Source: The Lux Collective

Challenges and Opportunities of hybrid Floating PV+BESS projects in remote islands of Maldives

Tarun Soni

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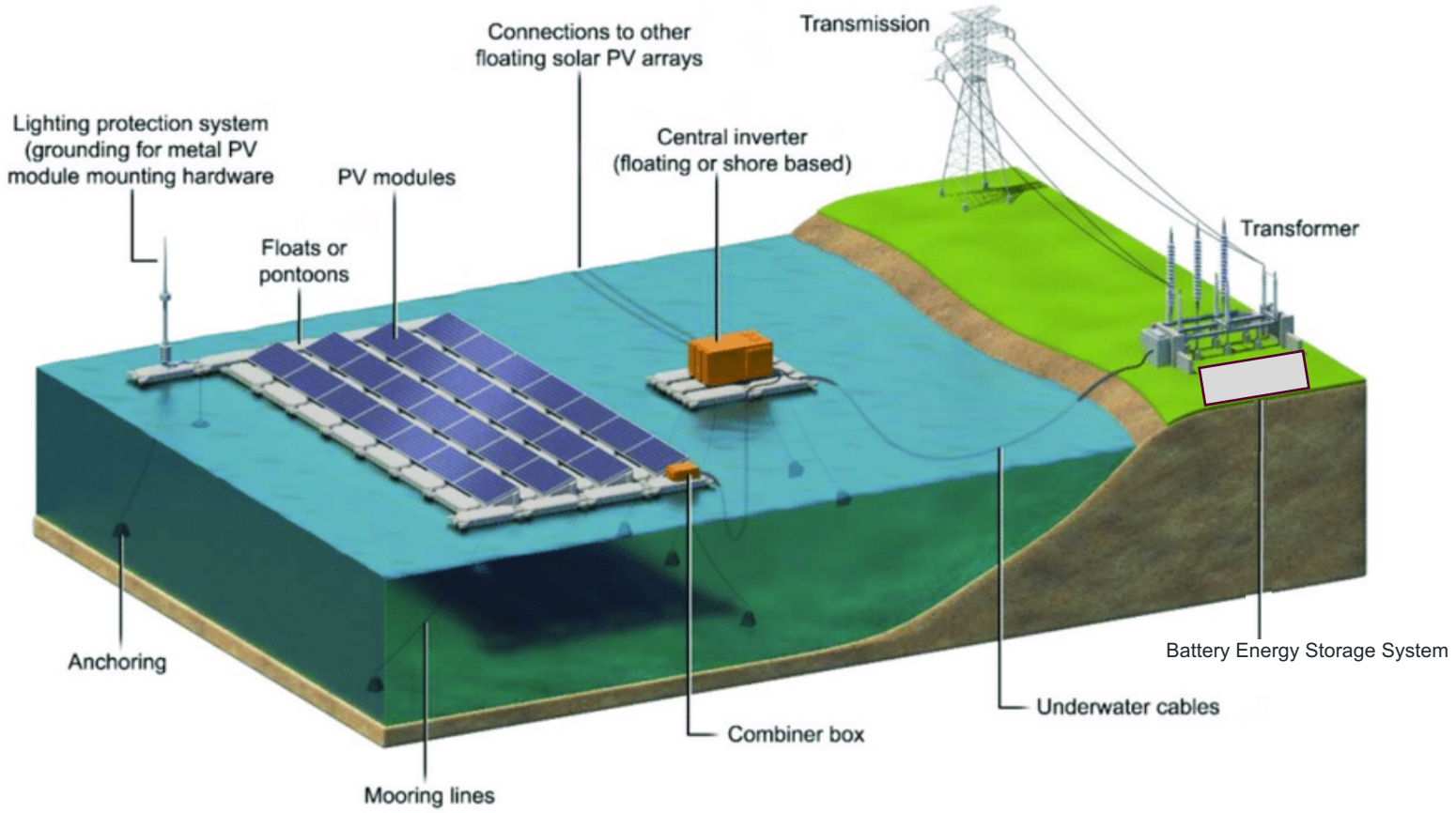
Agenda

- Hybrid floating PV+BESS – Overview and Growth drivers
- Challenges and Opportunities in Remote Islands Maldives
- In-house Modelling Tools:
  - GIS-Based Multi-Criteria Analysis (MCA) Site Screening Tool
  - AHEAD (Advanced Hybrid Energy Allocation & Dispatch)
- Case Study Results: Insights and Findings
- Key Takeaways: Summary of the Main Points

Source: Tarun Soni

Hybrid floating PV+BESS – Overview and Growth drivers



Source: researchgate.net

- ✓ Scarcity of land
- ✓ Need for the power which is:
  - ✓ Reliable
  - ✓ Independent
  - ✓ Cost effective
- ✓ Technological Advancements
- ✓ Commercial Viability
- ✓ FPV market valuations:
  2021: $2 Billion to 2031: $27 Billion
- ✓ Impressive Compound Annual Growth Rate (CAGR) of 13%

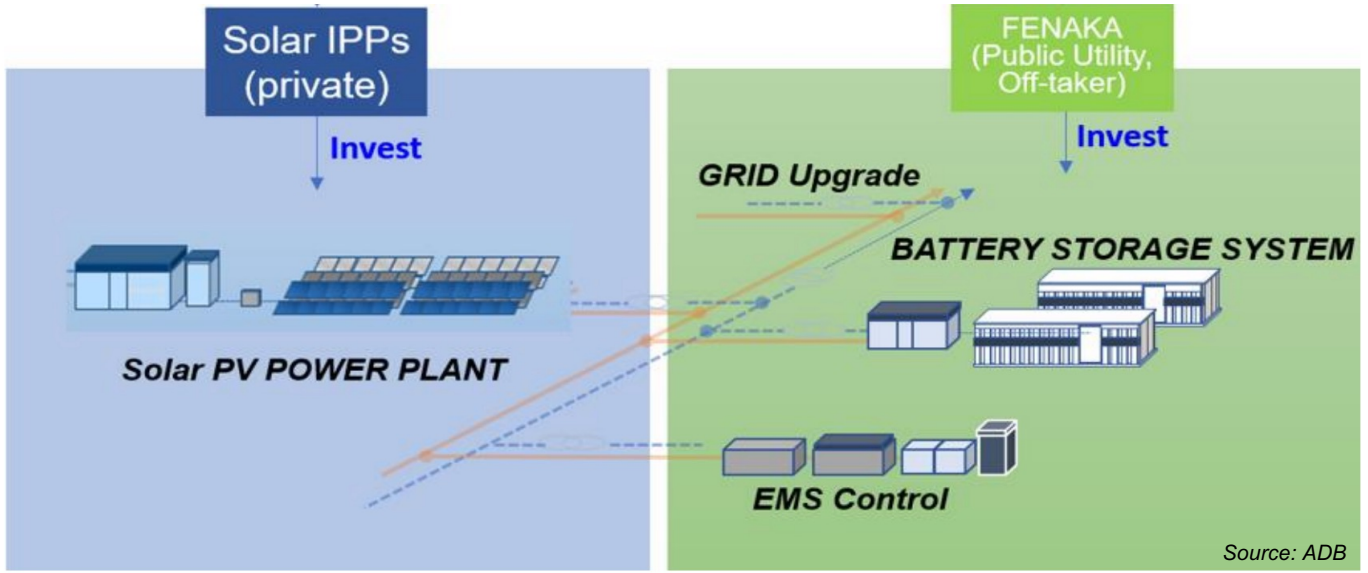
Challenges and Opportunities in Floating PV+BESS for remote islands in Maldives

Single Largest Solar PV Project

Widely dispersed and scattered

Combination of technology

- ✓ The presence of widely dispersed and scattered sites reflects a dedicated commitment to delivering clean energy to even the most remote islands.
- ✓ System shall be:
  - Modular deployment
  - Simplified infrastructure
  - Quick installation
  - Easy O&M



- ✓ The integration of ground-mounted, rooftop, and floating PV systems, together with Battery Energy Storage Systems (BESS), showcases the dynamic evolution of microgrids.
- ✓ Productive collaboration between public-private partnerships and sovereign teams yields positive outcomes

FPV development process

1. Site Screening
2. Site Inspection
3. Site Studies
4. Tendering and Financial Close
5. Construction and Commissioning
6. Operation and Maintenance
7. Project Completion and Decommissioning

- Identification of any red flags related to the site
- Largely be desktop-based

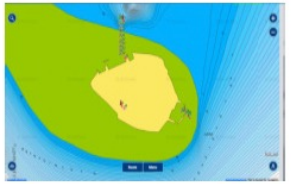
Main criteria:

- ✓ Topography
- ✓ Bathymetry
- ✓ Geology
- ✓ Hydrology
- ✓ Solar resource
- ✓ Infrastructure
- ✓ FPV Substation
- ✓ Grid access and Substation
- ✓ Environmental and Social

Each item is weighted depending on the impact they have on the suitability of the site

2. Shortlisting considering technical, E&S, grid-related, financial and meteorological constraints

1. Identification of potential sites based on proximity of load centers



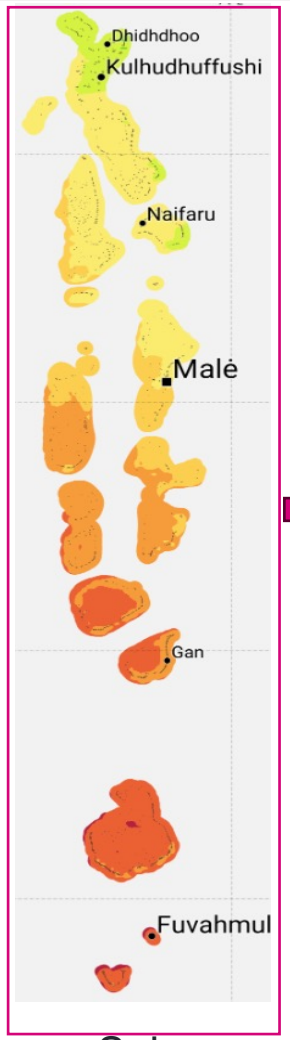
3. Fatal flaw assessment, focusing on likelihood of occurrence

4. Selection of preferred sites

In-house Modelling Tools: GIS based MCA Results - Insights and Findings

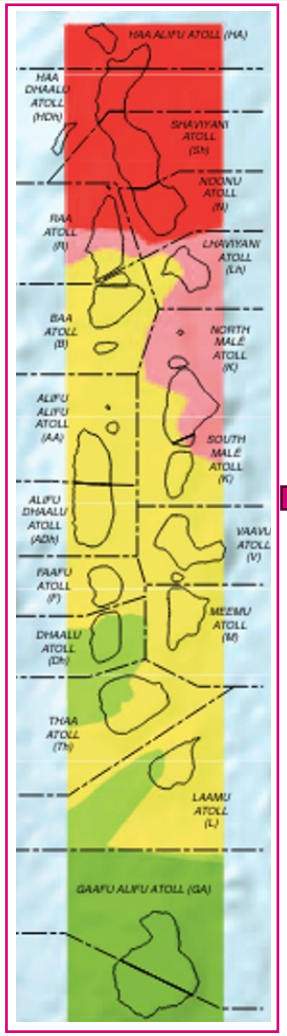
Parameters for the GIS-based Multi-Criteria Analysis (MCA) :

1. Protected areas
   - Forest / Natural parks
   - Endangered species
2. Solar irradiance (GHI)
3. Proximity to:
   - Substations
   - Military areas/Tourist activities (density)
4. Climate/Weather hazards
   - Wind load zones

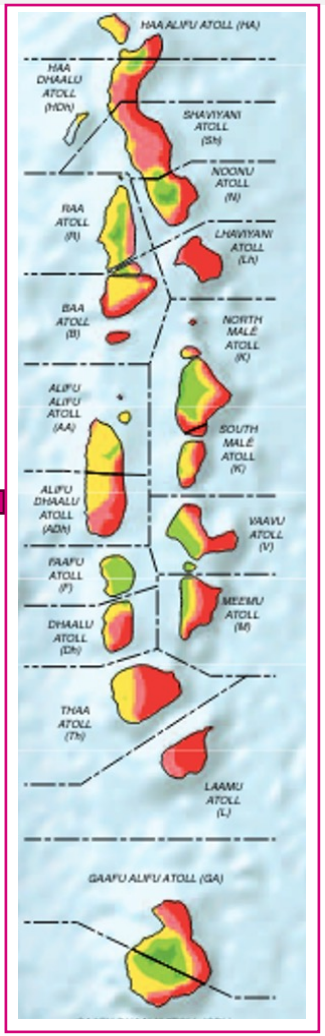


Solar Radiation

Protected areas

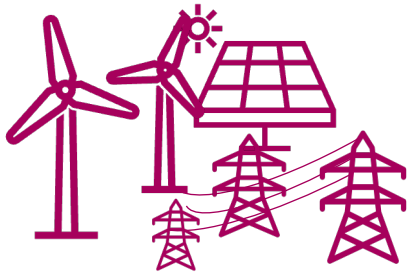


Wind zones



Other techno-socio-economic data

In-house Modelling Tools: AHEAD (Advanced Hybrid Energy Allocation & Dispatch)

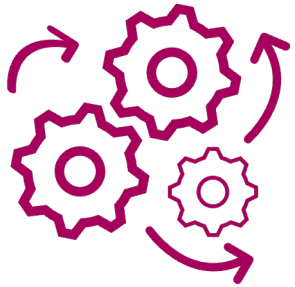


Hybrid system analysis

- Simulation tool especially for hybrid microgrid systems
- Wind, solar PV and battery
- Off-grid (gensets) or grid connected
- Determine optimized renewable share & carbon emission reduction

Time-efficient modeling

- Simulation in up to 1 minute time resolution
- Multi year simulations for whole project lifetime
- Tailored system sizing to meet load requirements
- Customizable and user defined dispatch strategy



Techno-economic Optimization

- Amortization: inbuilt cash flow based financial model to calculate financial KPIs like LCOE, IRR, NPV, ROI
- Optimization finds the lowest generation cost configuration

Decision process support

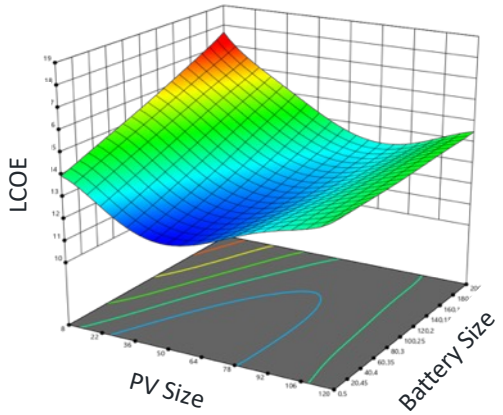
- Economics vs. strategy – make a conscious decision
- Visualize renewable generation vs. microgrid load
- Run multiple scenarios to determine the best solution

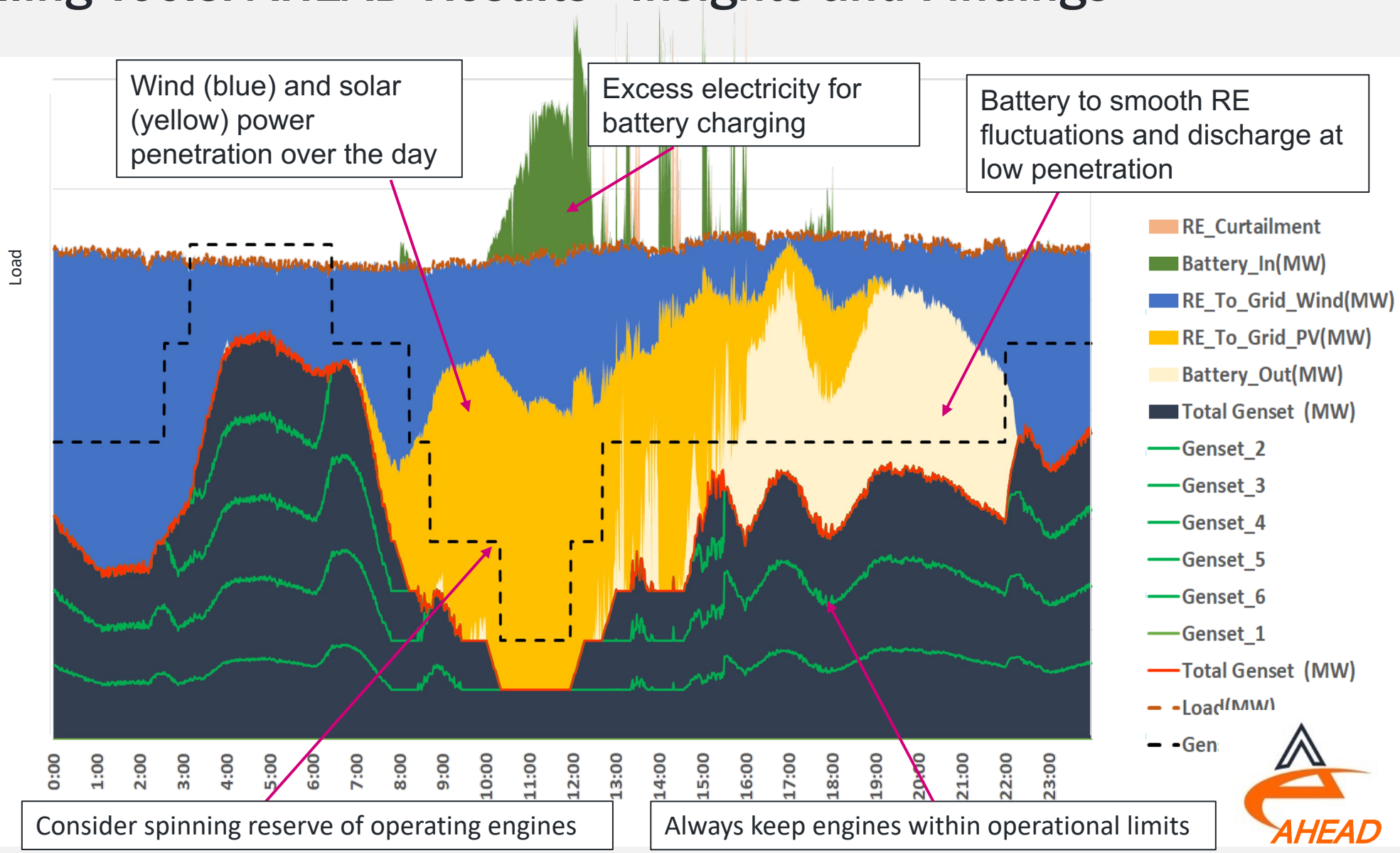
In-house Modelling Tools: AHEAD Results - Insights and Findings

Key features

- **Flexible** to accommodate project specific boundary conditions
- Customized **operating strategies**
- **Integrate** limitations from existing plants / grid

⇒ **Optimal Plant Sizing**





Key Takeaways: Summary of the Main Points

1. Floating PV (FPV) systems offer substantial growth opportunities for sustainable power generation, playing a vital role in clean energy solutions and mini grid evolution.
2. FPV combined with BESS ensures reliable power for remote islands despite challenges, ensuring energy security.
3. Collaboration in these projects can overcome potential challenges and promote clean energy systems, enabling possibilities of community-based PPAs and grid sales.
4. Techno-economic optimization tools (incl. GIS based MCA tool) are crucial for accurate site selection, system sizing, and quick cost estimation, enabling comprehensive high-level assessments and pre-feasibility studies.
5. Customization options enhance the effectiveness and applicability of these tools to different countries and regions, facilitating successful hybrid project development.

Thank you very much for your kind attention

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