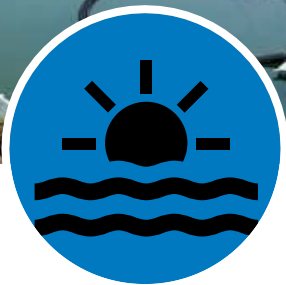


# Floating PV Potential and Technology Validation

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National Renewable Energy Laboratory (NREL)  
July 2024

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Introduction



FPV Technical  
Potential



FPV Technology  
Validation

# Introduction

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# NREL at a Glance

## 3,915 Workforce, including:

- 2,913 regular/limited term
- 531 contingent workers
- 223 postdoctoral researchers
- 155 graduate student interns
- 93 undergraduate student interns

—as of 5/15/2024

## World-class research expertise in:

- Renewable Energy
- Sustainable Transportation & Fuels
- Buildings and Industry
- Energy Systems Integration

## Partnerships with:

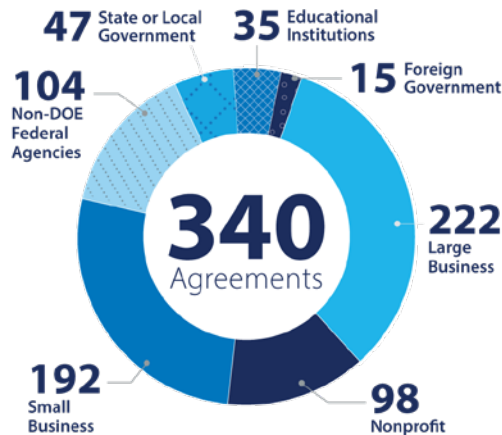
- Industry
- Academia
- Government

**4 Campuses** operate as living laboratories

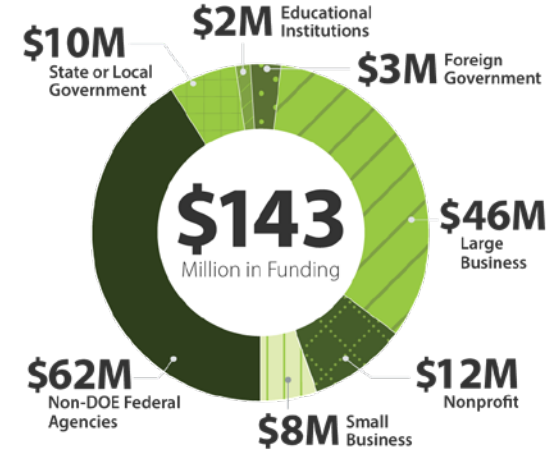


Photos by Prateek Joshi, NREL 88862 and 88860

## More Than 1,100 Active Partnerships in FY 2023

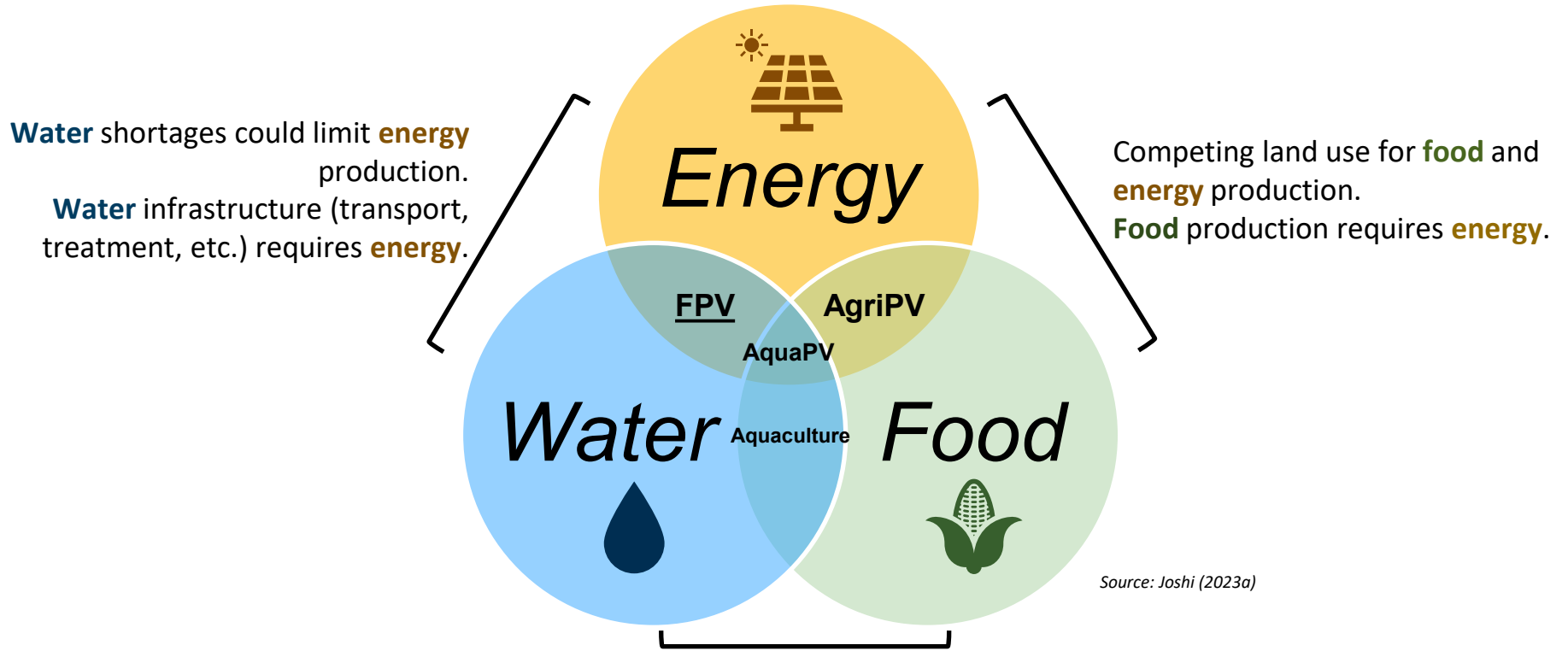


Agreements by Business Type



Funding by Business Type

# Food-Energy-Water Nexus for Solar PV



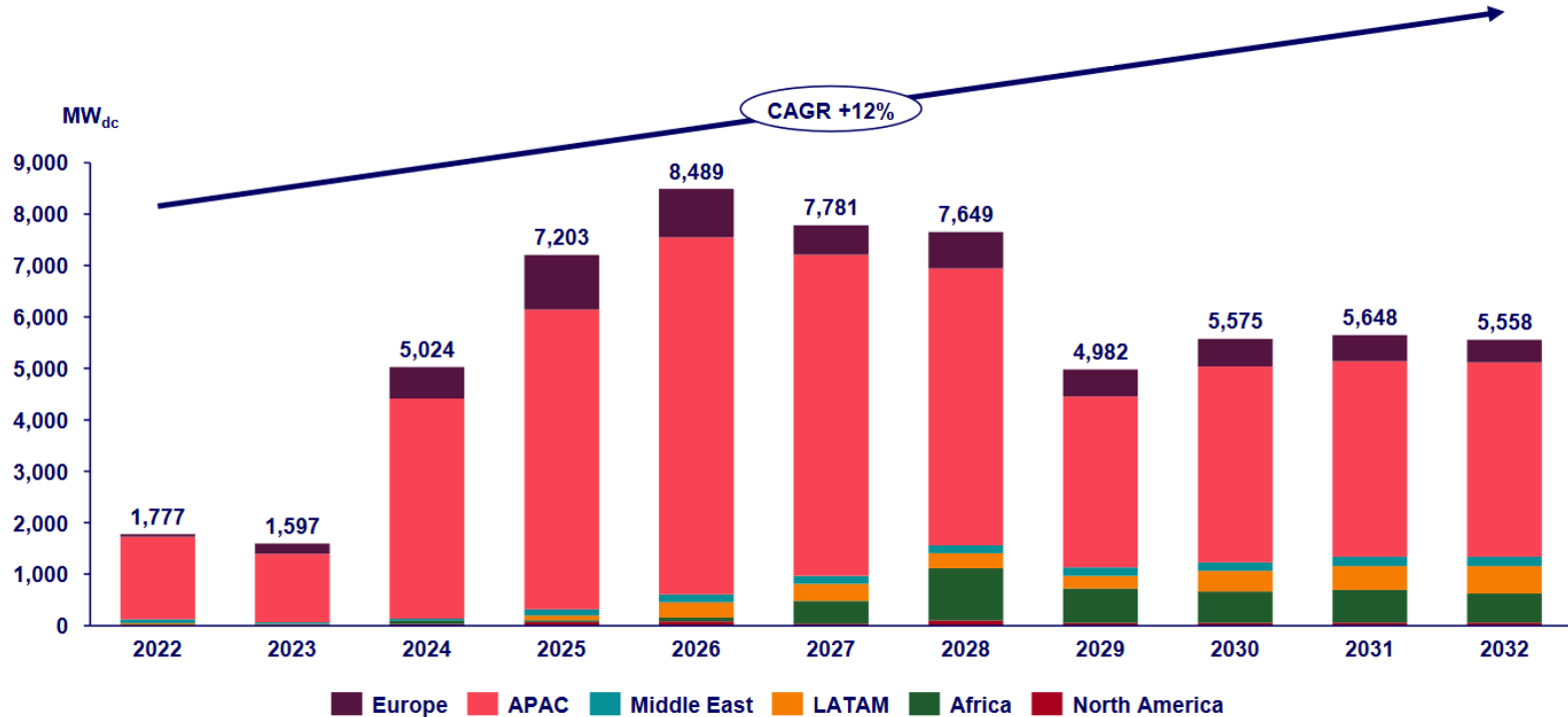
**Water** shortages could limit **energy** production.  
**Water** infrastructure (transport, treatment, etc.) requires **energy**.

Competing land use for **food** and **energy** production.  
**Food** production requires **energy**.

**Food** production could impact **water** quality and availability.  
**Water** shortages and contamination could limit **food** production.

Source: Joshi (2023a)

# Floating PV Market Growth by Region



Source: Sagardoy (2023) – Wood Mackenzie

# FPV Technical Potential

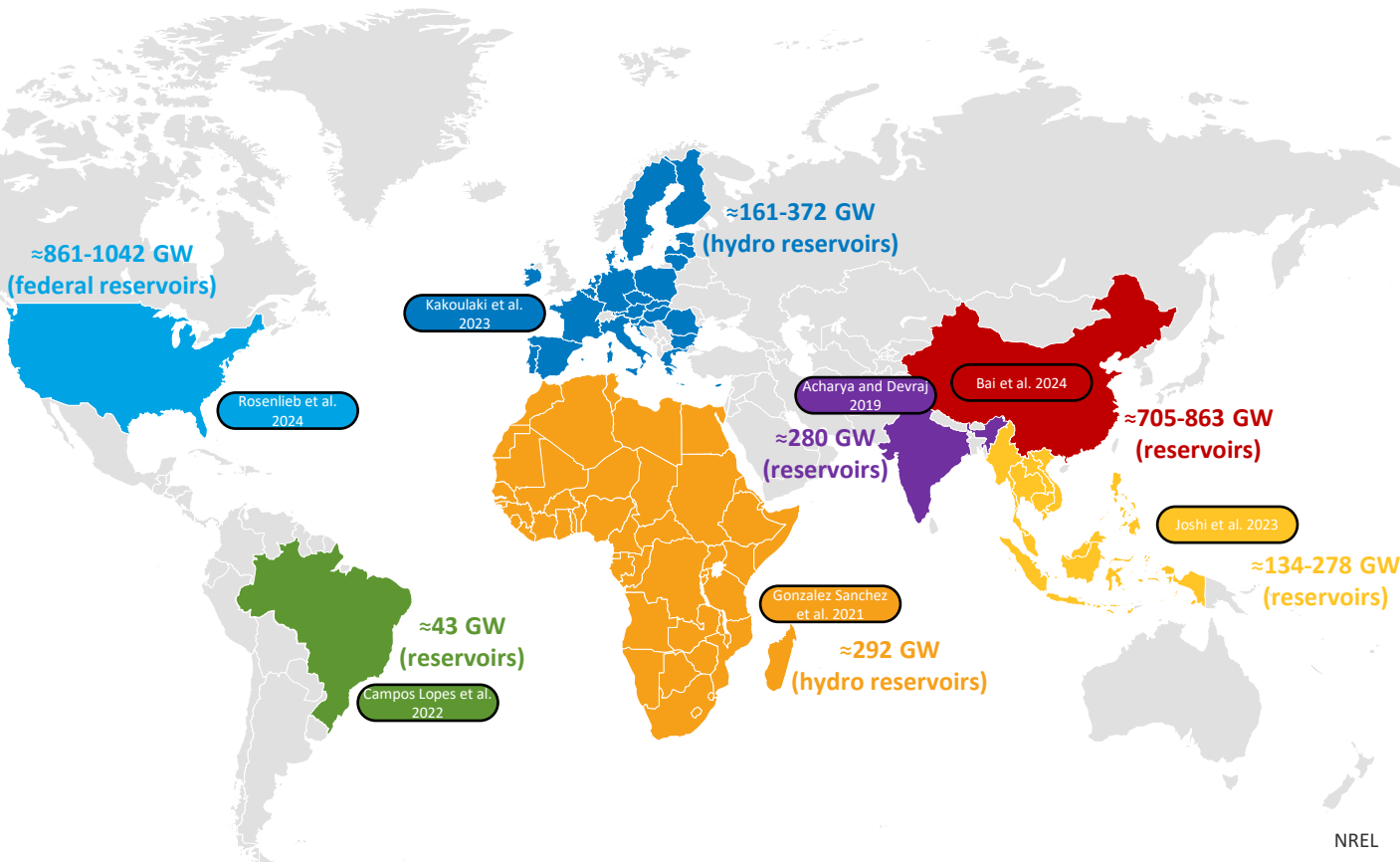
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# Select FPV Technical Potential Assessments

## Differences in:

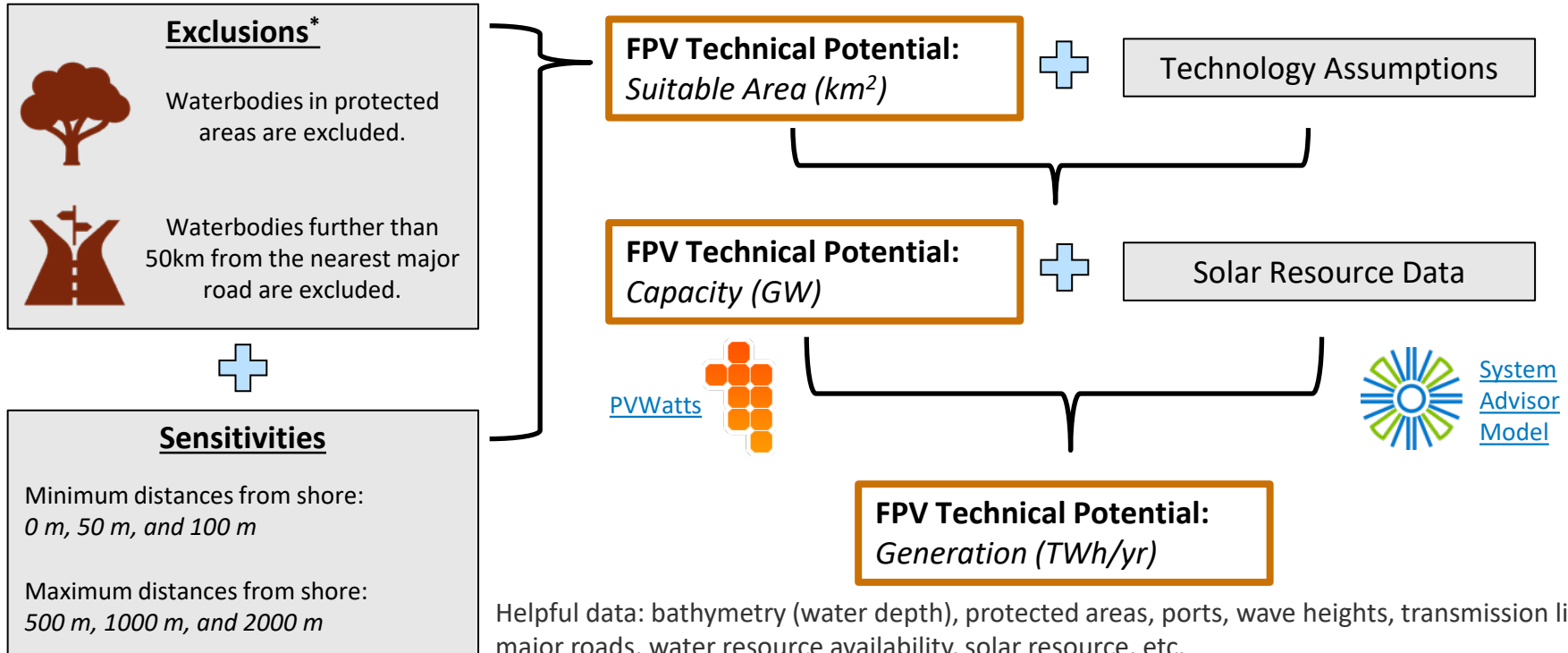
Waterbodies assessed, scenarios, assumptions (i.e., waterbody coverage), data sources etc.

*\*NOTE: Reservoirs refer generally to artificial waterbodies*





# Example Technical Potential Calculation



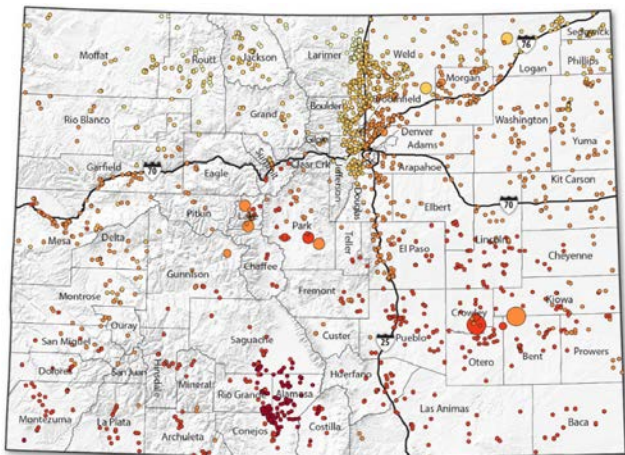
Source: Joshi et al. (2023)

Assess the use of the waterbody: recreation, water storage, flood control, irrigation, power generation, navigation, fishing, etc.

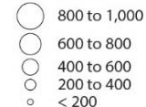
# Subnational FPV Assessments: Colorado and Puerto Rico

## Colorado

Number of waterbodies	1,900
Potential FPV capacity	11.1 GW



Generation (GWh/year)



Capacity Factor (percent)

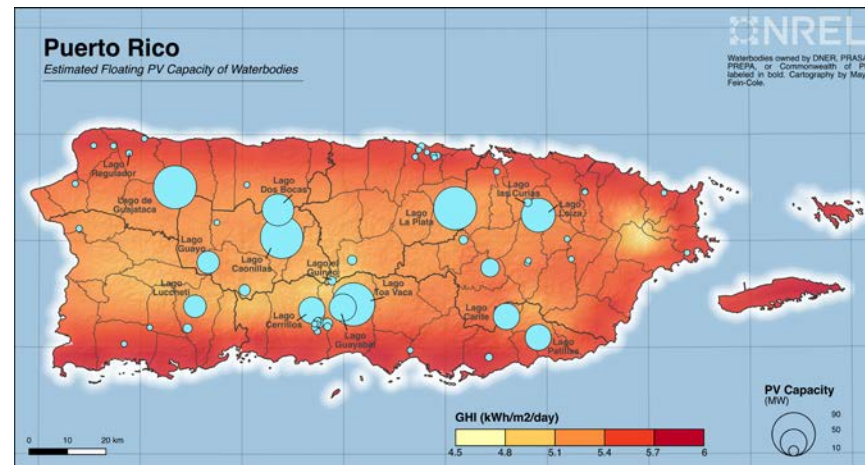


*Site specific assessment also conducted considering evaporation, algae, wildlife, water quality, and land-use trade-offs.*

Source: Liber et al. (2020)

## Puerto Rico

Number of waterbodies	55
Potential FPV capacity	636 MW



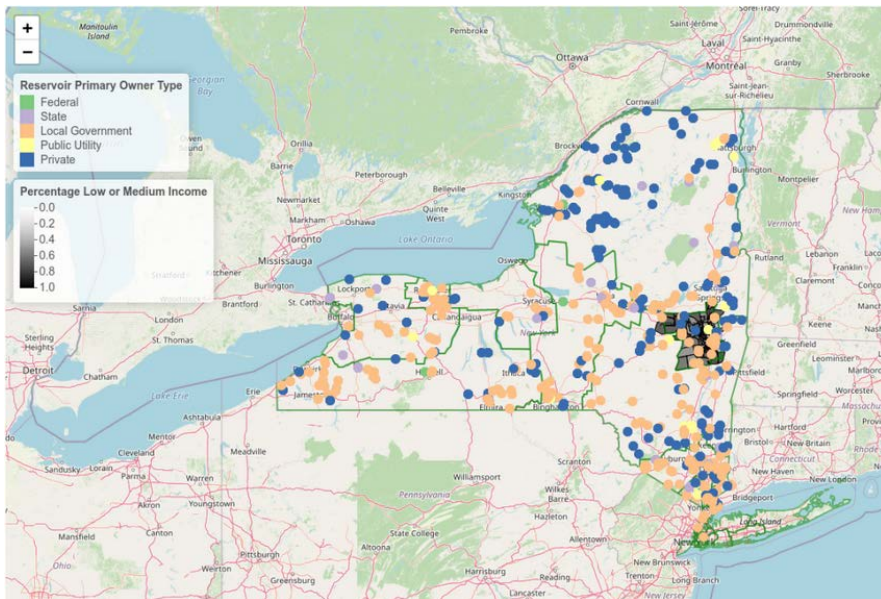
*Site specific assessment also conducted for six waterbodies with bathymetry data available.*

Source: Ortega Pastor et al. (2024)

# Data Explorers: United States and Southeast Asia

## United States

<https://idea.rpi.edu/research/projects/floating-solar-explorer>



## Southeast Asia



REdata  
explorer

<https://www.re-explorer.org/home>

A screenshot of the REdata explorer interface showing the 'Technical Potential' analysis settings. The interface is divided into three tabs: 'INTRO', 'ANALYSIS', and 'RESULTS'. The 'ANALYSIS' tab is active.

The 'Basic Analysis Parameters (Required)' section includes:

- Name Analysis Layer \***: A text input field containing 'Laos'.
- Select Country \***: A dropdown menu with 'Lao People's Democratic Republic' selected.
- Resource Type \***: A dropdown menu with 'Solar' selected.
- Technology Type \***: A dropdown menu with 'Floating PV' selected.

Below these settings are three sliders (1, 2, 3) and 'BACK' and 'NEXT' buttons.

# FPV Technology Validation

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# Wave Tank



Photo by Werner Slocum, NREL 80570

## Sea Wave Environmental Lab (SWEL)

- Ocean simulation tool to validate offshore technology
- Wet validation of small-scale devices that are approximately  $1/75^{\text{th}}$  the size of full-scale device
- 2D wave generator; 14 m long, 1.3 m deep, 2.5 m wide
- 13,000 gallons of fresh water
- Four motion tracking cameras to monitor device dynamics

Source: NREL (2022)

# Motion Platform



Photo by Bryan Bechtold, NREL 80658

## Large-Amplitude Motion Platform (LAMP)

- Simulations ocean conditions for technology validation
- Dry validation of small-scale to full-scale prototypes that can emulate typical wave states
- Supports a payload of up to 22,000 pounds
- Six different degree-of-freedom motions (surges up to 2.5 m, sways up to 2.3 m, and heaves up to 1.8 m)

Source: NREL (2023)

The background image shows two workers in white hard hats and orange safety vests installing solar panels on a structure that resembles a boat or a large watercraft. They are positioned on either side of a large solar panel in the foreground. The structure is on a body of water, and a shoreline with buildings and trees is visible in the distance under a clear sky.

# Thank You

[www.nrel.gov](http://www.nrel.gov)

NREL/PR-7A40-90523

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*Photo by Dennis Schroeder, NREL 53269*

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