Floating Solar Potential in Bangladesh: Transforming Unutilized Water Bodies into Renewable Energy

December 14, 2024

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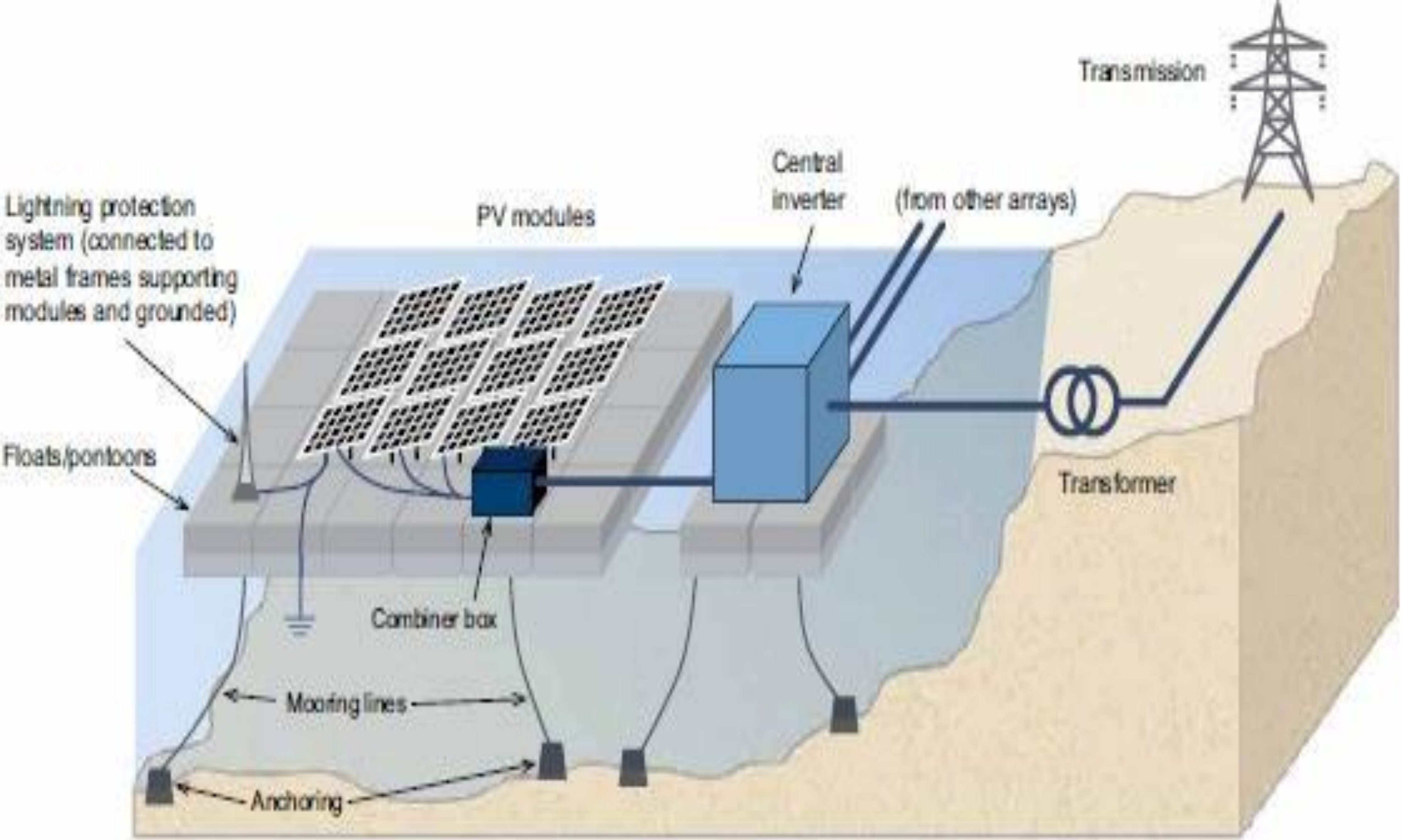
Topics to be Covered

- **Floating Solar Plant Components**
- **Advantages of Floating Solar Plants**
- **Challenges of Floating Solar Plants**
- **Global Case Studies of FSP and Plant under Preparation in South Asia**
- **Prospects of Floating Solar Plants in Bangladesh**

Floating Solar Plant Components

- Floating Platforms/Mounting Raft
- Photovoltaic Panels and Modules
- Anchoring and Mooring Systems
- Active Current (AC) Cabling
- Medium Voltage (MV) Transformers
- Power Transmission Systems
- Maintenance Access
- Constructability

Floating Solar Potential



Source: Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore.

Advantages of Floating PV System

- ✓ Land Use Optimization
- ✓ Efficiency Improvement
- ✓ Albedo Effect
- ✓ Water Conservation
- ✓ Environmental Benefits
- ✓ Low Impact on Aquatic Life
- ✓ Reduced Transmission Losses
- ✓ Scalability
- ✓ Lower Levelized Cost of Energy (LCOE)

Challenges of Floating Solar Plants

- High Initial Investment
- Technical Maintenance
- Environmental Concerns
- Weather Vulnerability
- Regulatory Hurdles

Global Case Studies of FSP

1. **China: Home to some of the world's largest operating floating solar plants, China has utilized former coal mining sites and reservoirs to generate renewable energy. The Anhui province hosts a massive 150 MW floating solar plant, showcasing the scalability of the technology.**

2. **Japan: Japan has adopted FSP on reservoirs and water treatment facilities. The Yamakura Dam hosts a 13.7 MW floating solar plant. It covers approximately 180,000 m^2 (18 ha) and consists of over 50,000 photovoltaic panels.**

3. **India: India has launched ambitious plans for floating solar plants to reduce dependency on fossil fuels. The Kayamkulam project (92 MW) in Kerala and the Ramagundam project (100 MW) in Telangana are notable examples.**

4. **Netherlands: Netherlands has integrated floating solar systems with existing water infrastructure, such as floodplains and canals. Sellingen (41.1 MW) and Uivermeertjes (29.8 MW) are two major plants.**

Major Plants under Preparation in South Asia

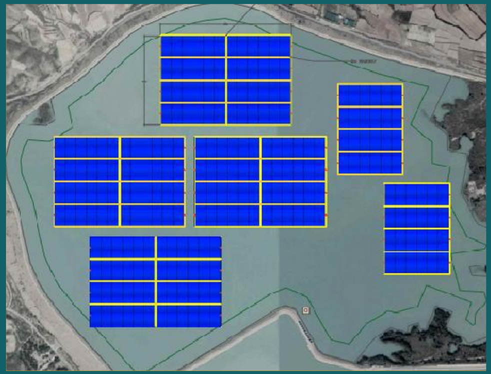
Bangladesh

100 MW Floating Solar Photovoltaic Power Plant Project in Motherganj, Jamalpur.

$167 million (2022)

India

ADB funded 500 MW West Bengal Floating Solar Project in Bakreswar Dam Reservoir



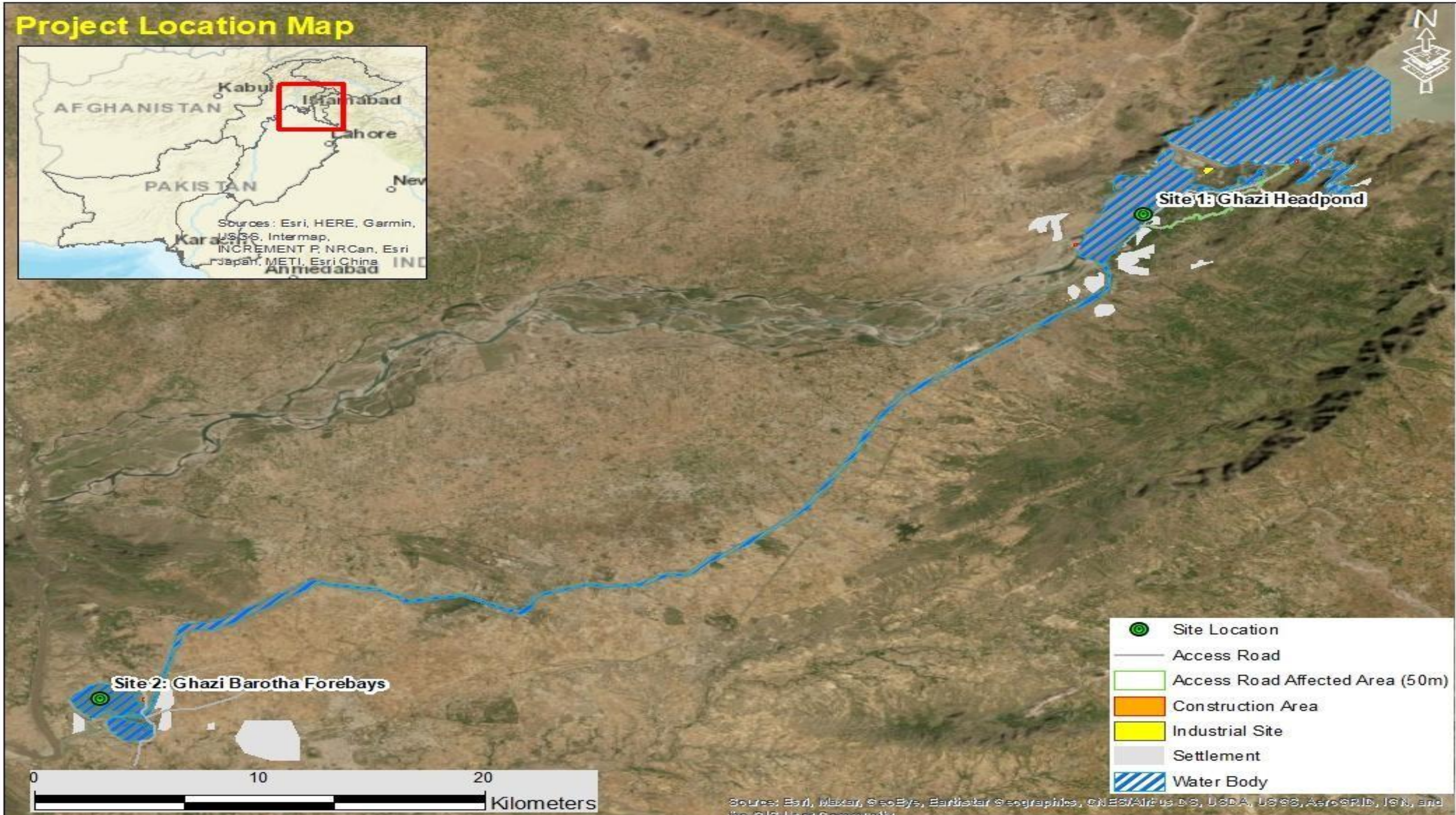
Pakistan

World Bank-funded 300 MW Floating Solar in Pakistan Project in Ghazi Barrage Headpond and Forebay

$324.46 million (2021)

Sri Lanka

USAID funded 100 MW Floating Solar Project at Castlereigh Reservoir



Project Location Map
Kabul
Islamabad
AFGHANISTAN
Lahore
PAKISTAN
New
Karachi
Ahmedabad
IND
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China
N
Site 1: Ghazi Headpond
Site 2: Ghazi Barotha Forebays
Site Location
Access Road
Access Road Affected Area (50m)
Construction Area
Industrial Site
Settlement
Water Body
0
10
20
Kilometers

FLOATING SOLAR IN PAKISTAN PROJECT - A CASE STUDY

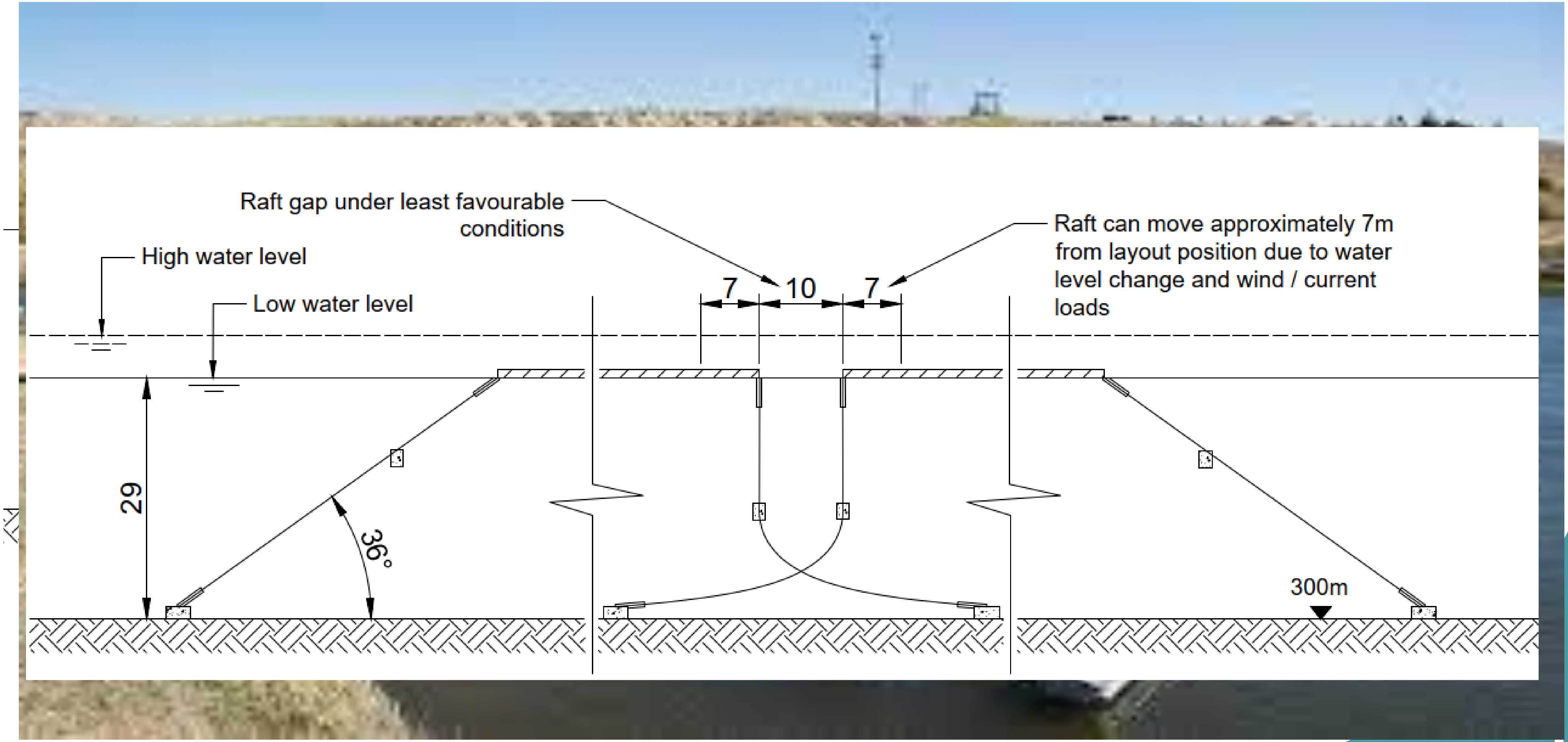
Description of the Project Sites

Name of site	Capacity (MW)	Area of water (ha)	Area of panel (ha)	Coverage	Nearest settlement to the construction site
Site 1: Ghazi Barrage Headpond	150	800	165	21%	Galla (north)
Site 2: Ghazi Barotha Forebay	150	400	165	41%	Barotha (east) Dhair (west), Jabba (north)

System Configuration

Sl.	Items	Headpond	Forebay
1	Plastic rafts	High-density polyethylene floats	
2	Mono-facial polycrystalline silicon modules	504,000	504,000
3	100kW String inverters	1,500	1,500
4	2,500kVA step-up to 33kV Transformers	60	60
5	160MVA step-up to 220kV Transformers	1	1
6	Mounting Structure	Modular floats at a fixed tilt of 12^0	
7	Anchoring	Bottom self-weighted concrete blocks anchoring	
8	Mooring line	Weighted mooring line where bed level is irregular.	
9	Pontoon	Facilitate boat access to the floating units	

Solar, raft, anchor, and mooring system



Risk Category and Screening

Risk Category	Screening Criteria
High	Large magnitude impact last for long time, extend over a large area, exceed national/international standards, endanger public health and safety, threaten a species or habitat of national or international significance, and/or exceed a community's resilience and ability to adapt to change.
Substantial	Clear evident change from baseline conditions and approach but not exceed applicable standards.
Moderate	Noticeable effect, but the magnitude of the impact is sufficiently small that the overall effect remain well within applicable standards.
Low	Either not be affected or the effect would be imperceptible or indistinguishable from natural background variation.

Environmental, Health, and Safety Risks

Environmental, Health and Safety Risks, and Impacts	Risk Ratings Before Mitigation and Control	
	Construction Stage	Operation Stage
Risk of falling in the water and drowning during installation of panels over water	Substantial	Low
Pollution of surface water due to the cleaning of accumulated bird droppings	Low	Substantial (Site 2)
Changes to water quality, thermal structure, and evaporation rate as a result of shading	Low	Substantial (Site 2)
Impacts on fish from shading and anchoring and cabling	Moderate	Substantial (Site 2)
Impact on migratory birds and their habitats	Moderate	Substantial (Site 2)
Aquatic habitat degradation as a result of altered quantity of bird droppings	Low	Substantial (Site 2) Low (Site 1)

Mitigation/Control Measures

- Risks of Falling into Water and Drowning

Eliminate

By constructing the FSP in the Land

Substitute

Assemble panels and connect arrays on land

Use mechanical equipment over water

Engineering Control

Use fence and safety nets

Use strong, stable and wide walkways or workplaces over water

Administrative/ PPE

Train workers

Devise rescue plan to comply with adverse weather

Life jackets

Mitigation/Control Measures

- **Impacts on Surface Water due to the Cleaning of Accumulated Bird Droppings**

Avoid

Collect and safely dispose bird droppings

Reduce the size of spaces in between panels

Minimize

Clean the panels frequently during bird migration period

Droppings should not be disposed into the waterbody

Mitigate/ Control

Use bird deterrents and spikes to prevent birds from landing on the panels

Offset

Improve the ecosystem quality of nearby waterbodies to allow winter birds to stage there

Mitigation/Control Measures

- **Changes to Water Quality, Thermal Structure, and Evaporation due to Shading**

Avoid

Build the FPV plant on land instead of water

Minimize

Keep the coverage of each waterbody to a minimum

Allow enough space between panel strings for light to pass through

Install panels in a landscape orientation

Mitigate/ Control

Add aeration system

Use glass-glass PV modules, to allow light reach waterbody

Schedule low water retention time

Compensate/ Offset

Fund research on improving water and ecosystem quality

Mitigation/Control Measures

- **Direct Impacts of Shading on Fish, Aquatic Algae and Plankton**

Avoid

Build FPV plant on land or other suitable locations

Minimize

Place the panels so light and wind penetration is maximized

Keep string row widths to a minimum by installing solar panels in a landscape orientation

Mitigate/ Control

Use glass-glass PV modules, enabling light to reach the water's surface to minimize ecological impacts

Compensate/ Offset

Fund research into how to improve the ecosystem given the pressures

Mitigation/Control Measures

- **Changes to Bird Habitats from Panel Installation**

Avoid

Avoid panel installation in waterbodies

Minimize

Use compact panels since they take up less space

Install the panel in such a way that allows more water surface as staging ground for birds

Mitigate/ Control

Use efficient solar panels so that fewer panels can generate same electricity

Install barrier and/or non-barrier bird deterrent systems

Compensate/ Offset

Improve habitat quality of nearby waterbodies so that birds can also use as staging grounds

Mitigation/Control Measures

- **Anchoring and Cabling Impacts on Fish**

Avoid

Avoiding using underwater anchoring and cabling systems

Minimize

Use less anchors and cables and also fix them in places not frequently used by fishes

Install fish deterrent (strobe light) to alert fishes of the presence of anchors and cables

Mitigate/ Control

Research, survey and monitor fish population, behavior and mortality around cables and anchors

Regular inspection of cables and anchors

Compensate/ Offset

Create a feeding schedule for the fish so they are not limited by nutrients

Mitigation/Control Measures

- **Degradation of Aquatic Habitat Due to Bird Droppings**

Avoid

Reduce the size of the cracks in between the panels

Minimize

Frequently clean bird droppings to minimize bulk accumulation, and do not dispose droppings into the waterbody

Mitigate/ Control

Use bird deterrent to scare birds from landing on the panels

Use nets around the panels to restrict birds from making nests under them

Compensate/ Offset

Improve habitat and ecosystem quality of nearby waterbodies to allow winter birds to the stage there instead

Prospects of Floating Solar Plants in Bangladesh

(1) KAPTAI LAKE

- **Largest man-made freshwater lake, spans 688 km^2 (68,800 ha) in Rangamati with maximum depth 53m.**
- **Supports power generation, irrigation, fisheries, and transportation.**
- **Utilizing 10% of its area could generate 6,200 MWp of electricity,**
- **An initial $6.2 billion investment (2021 price).**

(2) HAKALUKI HAOR

- **Largest freshwater wetlands, spans 181.15 km^2 (181, 000 ha) across Moulvibazar and Sylhet depth varies from 1.5–2 m in the dry season to 6–7 m during monsoons.**
- **Harnessing 10% of its area could generate 1,600 MWp of renewable energy,**
- **An estimated $1.6 billion investment (2021 prices).**

(3) CHALAN BEEL

- **Largest wetland, spans 368 km^2 (36,800 ha) across Pabna, Natore, and Sirajganj, depth ranges from 1–2 m in the dry season to 4–5 m during monsoons**
- **Utilizing 10% of its surface could generate 3,300 MWp of electricity**
- **Requires $3.3 billion investment (2021 prices)**

Thank You

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