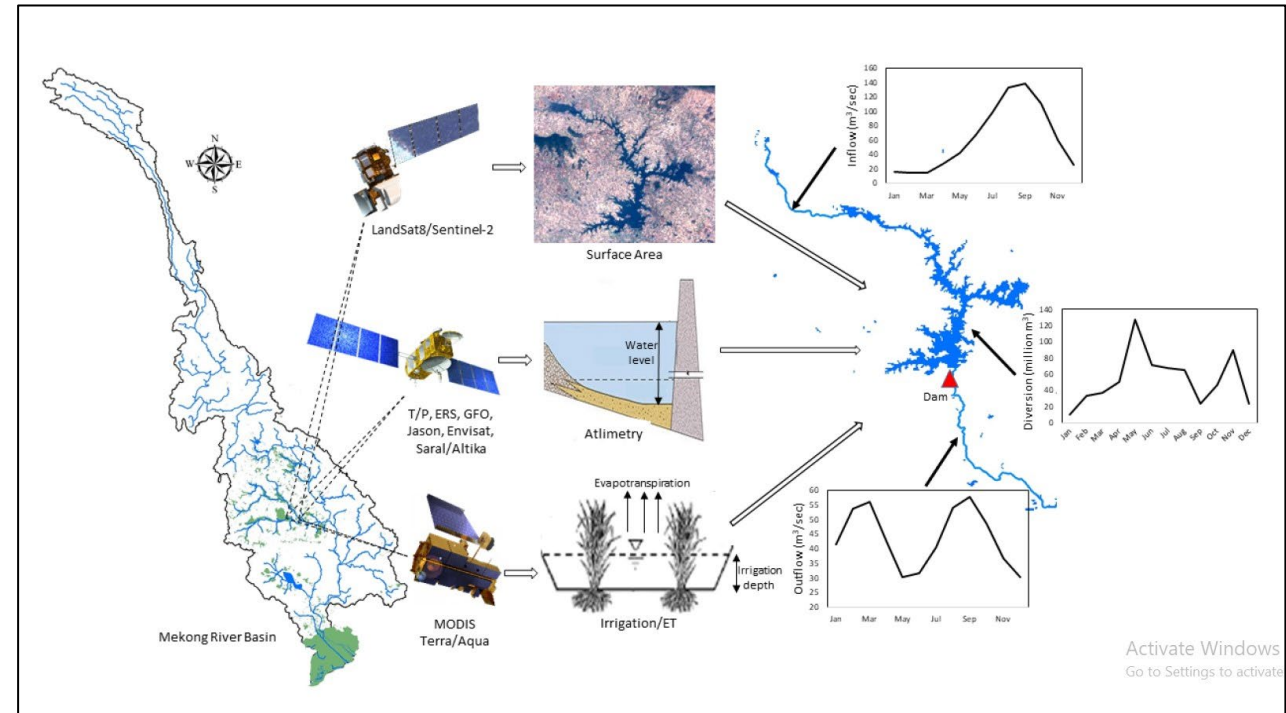


Tram Chim National Park, Viet Nam

# Critical knowledge gap (3)



How to use **new technologies, including Artificial Intelligence (AI), Remote Sensing (RS), and the Internet of Things (IoT)**, to improve warning and notification systems for climate-vulnerable communities and water/energy operators during extreme weather events, unusual water flows, floods, and drought?



Ali, S.A.; Sridhar, V. Deriving the Reservoir Conditions for Better Water Resource Management Using Satellite-Based Earth Observations in the Lower Mekong River Basin. *Remote Sens.* **2019**, *11*, 2872. <https://doi.org/10.3390/rs11232872>

# Critical knowledge gap (4)



**Governing long-term climate change adaptation measures to equitably enhance climate resilience of water and energy systems for all, especially climate-vulnerable communities and socially marginalized or at-risk groups.**



# Critical knowledge gap (5)



**Enhancing the effectiveness of knowledge-based policy influence organizations (KBPOIs) in generating evidence, engaging with and influencing policy, and addressing challenges arising from WEC and their interlinkages, including equity.**

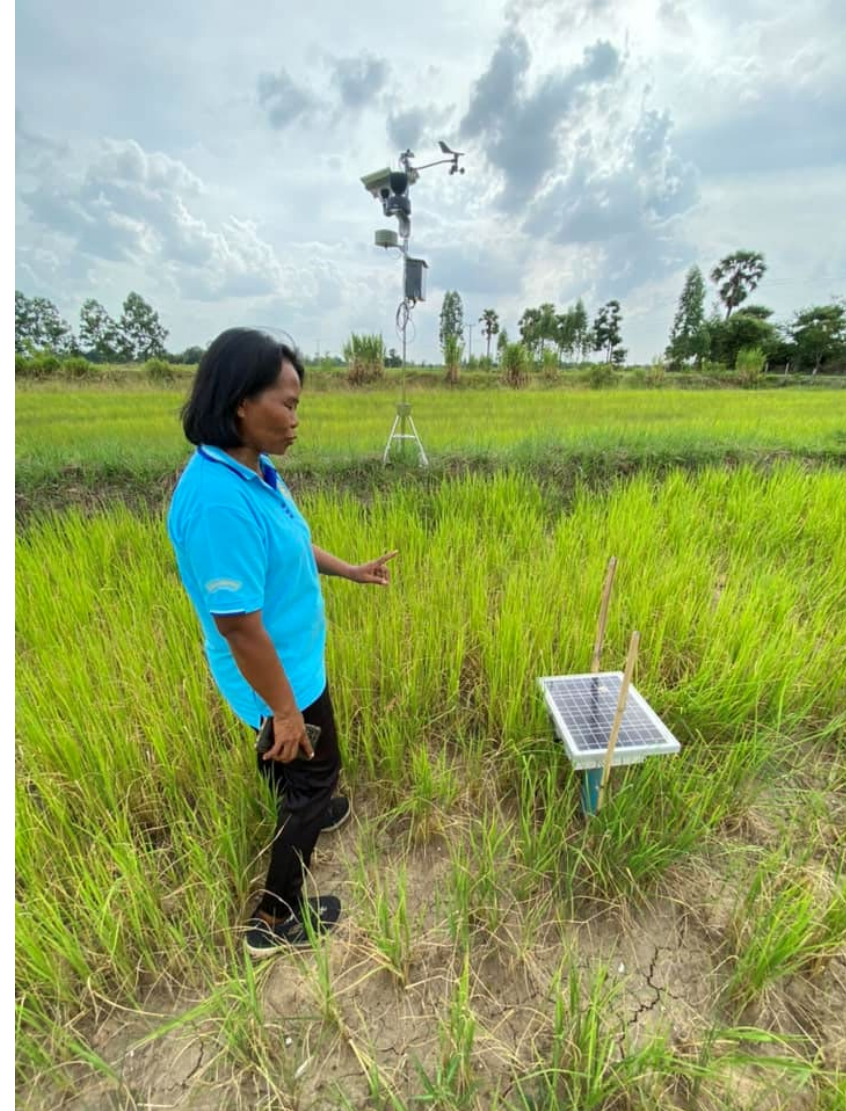




# Critical knowledge gap (6)



**Ways to mainstream Gender Equality, Disability, and Social Inclusion (GEDSI) into the WEC nexus policies and related coordination mechanisms for more inclusive and equitable planning and management.**





*How can we integrate the WEC nexus into the region's policies for climate action towards just and equitable outcomes?*

An advertisement for '#MEKONG THINK TANKS GRANTS' set against a background of a wide, muddy river flowing through a lush, green forest. The text is overlaid on the image. At the top left is the Australian Government crest and the text 'Australian Government Department of Foreign Affairs and Trade'. At the top right is the SEI logo. The main text reads '#MEKONG THINK TANKS GRANTS' in large, bold, white letters. Below this, in smaller white text, it says 'for research-to-policy proposals addressing water - energy - climate challenges'. A thick teal horizontal bar is positioned above the text 'APPLY NOW!' which is in large, bold, white letters. Below 'APPLY NOW!' is a QR code in a white square.

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for research-to-policy proposals addressing  
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Thank you!

