



30 August 2024

[Tethys](#) is a knowledge hub with information and resources on the environmental effects of wind and marine energy. The bi-weekly [Tethys Blast](#) highlights announcements and upcoming events; new documents in the [Knowledge Base](#); and international energy news. [ORJIP Ocean Energy](#) has partnered with [OES-Environmental](#) to provide additional content. [Email us](#) to contribute!

[Announcements](#)
[Upcoming Events](#)

[Marine Energy Documents](#)
[Wind Energy Documents](#)

[Marine Energy News](#)
[Wind Energy News](#)

Announcements

[New Tethys Story](#)

[SEASTAR: Enhancing Tidal Stream Environmental Monitoring and Sustainability](#) by Kate Smith (Nova Innovation)

Building on the success of Nova Innovation’s 6-turbine array in Shetland, Scotland, the ‘Sustainable European Advanced Subsea Tidal Array’ (SEASTAR) project will use Nova’s well-proven turbines to deliver a 4 MW tidal farm of 16 turbines. SEASTAR, located at the European Marine Energy Centre’s (EMEC) Fall of Warness tidal site in Orkney, Scotland, will be home to the largest number of tidal stream turbines ever deployed in a single location. [Learn more here.](#)

[ORISE Host Facilities](#)

The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) is seeking organizations to host a WPTO-funded fellow for up to 12 months as part of the [Oak Ridge Institute for Science and Education \(ORISE\) Marine Energy Fellowship Program](#). This program supports graduate and recent post-graduate students to advance marine energy research at their host facilities, with funding from WPTO. Please complete this [interest form](#) by 30 August 2024.

[Request for Information](#)

The National Renewable Energy Laboratory (NREL) has issued a [Request for Information](#) on behalf of the U.S. DOE WPTO to collect feedback from public and private investors, nonprofits,

professional societies, state and local governments, funding awardees, and the broader renewable energy investment community on the barriers to investing in or providing supplementary commercialization support to marine energy developers. Responses are due 30 August 2024.

BOEM Seeks Public Comment

The U.S. Bureau of Ocean Energy Management (BOEM) recently published a [Call for Information and Nominations](#) for a second regional offshore wind energy sale in the Central Atlantic. BOEM will accept nominations and comments through 21 October 2024. BOEM will also host several virtual and in-person public meetings in September and October. [Register here.](#)

Blue Energy Collaborative Scholarships

The International Network on Offshore Renewable Energy (INORE) has opened the Call for Applications for the [2024 Blue Energy Collaborative Scholarships \(BECS\)](#), sponsored by Ocean Energy Systems, until 14 September 2024. The grant aims to support formative research in the field of offshore renewable energy and promote collaboration and communication amongst early-career professionals from diverse disciplines, institutions, and nations.

New E-TWG Guidance Document

An expert committee of the New York State Offshore Wind Environmental Technical Working Group ([E-TWG](#)) has released [guidance for conducting pre- and post-construction monitoring](#) to detect changes in marine bird distributions and habitat use related to offshore wind development, as well as [guidance for the use of existing avian survey data](#) for site characterization purposes. These recommendations are intended to support environmental research in the U.S. Atlantic but have broad applicability to research efforts in all regions of offshore wind development.

Calls for Abstracts & Proposals

The Ocean Thermal Energy Association has extended the Call for Speakers for the [10th International Ocean Thermal Energy \(OTEC\) Symposium](#) through 30 August 2024. The symposium will take place 4-5 December 2024 in Rio de Janeiro, Brazil.

The [Call for Abstracts](#) for [WindEurope's Annual Event 2025](#) is now open through 6 September 2024. The annual event will take place 8-10 April 2025 in Copenhagen, Denmark.

The [Call for Abstracts](#) for the [Offshore Technology Conference \(OTC 2025\)](#) is open through 10 September 2024. OTC will take place 5-8 May 2025 in Houston, Texas, U.S.

The [Call for Abstracts](#) for the [Nova Scotia Offshore Wind Research & Development Forum](#) is open through 13 September 2024. The Forum will take place on 18 November 2024 in Halifax, Nova Scotia, Canada.

The Oceanic Network has opened the [Call for Workshops](#) for the [2025 International Partnering Forum \(IPF\)](#) through 1 November 2024. IPF 2025 will take place from 28 April to 1 May 2024 in Virginia Beach, Virginia, U.S.

Funding & Testing Opportunities

The Supergen Offshore Renewable Energy (ORE) Hub has launched its fifth [Flexible Fund Call for Proposals](#) and is seeking research proposals from universities or other institutions eligible to hold UK Research and Innovation awards to facilitate a UK-led ORE research projects aligned with, and in partnership with the Hub. Expressions of interest are due 2 September 2024.

The Supergen ORE Hub has also launched its [Early Career Researchers \(ECR\) Research Fund](#), which is designed to be a flexible research fund for ECRs to support small activities that either develops existing research activities or develops your skills further. Applications should be directed at offshore wind, wave, or tidal energy research and are due 16 September 2024.

The U.S. DOE's Wind Energy Technologies Office (WETO) recently announced the [Offshore Wind National and Regional Research and Development Funding Opportunity](#), which will award \$48.6 million for projects that address several major areas of need for offshore wind, including improving offshore wildlife protection through new monitoring technologies. Concept papers are due 3 September 2024 and full applications are due 7 November 2024.

UK Research and Innovation has opened a follow-on [funding opportunity](#) to build on existing engineering and physical sciences research outputs to accelerate economic, societal, policy and environmental benefits. Applications must build on prior Engineering and Physical Sciences Research Council funding. Applications are due 24 September 2024.

New Jersey's Research and Monitoring Initiative has released a [Request for Proposals](#) to support research projects focused on furthering ecologically responsible offshore wind development. Letters of intent are due 28 August 2024 and proposals are due 9 October 2024.

The Testing Expertise and Access for Marine Energy Research (TEAMER) program, sponsored by the U.S. DOE and directed by the Pacific Ocean Energy Trust (POET), is accepting [Request for Technical Support \(RFTS\) 14](#) applications through 4 October 2024 to support marine energy testing and development projects. Open Water Support applications can be submitted any time.

The U.S. National Science Foundation (NSF) opened applications for its [Engineering Research Initiation program](#), which aims to enhance engineering research capacity by supporting new academic investigators who have not received significant federal funding, and includes a special topic focused on Marine Energy and the Blue Economy. Applications are due 9 October 2024.

The Ocean Energy Safety Institute (OESI) has published a [Request for Proposals](#) to support research pathways across oil and gas, wind energy, and marine energy. OESI anticipates awarding up to \$16 million to foster enhanced safety protocols, improved technologies, and new insights into risk management. Proposals are due 18 October 2024.

The Natural Environment Research Council (NERC) is planning to open a [funding opportunity](#) to enhance understanding of the ecological, economic, and social value of marine artificial structures' natural capital to inform decision making and policy solutions for management for all life stages. The outline stage will open 5 September 2024 and close 31 October 2024.

The National Offshore Wind Research and Development Consortium (NOWRDC) has opened its [Solicitation 4.0 - Innovations in Floating Offshore Wind](#) to fund projects that address areas of need for floating offshore wind, including innovation in ports and vessels, transmission technology, and uncrewed underwater vehicles for environmental monitoring. An [informational webinar](#) will take place on 10 September 2024. Proposals are due 14 November 2024.

The Horizon Europe program is planning to issue a funding call, [Critical Technologies for Future Ocean Energy Farms](#), to support projects aimed at improving the performance of and knowledge of ocean energy. The call is expected to open in September 2024 and close in February 2025.

Career Opportunities

The Coastal Studies Institute is looking for an [Environmental Specialist](#) who will be responsible for developing and implementing environmental monitoring and research protocols, maintaining environmental permits, and outreach related to the marine energy device testing for the Atlantic Marine Energy Center (AMEC). Applications are due 30 August 2024.

France Énergies Marines is hiring a [Scientist/Engineer](#) with expertise in the environmental effects of offshore wind and marine energy. During a first phase, work will focus on a project aimed at improving the design of floating substations. Applications are due 3 September 2024.

University College Cork's MaREI is looking for a [Senior Post-Doctoral Researcher](#) to deliver a capability in numerical modelling of offshore renewable technologies and analysis of metocean data on large temporal and spatial scales. Applications are due 5 September 2024.

Plymouth Marine Laboratory is seeking an [Atmosphere-Ocean Scientist](#) and a [Senior Scientist in Ocean Colour Research](#). Applications are due 8 September and 16 September 2024, respectively.

NatureScot is seeking a [Marine Data Advisor](#) to join its Marine Energy programme, which coordinates and delivers advice for offshore wind developments in Scotland. This is a 9-month fixed-term appointment. Applications are due 9 September 2024.

Pacific Northwest National Laboratory (PNNL) is hiring an [Undergraduate Intern](#) and a [Masters Intern](#) to support the curation of content on knowledge hubs within the Portal and Repository for Information on Marine Renewable Energy (PRIMRE), including [Tethys](#), [Tethys Engineering](#), and the [Marine Energy Projects Database](#). Applications are due 10 September 2024.

PNNL is also hiring a [Post Masters Research Associate – Marine Energy and Environment](#) to assist with synthesizing and interpreting scientific information on interdisciplinary projects focused on environmental effects of marine energy and other areas like social and economic effects, community engagement, and aquaculture. Applications are due 17 September 2024.

The Pacific Marine Energy Center (PMEC) at Oregon State University is recruiting two [Post-Doctoral Scholars](#) to develop numerical and scaled physical models of sub-surface wave energy converters, autonomous underwater vehicle recharging, and real-time hybrid simulation of offshore wind turbines. The tentative closing date is 20 September 2024.

Avangrid is looking for a [Senior Offshore Wind Permitting Manager](#) to manage and coordinate permitting and compliance efforts for the New England Wind 1 Offshore Wind Project. The job posting closes on 20 September 2024.

Offshore Renewable Energy Catapult is recruiting a [People Business Partner](#) to support the delivery of its People strategy and a [High Voltage Test Laboratory Manager](#) to lead a team of engineers and technicians to deliver high voltage testing.

Upcoming Events

Upcoming Webinars

The National Renewable Energy Laboratory's Enabling Coexistence Options for Wind Energy and Wildlife ([ECO Wind](#)) project is hosting a webinar, "[Perspectives on Wind-Wildlife Constraints to Buildout Webinar 2: Operations](#)", on 3 September 2024 from 2:00-3:00pm MDT (8:00-9:00pm UTC) and feature three presentations on loads analysis, controls, and grid planning as they relate to wind facility operations. [Register here.](#)

Researchers at the Pacific Northwest National Laboratory (PNNL) are hosting a webinar, "[Offshore Aquaculture and Wave Energy in Puerto Rico – Research Study Update](#)", on 5 September 2024 from 11:00am-12:00pm EDT (3:00-4:00pm UTC). The webinar will highlight research investigating the technical and social feasibility of [co-locating marine energy and offshore aquaculture](#) in Puerto Rico and discuss a comprehensive spatial analysis, environmental fieldwork, and outreach and engagement. [Register here.](#)

Ocean Energy Systems (OES)-Environmental is hosting a public webinar, "[The State of the Science on Environmental Effects of Marine Renewable Energy](#)", on 2 October 2024 from 8:00-9:30am PDT (3:00-4:30pm UTC). During this webinar, OES-Environmental will present on findings from the *2024 State of the Science Report: Environmental Effects of Marine Renewable Energy*, which will be published in September 2024. [Register here.](#)

[WREN](#) is hosting a webinar, "[Using eDNA for wind energy and wildlife studies](#)", on 17 October 2024 from 10:00am-11:00am EDT (2:00pm-3:00pm UTC). During the webinar, researchers from France and the United States will present their research on the feasibility of using environmental DNA, or eDNA, to detect marine wildlife. [Register here.](#)

Upcoming Conferences

The Dutch Marine Energy Centre (DMEC) is hosting the [Advancing Nature-Inclusive Offshore Renewable Energy Solutions Conference](#) on 17 September 2024 in The Hague, Netherlands.

The [International Conference on Ocean Energy \(ICOE 2024\)](#) will take place on 17-19 September 2024 in Melbourne, Australia.

The [American Floating Offshore Wind Technical Summit \(Afloat 2024\)](#) will take place 24-25 September 2024 in Portland, Maine, U.S.

The [7th Asian Offshore Wind, Wave, and Tidal Energy Conference \(AWTEC 2024\)](#) will take place on 20-24 October 2024 in Busan, Korea.

The Marine Alliance for Science and Technology Scotland (MASTS) is hosting its [2024 Annual Science Meeting](#) on 5-7 November 2024 in Glasgow, Scotland. Early bird tickets now available.

Upcoming Workshops

As part of ICOE 2024, the U.S. DOE WPTO and partners are hosting a workshop focused on [Knowledge Gaps: Off-Grid and Micro-Grid Uses of Marine Energy](#) on 18 September 2024. The workshop will share progress on research that supports off-grid and micro-grid uses of marine energy for remote communities and power at sea, and seek to understand international industry's current projects and interests and how off-grid applications are being developed internationally. Interested ICOE attendees can [RSVP here](#).

As part of ICOE 2024, OES-Environmental and Offshore Renewables Joint Industry Programme (ORJIP) are hosting a workshop focused on [Environmental Effects for Permitting Off-Grid Marine Energy Applications](#) on 19 September 2024. The workshop will explore what level of environmental effects might be expected from smaller scale (off-grid) wave and tidal energy devices, and to determine what information is needed to streamline permitting for these devices. Interested ICOE attendees can [RSVP here](#).

New Documents on Tethys

[Tethys](#) hosts thousands of documents on the environmental effects of marine and wind (land-based and offshore) energy, including journal articles, conference papers, and reports.

Marine Energy

[Assessing the Potential of Marine Renewable Energy in Mexico: Socioeconomic Needs, Energy Potential, Environmental Concerns, and Social Perception](#) – Martínez et al. 2024

Although the literature on Sustainable Development Goals (SDGs) is vast worldwide, studies in Mexico focusing on Marine Renewable Energy (MRE) and SDGs are only beginning to emerge. Despite this academic gap, Mexico has signed up for the United Nations SDGs, which include producing clean and affordable energy and reducing CO₂ emissions to slow global warming. The country is, therefore, committed to implementing measures to help achieve these goals. This study is the first multidisciplinary analysis performed at a national level in Mexico, aimed at identifying

sites for efficient MRE production while considering socioeconomic needs, environmental risks, and societal acceptance of the new technologies.

Country-Specific Guidance Document: Denmark – OES-Environmental 2024

The [guidance documents](#) are intended to be available for regulators and advisors as they carry out their decision-making and for developers and consultants as they prepare consenting and licensing applications. This country-specific document presents an overview of regulations relevant for marine renewable energy development in Denmark from pre-application, through to application and post-consent and is intended mainly for developers and consultants. It is not intended to replace any formal guidance or prescribe action, but rather provide a starting point for understanding the key requirements of the regulatory framework. This document is intended to be read in conjunction with the [background document](#).

Synthesis of multinational marine aquaculture and clean energy co-location – Gonzalez et al. 2024

Marine co-location, i.e., multiple fixed ocean activities operating in the same place and at the same time, can maximize the space- and resource-use efficiency in crowded seascapes. While interest grows, commercial use is nascent and the collective benefits or limitations of co-locating aquatic food and clean energy remains scattered throughout the literature. In this study, we synthesize multinational findings of co-location scientific publications (N = 102) to better understand the patterns and knowledge gaps at the co-located ocean food-energy nexus. We track and compare food (aquaculture) and energy (tidal, offshore wind, and wave) co-located ocean activities, noting the focus (e.g., ecological), motivation (e.g., impact/risk), and assessment type (e.g., modeling), as well as nine key metrics of interest (depth, distance from shore, aquaculture yield, etc.), mainly for aquaculture co-location.

Wind Energy

Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea – Benhemma-Le Gall et al. 2024

This report presents the results of PrePARED research that builds upon consent monitoring undertaken during the installation of monopile foundations at Ocean Winds' Moray West Offshore Wind Farm in 2023. No noise abatement systems were required by regulators for this project, providing an important opportunity to use these data to support management in UK waters. The management of impulsive noise in the Southern North Sea Special Area of Conservation (SNS SAC) for harbour porpoises uses time-area thresholds to limit the number of days on which activities producing impulsive noise are permitted. Licencing of these activities is underpinned by Effective Deterrent Ranges, which are used to assess the spatial scale of disturbance from different noise sources.

Offshore windfarm construction elevates metabolic rate and increases predation vulnerability of a key marine invertebrate – Cones et al. 2024

Here, we examined critical behavioral, physiological, and antipredator impacts of actual pile driving construction on the giant sea scallop (*Placopecten magellanicus*). Benthic taxa including bivalves are of particular concern because they are sound-sensitive, cannot move appreciable distances away from the stressor, and support livelihoods as one of the world's most economically and socially important fisheries. Overall, pile driving sound impacted scallops across a series of behavioral and physiological assays. Sound-exposed scallops consistently reduced their valve opening (22%), resulting in lowered mantle water oxygen levels available to the gills. Repeated and rapid valve adductions led to a 56% increase in metabolic rates relative to pre-exposure baselines.

Collaboration for Environmental Mitigation and Nature Inclusive Design (CEMNID) – Xodus Group & The Rich North Sea 2024

Research published by the Scottish Offshore Wind Energy Council (SOWEC) explores how developers of offshore wind could go above and beyond existing mitigations to maximise opportunities for nature while developing green infrastructure projects. Supported by SOWEC, the Collaboration for Environmental Mitigation & Nature Inclusive Design (CEMNID) project, a collaboration between offshore wind developers and Scottish regulators, has produced a new set of tools for the sector including a ‘Good Practice Mitigation Library’ and a suitability review of Nature Inclusive Design measures. These offer a practical framework for the offshore wind sector to deliver projects with minimal impact and to benefit the marine environment.

News & Press Releases

Marine Energy

University of Washington Expands Research Opportunities With TEAMER – U.S. DOE

Environmental monitoring is critical to the successful development and deployment of marine energy devices, but opportunities to test these technologies in the water—tank, basin or field—alongside prototype marine energy converters are often hard to come by. That’s one of the reasons why, in 2020, the U.S. DOE launched the TEAMER program. Sponsored by WPTO and directed by POET, TEAMER gives developers and researchers the opportunity to test and refine their marine energy technologies at private industry organizations, academic institutions, and national laboratories within the TEAMER Facility Network. For the University of Washington (UW), TEAMER’s support enabled testing of several environmental monitoring technologies.

EU backs Ocean Oasis with nearly €6M to advance wave energy-powered desalination tech **– Offshore Energy**

A consortium led by the Norwegian company Ocean Oasis has secured a grant of nearly €6 million from the European Union (EU) to enhance the supply of desalinated water from floating buoys in deep water off the coast of Gran Canaria, Spain. The European Executive Agency on Climate, Infrastructure, and Environment (CINEA) awarded the €5,9 million grant under the framework of the Circular Economy and Quality of Life Programme. According to Ocean Oasis, the project will be led by Ocean Oasis Canarias, a subsidiary of the company based in Gran Canaria. The project, named Desalination for Environmental Sustainability and LIFE (DESALIFE) whose start date is expected to be January 1, 2025, aims to build and deploy the first fleet of Ocean Oasis' desalination buoys to provide water for 15,000 people in the Spanish island of Gran Canaria.

Eco Wave Power Announces H1 Results; Unveils Data from its Grid-Connected Project That Won the EDF Pulse Award, Kicks-Off Portugal Project, and Announces Green Light for its Shares Repurchase Program – Eco Wave Power

Eco Wave Power, an onshore wave energy technology company that has developed a patented, smart, and cost-efficient technology for turning ocean and sea waves into green electricity, is pleased to report its financial results as of and for the six months ended June 30, 2024 and provide a corporate update. In Israel, the EWP-EDF One Project in the Port of Jaffa, has been delivering clean energy from the waves to the Israeli National electrical grid, since its connection to the grid in the end of 2023. The Company also Announced its Support for the *Marine Energy Technologies Acceleration Act*, federal legislation in the U.S. that would invest \$1 billion to advance marine energy toward full scale commercialization.

Minesto puts together investment offer for buildout of tidal kite array – Offshore Energy

Swedish tidal energy developer Minesto has put together an investment offer for the first-phase buildout of an array of tidal kites in Hestfjord, Faroe Islands. According to Minesto, the actual production results of its utility-scale tidal energy kite Dragon 12 (D12) are used to accurately predict electricity production volumes in the site's business plan. One Dragon 4 (D4) unit, installed in March, has received hardware upgrades. The second D4 went in June in Minesto's Gothenburg workshop for the same upgrades. The installed power plants contribute to progress in environmental monitoring, which is valuable for the development phase in Hestfjord, said Minesto. This monitoring includes sound measurements, bird studies, and whale monitoring. D12 underwent service and inspection, after four months of grid-connected operation in Vestmana, Faroe Islands.

Ryder Provides Offshore Floating Tidal Turbine Support – Ryder Engineering

RYDER is pleased to announce the successful completion of a geotechnical site investigation for an esteemed offshore floating tidal turbine project. The project, located at the Fall of Warness EMEC test site in Orkney, represents a significant advancement in

the floating wind and tidal energy sector. This project aligns with recent developments in the UK's commitment to renewable energy. In May, the UK Government announced a substantial £4.6 million support package aimed at bolstering the development of the UK's islands, with £3 million specifically allocated to the Orkney-based European Marine Energy Centre (EMEC) over the next two years.

Wind Energy

[Biden-Harris Administration Announces First-Ever Wind Lease Sale Offshore Oregon](#) – U.S. Department of the Interior

In the latest step by the Biden-Harris administration to support the growing momentum across America for a clean energy future, the Department of the Interior recently announced it will hold an offshore wind energy lease sale off southern Oregon. The two areas to be auctioned on October 15, 2024, by BOEM could generate more than 3.1 gigawatts of clean, renewable energy if fully developed, which could power approximately one million homes. The news follows a series of announcements from the Department in its historic efforts to expand offshore wind energy opportunities, building on investments made by the President's Investing in America agenda and creating good-paying jobs for American workers.

[Salamander windfarm deploys innovative environmental monitoring campaign](#) – Salamander Floating Wind

Salamander, a joint venture between Ørsted, Simply Blue Group and Subsea7, has partnered with two Scottish universities to investigate any potential impact of floating windfarms on marine ecosystems. The PREDICT 2.0 initiative involves deployment of various sensors that can be used to help identify the potential impacts of floating windfarms on marine ecosystems, including the drivers of variation in fish movement and availability as prey. The innovation package has now been deployed on the Salamander floating wind site, as was committed to during the project's Innovation and Targeted Oil & Gas (INTOG) bid. The sensors – which include a fluorometer and echosounder - are gathering data on fish presence and behaviour as part of a research programme.

[BOEM Issues Offshore Wind Research Lease to State of Maine](#) – U.S. BOEM

Recently, BOEM announced the execution of the nation's first floating offshore wind energy research lease. The lease area covers a little under 15,000 acres located 28 nautical miles offshore Maine on the U.S. Outer Continental Shelf and could allow for the deployment of up to 12 floating offshore wind turbines capable of generating up to 144 megawatts of renewable energy. The research array will allow the State, the fishing community, wildlife experts, the offshore wind industry, and others to conduct in-depth studies and thoroughly evaluate floating offshore wind as a renewable energy source in the region. Research conducted on the array will evaluate its compatibility with existing ocean uses and assess its potential effects on the environment, supply chains, and job creation.

RWE marks major milestone with installation of HVDC Offshore Converter Platform for Sofia Offshore Wind Farm – RWE

RWE, one of the world's leading companies in offshore wind, has achieved a major milestone in the delivery of its flagship Sofia Offshore Wind Farm with the successful installation of the Offshore Converter Platform (OCP) which converts high voltage alternating current (AC) to high voltage direct current (DC). This critical infrastructure sits at the heart of the wind farm and is RWE's first offshore deployment of High Voltage Direct Current (HVDC) technology. Its successful installation keeps the 1.4 gigawatt (GW) project on track to be fully operational in 2026. Once fully operational, Sofia will be capable of generating enough electricity to power approximately 1.2 million typical UK homes.

7.6 GW Offshore Wind Plan Gets State Regulator Approval in California – Offshore Wind

The California Public Utilities Commission (CPUC) has finalised its plan to facilitate the state's procurement of more than 10 GW of large-scale renewable energy and storage, including 7.6 GW of (floating) offshore wind. CPUC has voted to adopt a proposed decision from July, directing the Department of Water Resources (DWR) to procure electrical resources with long lead times, including offshore wind. The maximum capacity outlined in the initial determination under Assembly Bill 1373 includes up to 7.6 GW of (floating) offshore wind, up to 1 GW of enhanced geothermal systems (EGS), up to 1 GW of multi-day long-duration energy storage (LDES), and up to 1 GW of LDES with a discharge period of at least 12 hours.