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Tension Leg Platform R&D for Offshore Wind

Additional submitted attachment is included below.

CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

Electric Program Investment Charge 2026–2030 (EPIC 5) Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.

To submit the form, please visit the e-commenting link: https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx and select the Docket **25-EPIC-01**. Enter your contact information and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

   Matthew Hall, matthew.hall@nrel.gov, 720-364-0424

2. Please provide the name of the contact person's organization or affiliation:

   National Renewable Energy Laboratory

3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

   The CEC should consider funding research on using tension-leg platforms (TLPs) to enable large-scale offshore wind energy development with minimized space use. By using taut vertical mooring lines, TLPs take up drastically less space than any other floating support structure for offshore wind turbines. As such, they provide the possibility for California floating wind farms to minimize obstruction of other ocean activities and facilitate fishing, shipping, and other marine navigational activities within the lease areas.

   Few floating wind turbine TLPs have been deployed, and none in water depths approaching those of California. EPIC funding could enable research and development of TLP technology suited for California conditions, including:
   - System designs and tendon material choices to achieve sufficient stability despite the long tendon lengths required for California water depths.

- Practical tendon fabrication and installation methods for large-scale deployment of long tendons in CA wind farms, considering cost, supply chain, vessel capabilities, etc.
- TLP platform assembly, tow-out, and installation methods considering California port capabilities and domestic installation vessels.
- Mitigating TLP-specific risks in California metocean and seismic conditions, such as anchor movement during soil liquefaction and potential for vortex-induced vibration of tendons under large ocean currents.

4. In accordance with Senate Bill 96[i], please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

   Floating wind turbine platform developers (including some based in California) looking to adapt TLP technologies to California conditions face a range of technical challenges related to stability, structural resonances, tendon materials, installation logistics, anchoring robustness and more.[1] EPIC-funded research and development on TLPs will help address these technical challenges and enable TLP solutions that are feasible for California site conditions. This will allow TLP technology developers to participate in the California offshore wind market and expand the range of technology options available for the state's offshore wind projects.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety,[ii] reliability,[iii] affordability,[iv] environmental sustainability,[v] and equity?[vi]

   Developing TLP technology solutions that meet the technical requirements of California offshore wind conditions while achieving cost efficiency and logistical feasibility will open up an important new option for California's offshore wind lease areas. The selection of TLPs for these lease areas could bring important local benefits in enabling ocean co-use and reducing environmental impact, which can increase social acceptance of offshore wind projects prior to their execution and result in more sustainable and equitable offshore wind farms.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

TLP solutions for California floating wind farms can be evaluated with metrics across several domains:

- Technical feasibility: any TLP design must be evaluated using established loads analysis methods following standards such as those specified by the American Bureau of Shipping to confirm survivability in California conditions.
- Technical risk: any TLP design should be analyzed under failure conditions to assess its level of redundancy. Solutions can be compared in terms of which types of failures (e.g. anchor release) are catastrophic or survivable.
- Cost: the relative cost of a TLP solution can be compared against more established semisubmersible platform and mooring solutions (such as reference designs developed by NREL[2]).
- Installation feasibility: an installation plan for the TLP solution can be evaluated for the port and vessel capabilities it requires (e.g. port draft, cranes, types of installation vessels) and whether those capabilities already exist.

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

[1] Cooperman, A., Hall, M., Housner, S., Hein, C., Duffy, P., Mulas Hernando, D., Carmo, L., Moreno, F., & Musial, W. (2024). Investigation of the Challenges of Offshore Wind in Ultradeep Water. https://doi.org/10.2172/2484304

[2] Lozon, E., Lekkala, M., Sirkis, L., & Hall, M. (2025) Reference mooring and dynamic cable designs for representative U.S. floating wind farms, Ocean Engineering, https://doi.org/10.1016/j.oceaneng.2025.120473

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:[vii]
    a. Transportation Electrification
    b. Distributed Energy Resource Integration
    c. Building Decarbonization
    d. Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas
    e. Climate Adaptation

   Please describe in as much detail as possible how your proposed concept would support these goals.

The proposed concept supports EPIC's goal (d) Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas by enabling floating offshore wind farms that have reduced space use and allow ocean-space co-use by fishing and other users. This supports more socially acceptable and environmentally benign offshore wind energy installations, helping meet California renewable energy targets in a more sustainable and equitable way.

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.

EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.

To learn more about EPIC, visit: https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program

EPIC 5 documents and event notices will be posted to: https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5

Subscribe to the EPIC mailing list to stay informed about future opportunities to inform the development of EPIC 5: https://public.govdelivery.com/accounts/CNRA/signup/31897

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i See section (a) (1) of Public Resources Code 25711.5 at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25711.5.

ii EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

iii EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

iv EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

v EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

vi EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

vii In 2024 the CPUC adopted five Strategic Goals to guide development of the EPIC 5 Investment Plan. A description of the goals can be seen in Appendix A of CPUC Decision 24-03-007 available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF