

# Cross-Border Hydro Synergy (CBHS): A Regional Framework for Sustainable and Cooperative Hydropower in Southeast Asia

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# I. Introduction

## Why Hydropower Matters

### Potential

- Southeast Asia has huge hydropower resources—around **170 gigawatts (GW)** technically available. This makes it one of the richest regions in water-based energy in the world. If fully developed, this energy could provide **reliable electricity**, support **industrial growth**, and help the region **shift toward renewable energy**.

### Reality

- Even with this large potential, only a small part is currently used in a sustainable way. Many projects are **unfinished, delayed, or struggle** to meet environmental and social standards. Because of this, countries still rely **heavily on fossil fuels**, slowing down progress toward **clean energy and climate goals**.

### Barriers

- **Fragmented governance across borders:** Hydropower resources are shared across multiple nations, but most policies are developed at the national level, leading to mismatched priorities and competition rather than cooperation.
- **Limited regional coordination:** ASEAN countries often pursue self-reliant energy development strategies, which prevent the optimization of shared resources and infrastructure.
- **Climate variability:** Increasingly unpredictable rainfall, droughts, and floods disrupt water availability, creating challenges for both power generation and water management.

### Example

- Major river basins such as the Mekong, Salween, and Irrawaddy cross several national boundaries. When countries develop dams or reservoirs unilaterally, these projects can cause tensions between upstream and downstream nations, as well as significant ecological risks such as altered fish migration, reduced sediment flow, and community displacement.

**Hydropower must shift from being a national asset to a regional public good.**



“ The CBHS framework focuses on **four main** objectives: ensuring energy resilience, adapting to climate risks, fostering cross-border cooperation, and empowering local communities. ”

**Regional Energy Resilience**

Hydropower provides dispatchable and stable electricity, complementing intermittent sources such as solar and wind. It also reduces reliance on imported fossil fuels, strengthening the region’s energy security.

**Climate-Responsive Development**

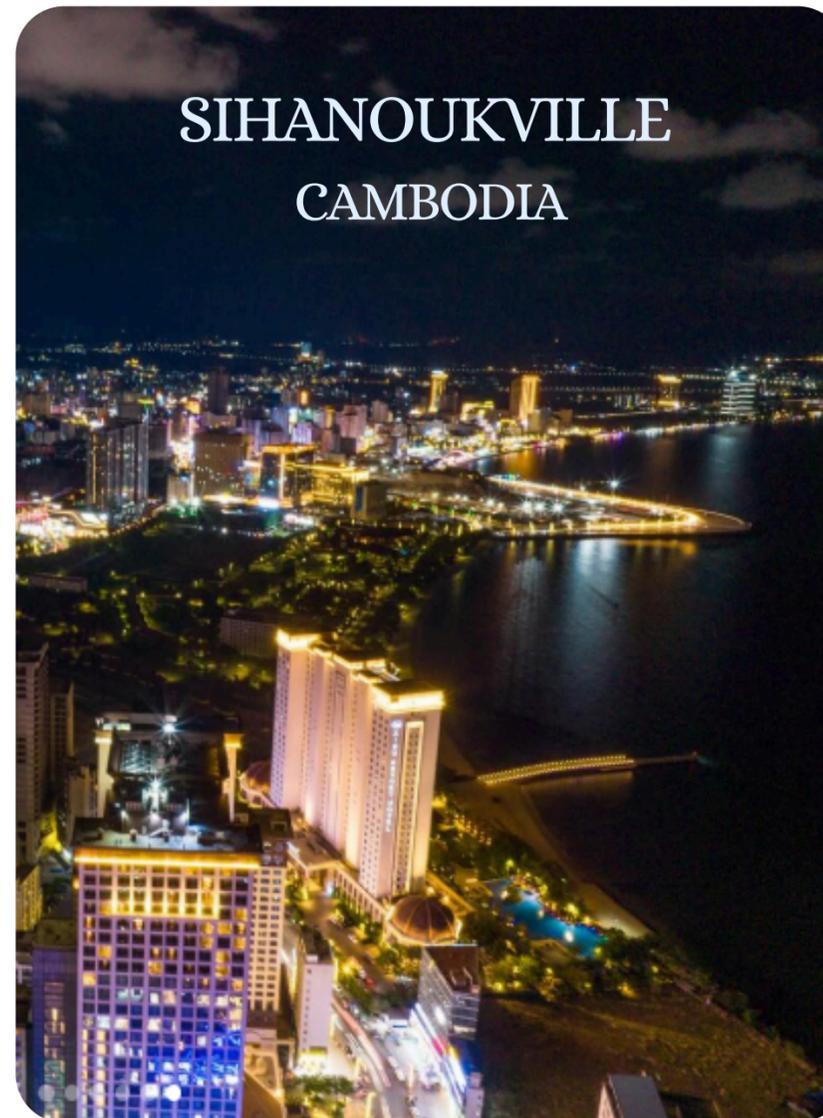
Through adaptive reservoir management, climate-proof engineering of dams, and the use of early-warning systems, hydropower can help mitigate the risks of droughts and floods while ensuring long-term sustainability.

**Transboundary Integration**

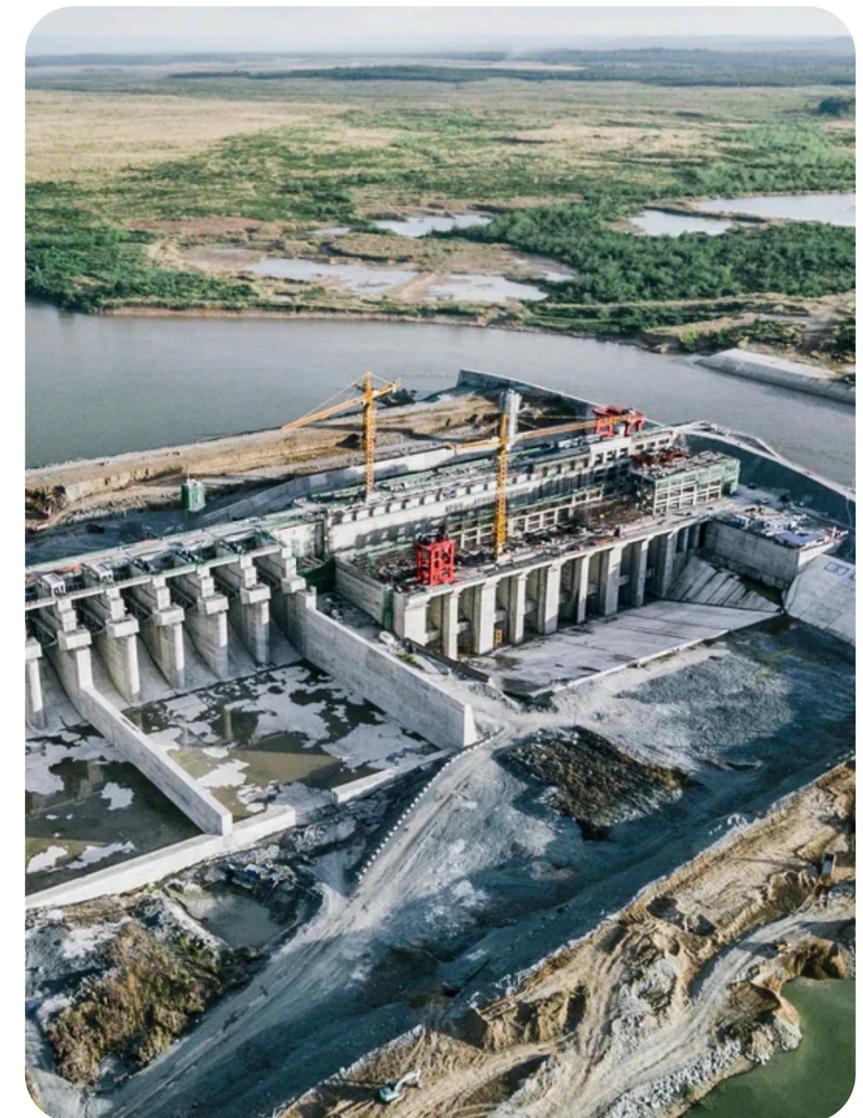
Coordinated and joint planning minimizes the risk of upstream-downstream conflicts and ensures ecological balance is maintained across borders.

**Local Empowerment & Innovation**

Hydropower development creates green jobs, supports skill-building, and fosters innovation ecosystems, while empowering local communities to benefit from sustainable and inclusive growth.

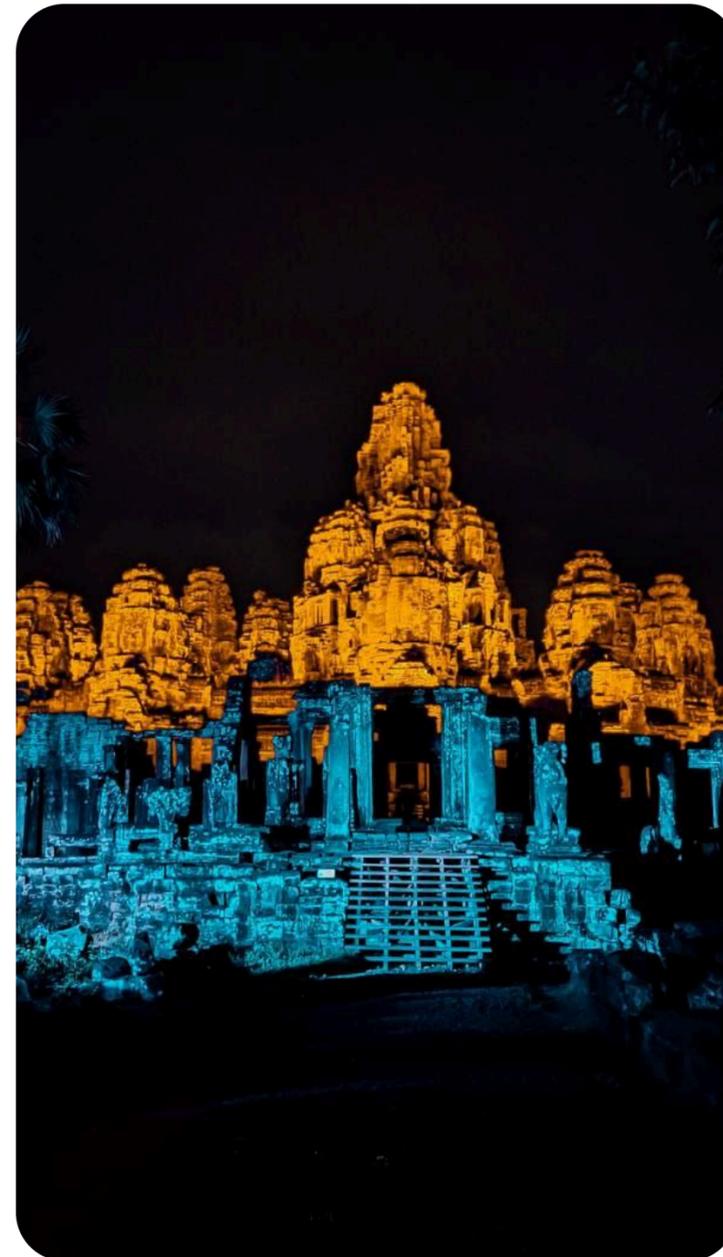


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II. Policy Objectives –  
What CBHS Wants to Achieve





“ Hydropower is a shared regional resource. Through collaboration, Southeast Asia can achieve an energy future that is green, inclusive, and economically resilient. ”

**Hydropower is a shared regional resource**

Hydropower in Southeast Asia is not limited to one country alone—most rivers flow across borders, connecting several nations. This means the water resources that generate electricity are shared by the region as a whole. Treating hydropower as a regional resource allows countries to benefit together, rather than competing against each other.

**Regional cooperation = green, inclusive, resilient energy future**

If countries work together, hydropower can become a foundation for a sustainable and stable energy system. Cooperation makes it possible to reduce dependence on fossil fuels, lower carbon emissions, and ensure that all countries—including those with fewer resources—gain access to affordable and reliable clean energy. In short, regional cooperation leads to a green, fair, and resilient energy future.

**Key Principles of CBHS**

1. **Shared Responsibility:** Hydropower affects everyone—upstream countries, downstream nations, and local communities. Success depends on collective responsibility, where all parties share the benefits, but also the duty to protect rivers, ecosystems, and people’s livelihoods.
2. **Technological Innovation:** New technologies like AI-powered digital twins, smart grids, and data-sharing platforms can make hydropower safer, more efficient, and more reliable. Innovation helps countries manage rivers better, predict floods and droughts, and trade electricity across borders smoothly.
3. **Inclusive Development:** Hydropower should not only produce electricity—it should also create jobs, build skills, and empower local communities. Projects must include people in decision-making and ensure that economic and social benefits are shared fairly across society.

# III. Hydropower: Shared, Sustainable, Inclusive



# IV. Key Policy Instruments

To make cross-border hydropower cooperation effective, the CBHS framework relies on four key instruments. Each plays a distinct role in ensuring sustainable, efficient, and equitable development:

## 1. SEA-HSS – Sustainability Standards for Hydropower

- A regional version of global hydropower sustainability standards.
- Ensures that projects protect biodiversity, respect Indigenous rights (FPIC), manage sediment flows, and maintain environmental flow thresholds.
- Helps countries align hydropower development with ecological and social safeguards.

## 2. HDTP – Hydro-Digital Twin Platform

- An AI-powered platform that simulates river basins and reservoir operations in real time.
- Integrates meteorological and hydrological data, power demand forecasts, and reservoir system models.
- Enables proactive management of water flows, reduces flood risks, and improves cross-border coordination.

## 3. CPX-Z – Cross-Border Power Exchange Zones

- Designated electricity trade corridors linking hydropower supply countries (e.g., Laos, Myanmar) with high-demand centers (e.g., Bangkok, Ho Chi Minh City, Singapore).
- Supports harmonized grid operations, standardized pricing, and financial clearing systems.
- Encourages regional energy security and equitable electricity distribution.

## 4. GHFF – ASEAN Green Hydro Finance Facility

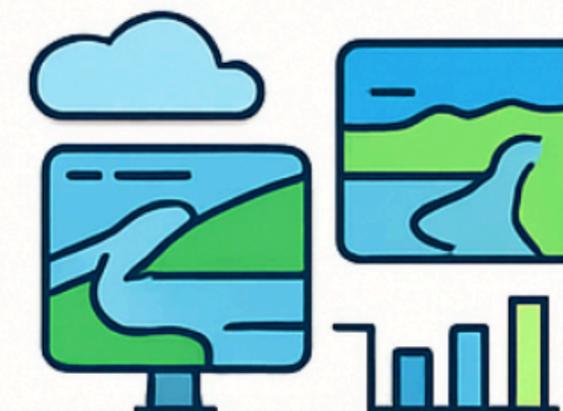
- A regional financing platform backed by ASEAN Infrastructure Fund, ADB, and GCF.
- Offers performance-based grants, credit enhancements, and outcome-based financing.
- Reduces financial risks for cross-border hydropower projects, ensuring they are resilient, sustainable, and attractive to investors.

**Takeaway:** These four instruments together provide the regulatory, technological, operational, and financial tools needed to make regional hydropower cooperation viable, sustainable, and beneficial for all ASEAN countries.

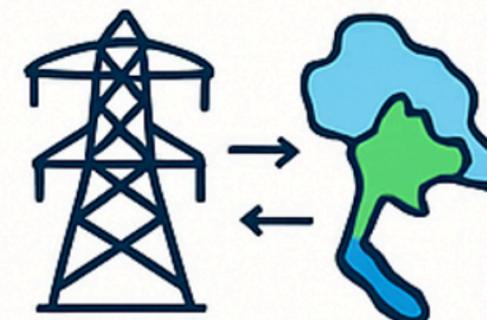
## 1 SEA-HSS – Sustainability Standards for Hydropower



## 2 HDTP – Hydro-Digital Twin Platform



## 3 CPX-Z – Cross-Border Power Exchange Zones



## 4 GHFF – ASEAN Green Hydro Finance Facility





# V. Southeast Asia Hydropower Sustainability Standard (SEA-HSS)

The SEA-HSS is a regional framework adapted from global hydropower sustainability standards. It is designed to make sure that hydropower projects in Southeast Asia are not only about producing electricity but also about protecting nature, respecting people, and ensuring long-term benefits.

Key Components:

## 1. Biodiversity Conservation Metrics (IUCN Guidelines)

- Projects must protect ecosystems, wildlife, and river habitats.
- For example, dam planning should consider fish migration routes, wetlands, and endangered species.

## 2. FPIC (Free, Prior, and Informed Consent)

- Indigenous and local communities must be consulted before any project starts.
- They should be fully informed of risks and benefits, and their agreement must be obtained without pressure.

## 3. Sediment Flow Management

- Natural sediment movement in rivers is essential for soil fertility, fisheries, and preventing erosion.
- Dams must include systems to allow sediment to pass through and avoid damaging downstream areas.

## 4. Environmental Flow (E-flow) Thresholds

- Rivers must maintain a minimum water flow to sustain ecosystems, agriculture, and livelihoods.
- This prevents rivers from drying out and protects the balance of aquatic life.

**Goal:** The SEA-HSS ensures that every hydropower project is ecologically sound, socially responsible, and culturally respectful. It helps balance the need for clean energy with the protection of communities, rivers, and biodiversity.



# VI. Hydro-Digital Twin Platform (HDTP)

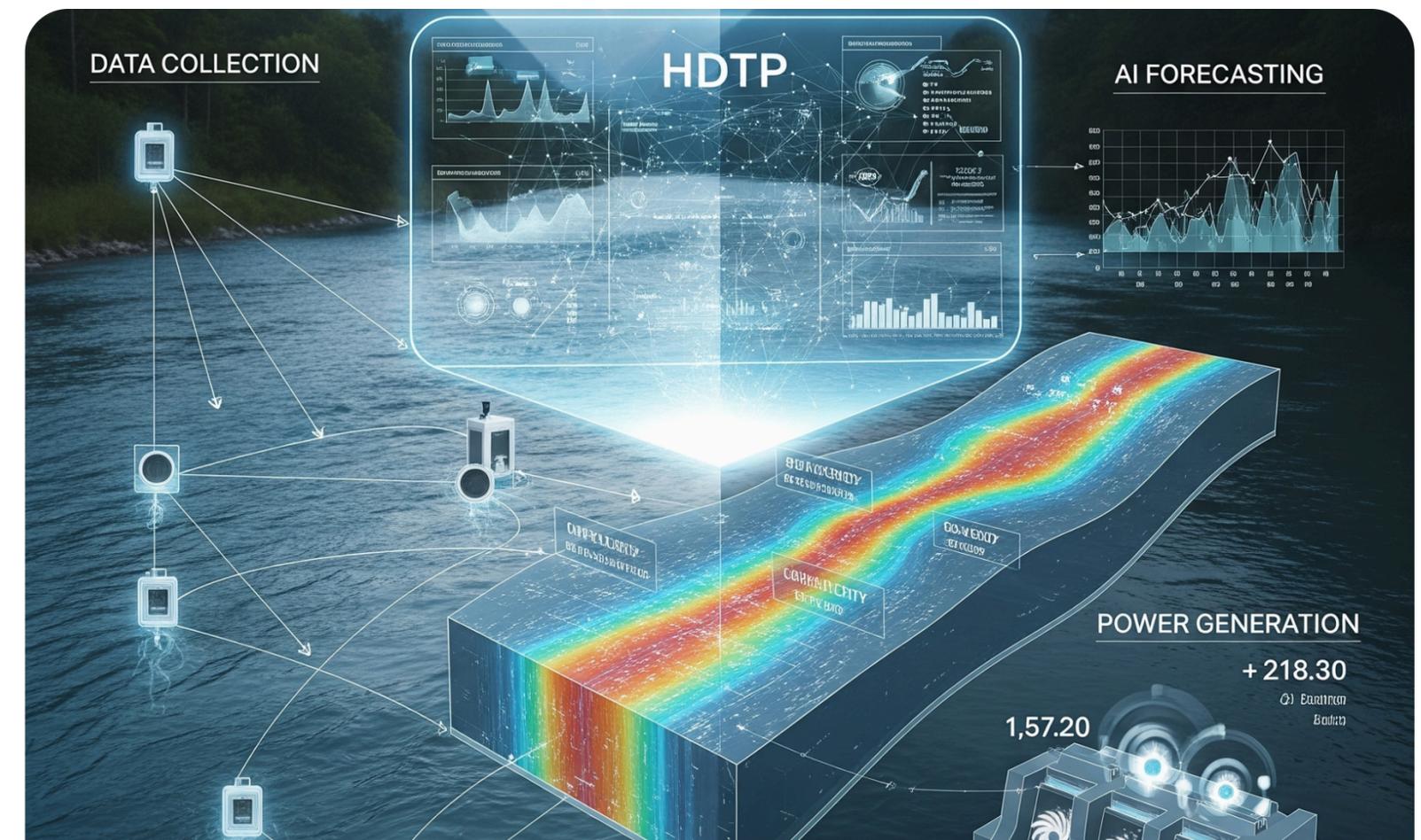
The Hydro-Digital Twin Platform is like a virtual copy of a river system that uses AI and data to simulate real-life conditions. It helps countries manage water and hydropower more intelligently. **How it works:**

- Collects real-time weather and water data (rainfall, river flow, reservoir levels).
- Uses AI forecasting to predict electricity demand.
- Simulates reservoir and river systems, showing how water moves and how power can be generated.

## Benefits:

- Optimized reservoir operation → ensures water is stored and released at the right time.
- Cross-border coordination → countries can share data and manage shared rivers together.
- Flood and drought risk reduction → helps predict extreme weather events and prepare in advance.

In short, the HDTP makes hydropower smarter, safer, and more cooperative across countries.



# VII. Cross-Border Power Exchange Zones (CPX-Z)

To meet the growing electricity demands of major cities like Singapore and Ho Chi Minh City, Cross-Border Power Exchange Zones (CPX-Z) provide a framework for supply countries, such as Laos and Myanmar, to share their abundant hydropower resources through harmonized grid systems and standardized pricing.

## Examples

- Supply countries: Laos, Myanmar (rich in hydropower resources).
- Demand centers: Bangkok, Ho Chi Minh City, Singapore (large cities with growing electricity needs).

## What's Required

- Harmonized grid codes → electricity systems across countries must use the same technical standards.
- Standardized pricing → clear and fair rules for how electricity is priced.
- Financial clearing systems → trusted mechanisms to handle cross-border payments.

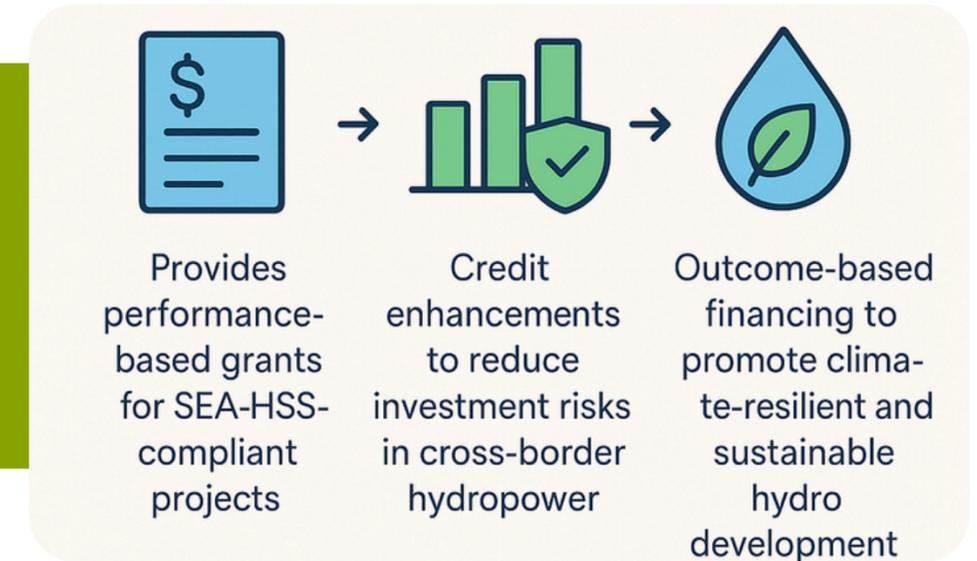
## Impact

- Creates a reliable electricity supply for the whole region.
- Strengthens energy security, reducing dependence on imported fossil fuels.
- Encourages regional cooperation instead of competition.

In short, CPX-Z allows ASEAN to share clean power fairly and efficiently across borders.



# VII. ASEAN Green Hydro Finance Facility (GHFF)



The GHFF is a special financing platform created to help ASEAN countries build sustainable and climate-resilient hydropower projects. It is supported by: ASEAN Infrastructure Fund (AIF), Asian Development Bank (ADB), Green Climate Fund (GCF)

## What it Provides

1. Performance-based grants → Money is given when projects meet certain social, environmental, or efficiency goals.
2. Credit enhancements → Reduces risks for investors by providing guarantees, making projects more attractive to fund.
3. Outcome-based financing → Projects receive funding based on real results, such as reduced CO<sub>2</sub> emissions, better flood protection, or improved community benefits.

## Purpose

1. Encourage investment in cross-border projects, which are usually harder to finance.
2. Ensure hydropower projects are green, socially responsible, and resilient.
3. Build confidence among private investors and governments to support clean energy.

# IX. Alignment with SAREF 4.0

The Cross-Border Hydro Synergy (CBHS) framework directly supports ASEAN’s SAREF 4.0 goals (Sustainability and Renewable Energy Forum). How CBHS aligns:

## Energy Transition

- Shifts the region away from coal and diesel.
- Expands the share of clean, renewable hydropower in the energy mix.

## Economic Recovery

- Hydropower investments create 3.4 times more jobs compared to fossil fuels.
- Generates foreign exchange earnings through electricity trade.

## Sustainable Growth

- Protects agriculture, fisheries, and tourism by managing rivers responsibly.
- Reduces disaster risks (floods, droughts) through climate-responsive hydropower.

In short, CBHS is not just about energy—it’s about jobs, livelihoods, and resilience for the whole region.

**SUSTAINABILITY & RENEWABLE ENERGY FORUM |  SAREF 4.0**

Partnerships for Our Goals | Sustainable Growth & Prosperity for the Region

# X. Implementation Roadmap

The CBHS framework will be implemented step by step to ensure success:

## 2025: Policy Co-Design

- Establish ASEAN Hydropower Council to oversee cooperation.
- Launch SEA-HSS v1 (first version of the sustainability standard).

## 2026–2028: Technology Rollout

- Deploy the Hydro-Digital Twin Platform (HDTP) for river and reservoir monitoring.
- Set up 3 pilot Cross-Border Power Exchange Zones (CPX-Zs) in key regions.

## 2029–2032: Scaling & Legal Harmonization

- Make SEA-HSS mandatory for all new projects.
- Finalize cross-border electricity trading agreements across ASEAN.

By 2032, ASEAN will have a fully coordinated, technology-enabled, and legally aligned hydropower system, paving the way for regional energy security and climate resilience.



If the CBHS framework is fully implemented, ASEAN can expect big positive changes by 2035

40% of cross-border electricity trade from hydropower

- Nearly half of the electricity traded between ASEAN countries will come from clean hydropower instead of fossil fuels.
- This means the region will be more energy-independent and less reliant on imported oil and gas.

30 million tons of CO<sub>2</sub> avoided annually

- By replacing fossil fuel power plants, hydropower could prevent the release of 30 million tons of carbon dioxide every year.
- This is equal to taking more than 6 million cars off the road.

500,000+ green jobs created

- Hydropower development, maintenance, and related industries will generate half a million sustainable jobs.
- These include roles in construction, engineering, data management, local services, and community development.

25% improvement in energy reliability

- A more stable and interconnected power grid reduces blackouts and power shortages.
- Countries can rely on each other's resources when local supply is low.

CBHS creates cleaner air, more jobs, and a stronger, more reliable energy system for the entire region.

# XI. Expected Impacts by 2035



## XII. Recommendations



To make CBHS successful, the following actions are recommended:

### Form ASEAN Hydropower Council

- A regional body to oversee planning, coordination, and dispute resolution.

### Pilot CPX-Z & HDTP in Mekong basin

- Start with one of the most important river systems to test cross-border electricity trade and digital twin technology.

### Adopt SEA-HSS for all new hydropower projects

- Ensure every project follows environmental and social safeguards.

### Leverage GHFF for cross-border investments

- Use financing tools to attract private and public investors.

### Build local capacity through training programs

- Equip local workers, engineers, and communities with the skills needed for sustainable hydropower.

### Promote data-sharing & transparency

- Countries should openly share water, energy, and climate data to improve cooperation and trust.

These steps ensure that hydropower is sustainable, inclusive, and beneficial for all ASEAN members.

# XIII. Conclusion

The Cross-Border Hydro Synergy (CBHS) framework is a regional strategy that unites ASEAN countries to manage hydropower together in a sustainable way

It brings three big benefits:

## 1. Clean Energy Transition

- Helps ASEAN move away from coal and diesel.
- Expands renewable energy like hydropower to meet growing demand.

## 2. Economic Resilience

- Creates 500,000+ of green jobs and boosts local industries.
- Reduces dependence on imported fossil fuels, saving foreign exchange.
- Strengthens cross-border trade in electricity, improving regional prosperity.

## 3. Climate Security

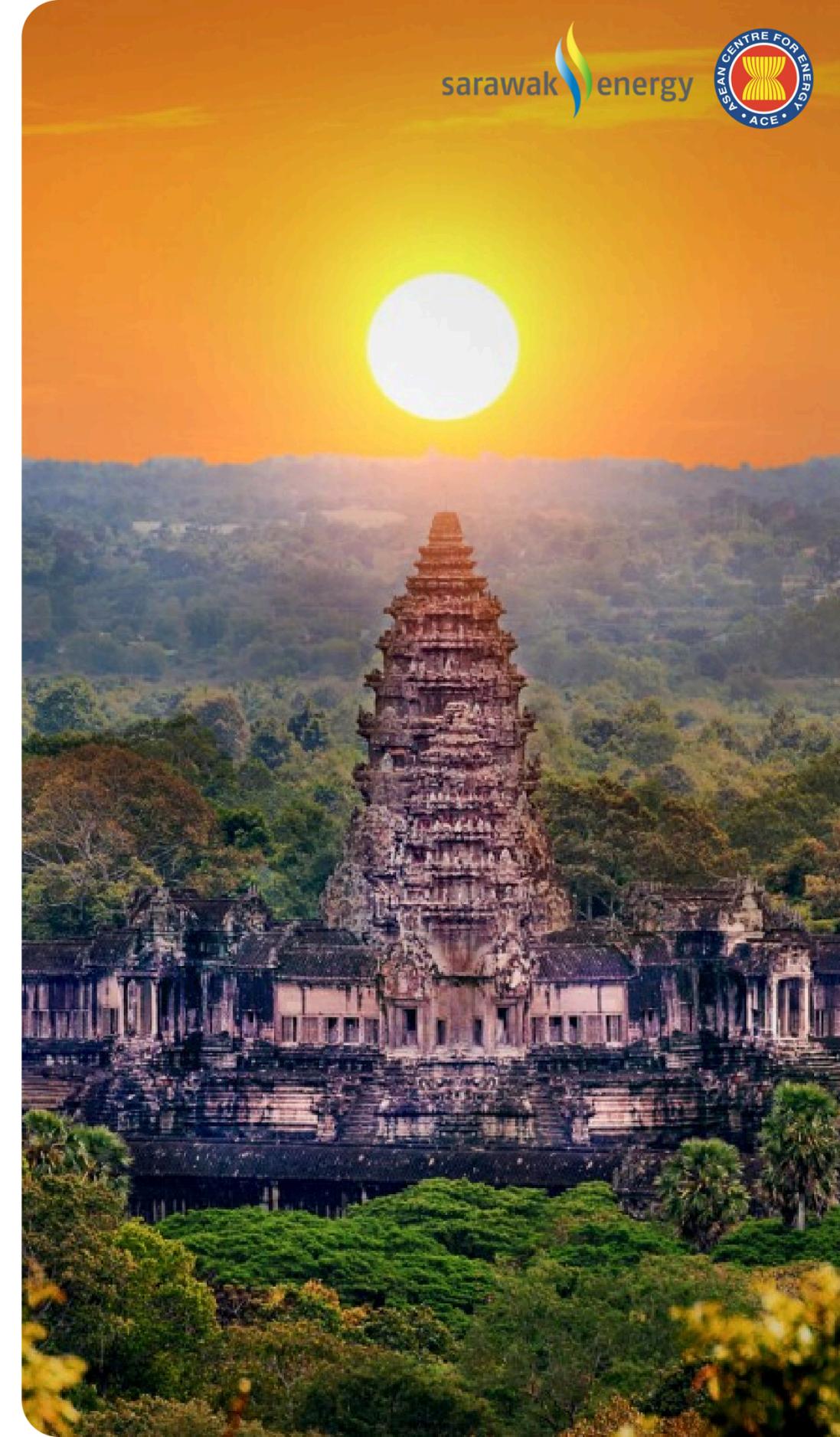
- Cuts millions of tons of CO<sub>2</sub> emissions every year.
- Supports flood and drought management through coordinated river basin operations.
- Protects ecosystems, agriculture, and fisheries that depend on healthy rivers.

### How it fits ASEAN's bigger vision:

The framework directly supports SAREF 4.0 goals by balancing energy transition, economic recovery, and sustainable growth.

### Key Message:

The CBHS is more than just about energy—it's about regional unity. It shows how ASEAN can turn shared rivers into shared opportunities for clean growth, resilience, and cooperation, ensuring no country is left behind.



# Thank You

