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Distributed wind power

Additional submitted attachment is included below.

PYRO-E Clean Energy Generation

Saturday, December 17, 2022

Anthony Ng
Manager - Energy Deployment and Market Facilitation Branch
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

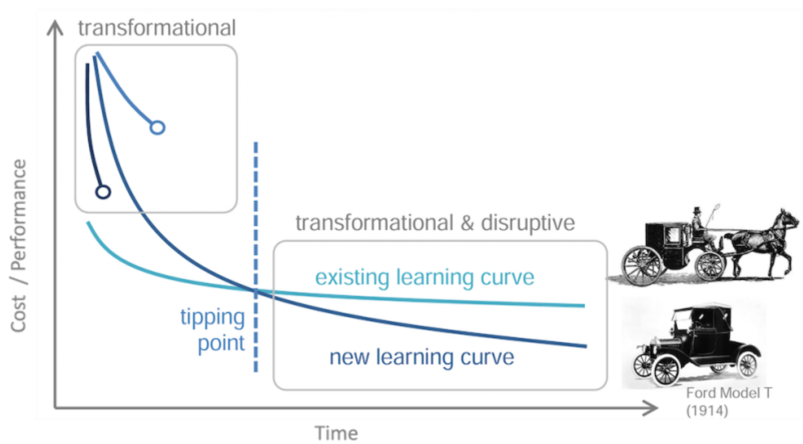
RE: Responding to with Climate Innovation Program (Docket: 22-ERDD-02)

Dear Mr. Ng,

Pyro-E appreciate the opportunity to offer feedback on the CEC's Climate Innovation Program to identify the opportunities for investment. Our response is provided below.

1. **What criteria should the CEC use to evaluate eligible technologies?**

Transformational technologies should be evaluated for its potential to move the needle in GHG reduction. From a historical perspective, technologies that were transformational all created 1) Innovative products that catalyzes 2) scalable business models. Lessons from the past suggest that these two factors are critical for lowering the cost of nascent but promising technologies over time through economies of scale. The new technology eventually displaces the old to benefit the public and environment – ex., gasoline cars overcame horse/buggy, brought on by the new manufacturing model for mass production rather than the technology itself. The Climate Innovation Program must not only evaluate the technical merits but also the potential scalability of the business model[1].



Proposals should identify the new learning curve that would inform the cost/performance trajectory in the ultra-competitive and cost-sensitive energy sector. It is essential to test and validate the vision of how the cost/performance metrics can be transform over time with economy of scale. At a high level, those proposed innovation should adhere to one of the three pillars of a low carbon economy:

- Decentralization – Last mile problems are the most difficult and expensive to solve, but its solution will provide the highest GHG reduction payoff.

[1] https://hbr.org/2009/11/how-to-jump-start-the-clean-tech-economy

9248 1/2 Hall Rd, Downey, CA 90241 |www.pyro-e.com | Phone: (510)578-8849 | Fax: (800)536-8677

- Decarbonization – Improving the energy-use efficiency within energy, transportation, and related sectors
- Digitization – Match variable demand with flexible, better control generating assets as more generation & storage assets are added behind & in front of the meter.

As examples, the given approach to transforming the energy sector had recently catalyzed these scalable business models:

- Feed-in tariff public partnerships to support residential PV generation
- Subscription for smart metering and various micro-grid services
- Vehicle-to-grid two-way charging using electric vehicles
- Grid-scale battery to foster new material chemistry and supply chains

2. **What is your top-priority technology topic where you believe the most funding and emphasis should be placed because it could have the most significant impact and why?**

Vertical axis wind turbines (VAWTs) are simple, low footprint, and environmentally safe[2]. They could complement rooftop solar and operate behind the meter in microgrids applications. Unlike grid-scale turbines, small deployments could generate rate savings locally while, when broadly deployed, reduce stress on the grid. CEC funding could advance VAWTs for communities and businesses with grid-parity electricity while leveraging the same business models as rooftop solar PV for expansion.

Urban setting atop buildings, levees, overpasses, and roadways all provides the possible sites for VAWTs. These retrofits support the decentralization, decarbonization, and digitization of the energy landscape. To be specific, VAWT systems having a 1-kW minimum capacity and 10-m^2 footprint could find suitable installation sites without requiring land or environmental permitting. Having a small system capacity also make VAWTs adaptable to variable site conditions, a key driver for faster adoption for the distributed and intermittent wind resource in populated areas.

Today, the VAWTs technology remains nascent and expensive. However, novel concepts in compliant machines and solid-state energy generation offer new avenues of exploration. Unlike convention electromagnets, these concepts are more scalable in manufacturing to reap the economies of the scale. Collectively, having individual VAWTs that synchronize in motion to achieve greater levels of efficiency have not been investigated in depth thus far. These exploratory areas, both on the component and system level design, could overcome the low efficiency and structural reliability issues of current practice.

Sincerely,

Kevin Lu, phd.
Pyro-E, Inc. / kevin.lu@pyro-e.com

[2] M. A. Kader Zilani, et al., "Unconventional Energy Harvesting from Wind Velocity and VIV Resonance Phenomenon by using Bladeless Wind Turbine (BLWT)," 2021, ICICT4SD, pp. 254-258, doi: 10.1109/ICICT4SD50815.2021.9396939.