U.S. DEPARTMENT OF ENERGY | OFFICE OF ELECTRICITY

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$2.25M Silicon Carbide Packaging Prize

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American-Made Prizes with the U.S. Department of Energy's Office of Electricity
April 2024

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American-Made Challenges Overview

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The American-Made program is your **fast track to the clean energy revolution**. Funded by the U.S. Department of Energy, we incentivize innovation through prizes, training, teaming, and mentoring, connecting the nation's entrepreneurs and innovators to America's national labs and the private sector.

supercharge

A REVOLUTION OF **BOLD IDEAS**

Fast track your ideas for the clean energy revolution

$240M+
in cash prizes and support

70+
prizes

400+
Network members

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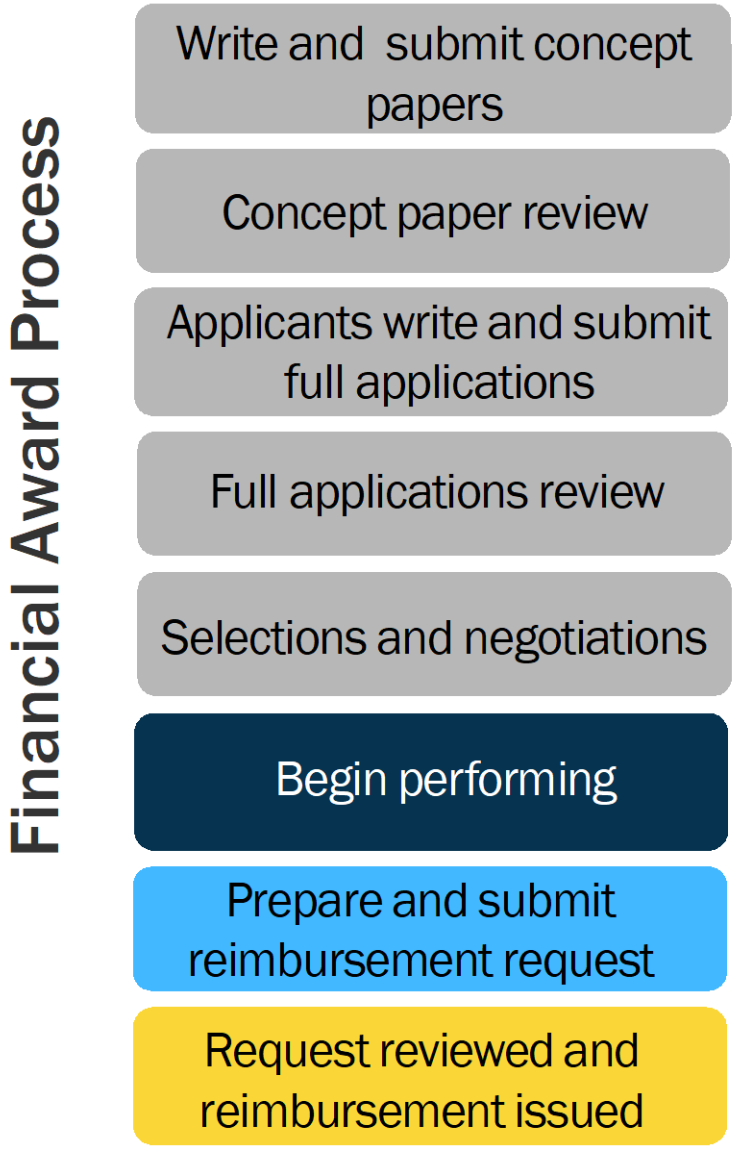
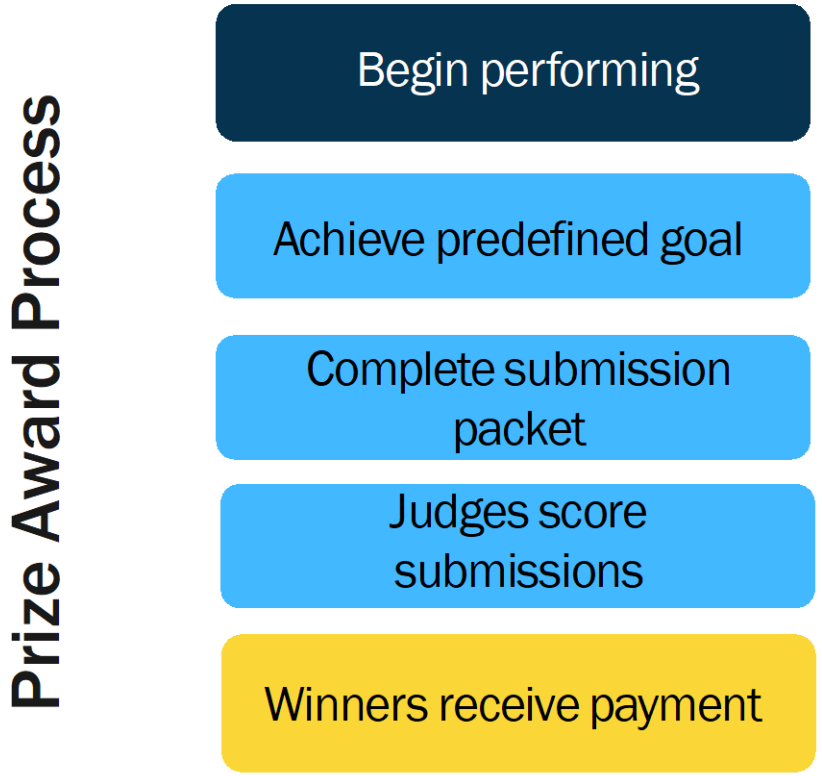
Grants vs. Prizes





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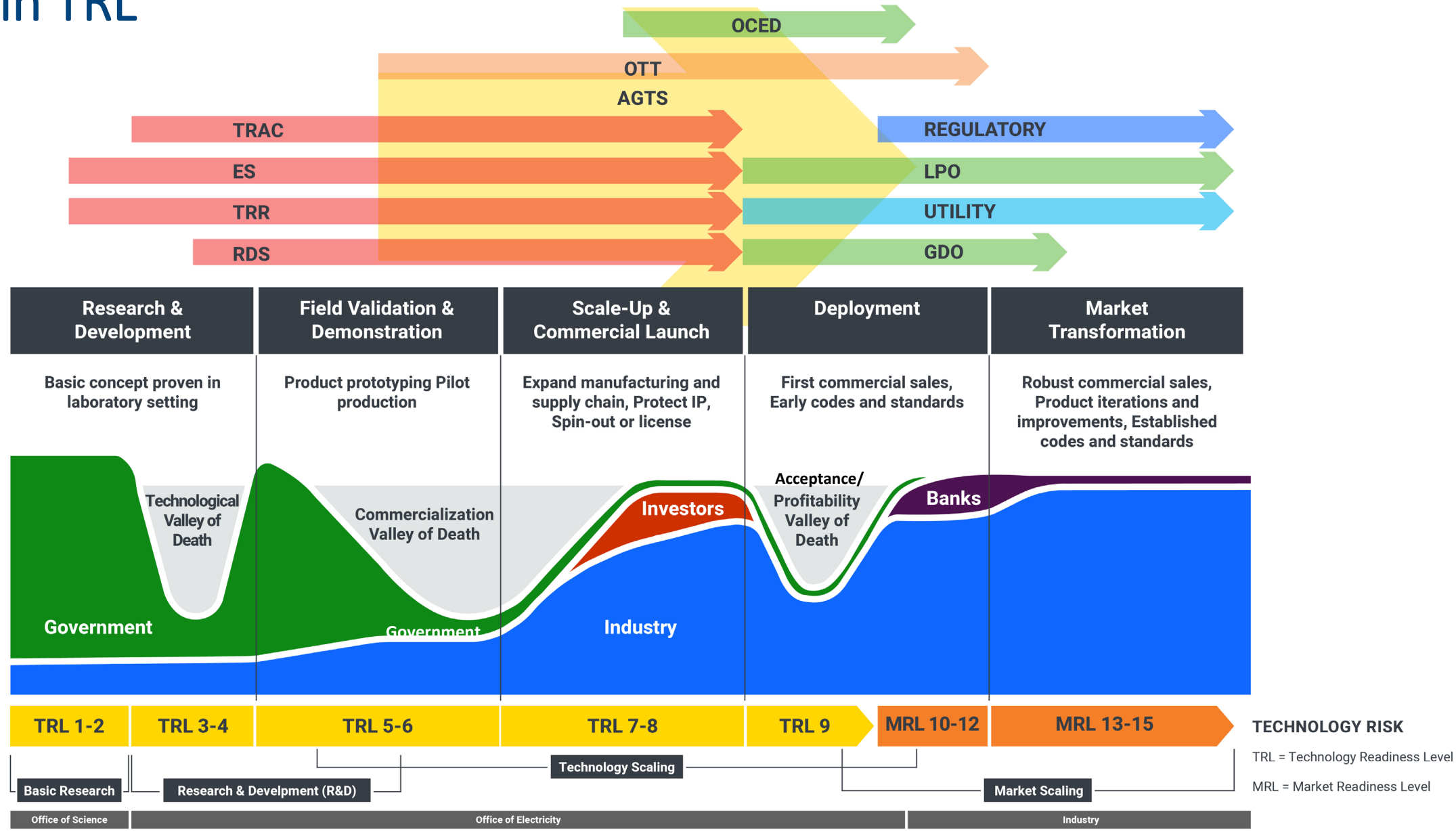
Office of Electricity (OE) Overview

Office of Electricity

- Leads national efforts to develop next-generation tools for the electricity delivery system ensuring a **reliable**, **resilient**, **affordable** and **secure electric grid** in the U.S. and providing global technology leadership.
- Focused on **software**, **hardware**, and **systems** that addresses systems integration, security, policy and other cross-cutting issues.
- Drive electric grid modernization and improving grid operations through **research**, **demonstrations**, **analytics**, **facilitation**, and **partnerships**.

OE in TRL



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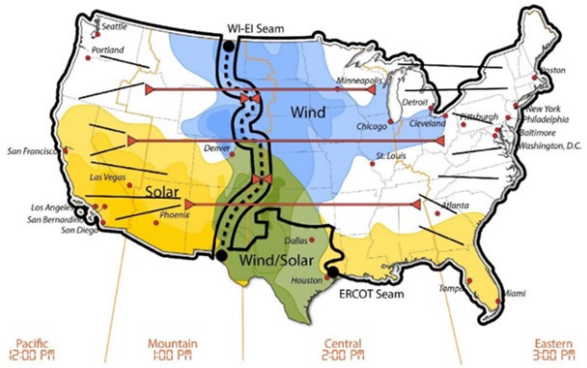
Grid Trajectory Considerations



Loose Coupling
Agile/Flexible

High RE Penetration, High-Voltage AC+DC Grids, and Storage

Dynamic and Coordinated Grid across TD&C

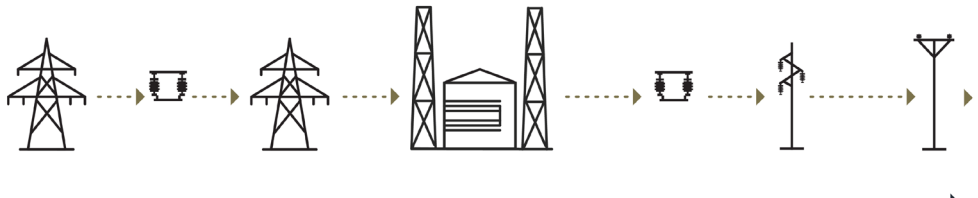
Next-Generation Electricity Network
- Control of flexible generation and load
- Energy storage
- Synthetic inertia
- Multi-directional power flow
- Varied/dynamic grid configuration
- Evolving business and market structures

Capital Intensive
Economies of scale

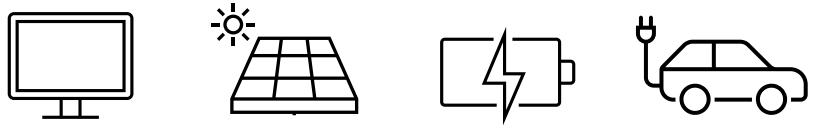
Capital Diffuse
Network economies

Current Grid

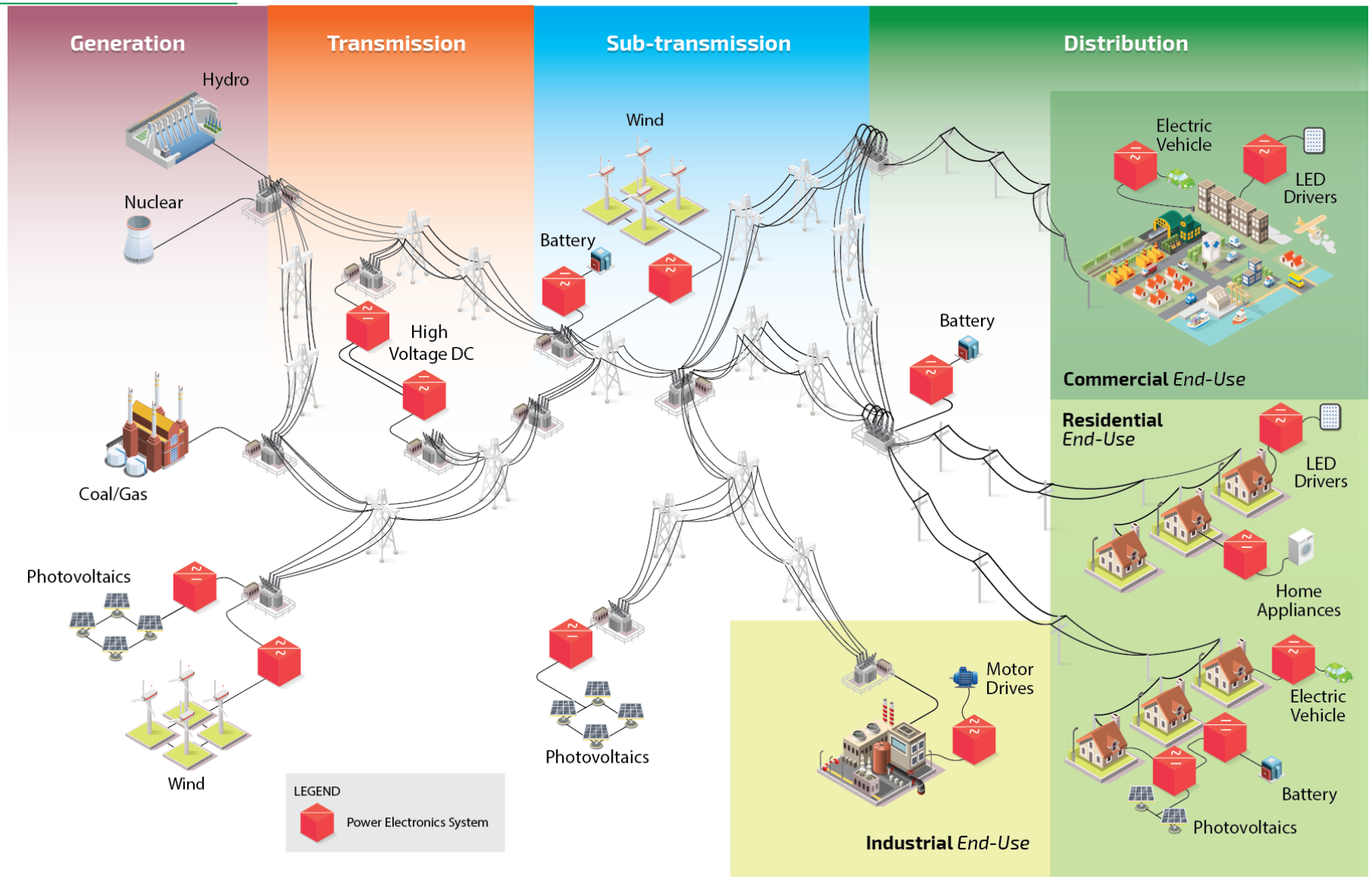
High DER + Complex Industry Structure



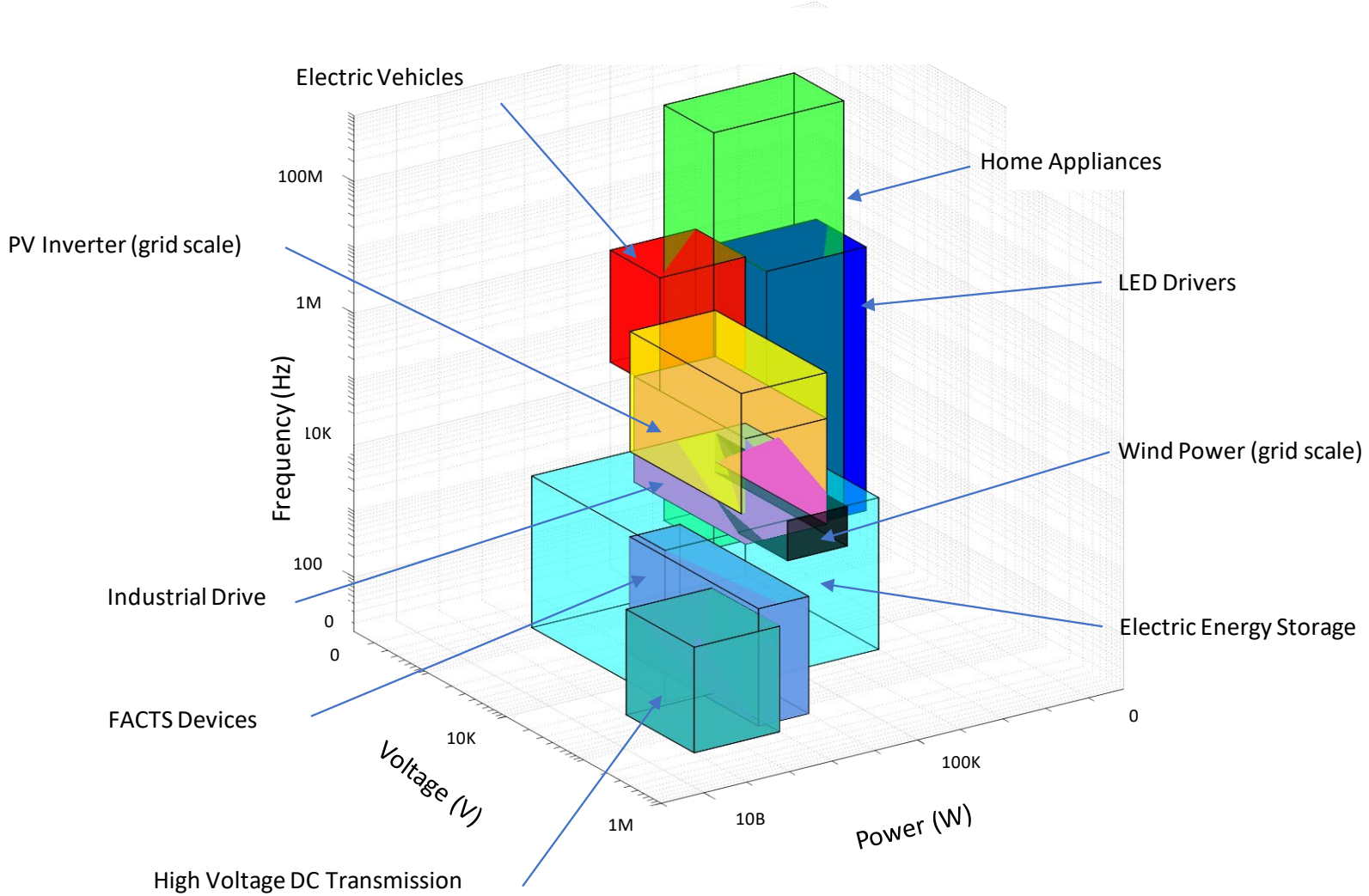
Tight Coupling
Rigid/Brittle



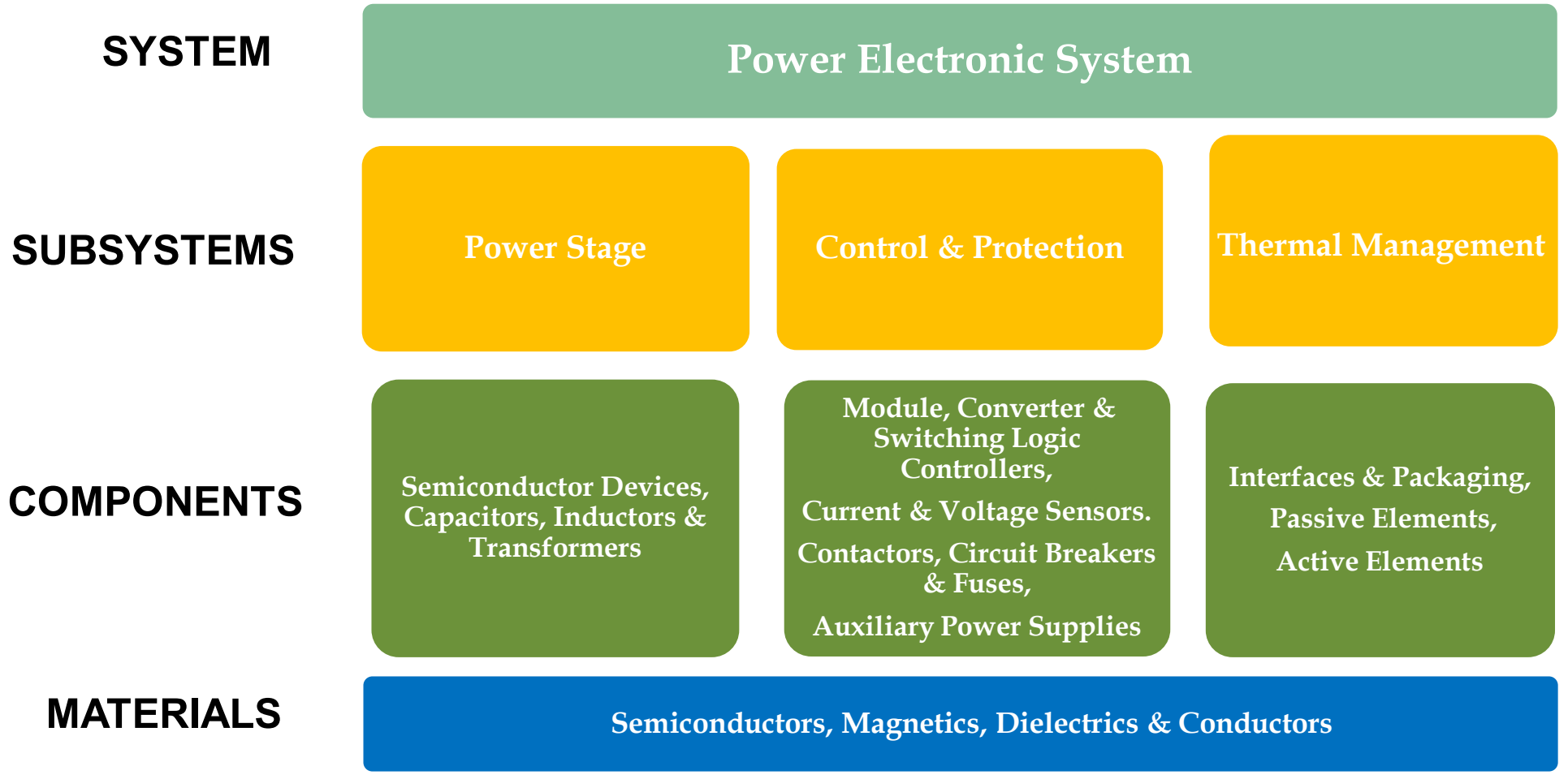
PES throughout the grid



PES Design Space for various applications



Hierarchy of PE Research and Development



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EFN Overview

Meet with EFN Prize Experts

Schedule a call with Tom Jensen and/or email EFN prize experts with questions

Schedule a Call -
https://calendly.com/entrepreneurfutures/coaching

Email Us –
admin@entrepreneurfutures.org

Tom Jensen
EFN Founder/ Executive Director
linkedin.com/in/jensentomc

Tom has 30 years of experience starting and accelerating venture backed companies and leading global consulting practices and projects for Fortune 500 companies. He has advised and mentored over 200 technology startups, including more than 50 in the energy and materials spaces. Startups who have completed EFN programs have raised more than $3.5B, with exits valued at over $4B.

Tom has coached and advised teams in 10+ American Made technology prize competitions.
www.entrepreneurfutures.org

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Silicon Carbide (SiC) Packaging Prize Overview

Silicon Carbide (SiC) Packaging Prize

The **three-phase $2.25 million** Silicon Carbide (SiC) Packaging Prize—launched by the U.S. Department of Energy's (DOE's) Office of Electricity—was established to develop and expand upon traditional semiconductor packaging designs. SiC power modules, though prime candidates for high-performance electronics, are often limited by traditional packaging techniques. To enable grid-based applications, SiC power modules must support higher voltage and higher current ratings.

The SiC Packaging Prize invites competitors to propose, design, build, and test state-of-the-art packaging prototypes that move the industry beyond its current state.

Phase 1: Design Study
8 months

Competitors will describe their team, their plan to make progress toward SiC packaging, showcase their current prototypes, and provide evidence of their current metrics that are in alignment with the goals of the prize. The goal of this phase is to develop a set of design documents for a Phase 2 prototype.

Phase 2: Initial Demonstration
14 months

Winners from Phase 1 will showcase and demonstrate the advancements made during the prize competition in packaging solutions for SiC modules. This phase is designed to act as a milestone towards achieving the Phase 3 target—improvement over conventional packaging and creating transformative solutions.

Phase 3: Final Demonstration
14 months

Winners from Phase 2 will will demonstrate an advancement in packaging solutions for SiC modules, meeting or exceeding the Phase 3 high voltage and high current targets, while continuing to innovate towards an improvement over state-of-the-art packaging.

Who Can Apply?

This competition is open only to private entities (for-profits and nonprofits); nonfederal government entities such as states, counties, tribes, and municipalities; academic institutions; and individuals, subject to the following requirements:

- Private entities must be incorporated in and maintain a primary place of business in the United States.
- Academic institutions must be based in the United States.
- An individual prize competitor or group of competitors who are not competing as part of an incorporated private entity must all be U.S. citizens or legal permanent residents.
- Individuals competing as part of an incorporated private entity may participate if they are legally allowed to work in the United States.

Please read the Official Rules for more information.

What to Submit

A complete submission package for Phase 1 should include the following items:

- 90-second video *(public)*
- Cover page and narrative
- Summary PowerPoint slide
- Letters of commitment or support *(optional).*

Reviewers will evaluate submissions by assigning a single score for each scored submission section, based on their overall agreement or disagreement with a series of statements. The scores are as follows:

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

For more information about submission materials, please read the Official Rules.

Phase 1 Submission Package Details

90-second Video *(public)*

Suggested content competitor provides:

- Showcase the innovative nature of your team, work, and prototype.
- Describe your solution, why it is transformational, and how you will meet the metrics in in prize.
- Describe who you are (your organization and key team members) and why you have a competitive edge.

A single score on a scale of 1–6 is provided, **taking the following statements into consideration**:

- The video showcases the work done to date and how the innovation works. The video describes the current state of the prototype and explains how the team will advance the solution over time.
- The video shows a knowledgeable and skillful team that is committed to completing the entire prize.

Cover Page

List basic information about your submission, including:

- Project title
- Team name
- Short description
- Your city, state, and nine-digit ZIP code.
- Key project members (names, contacts, and links to their professional online profiles)
- Other partners (if any)

Phase 1 Submission Package Details *(cont.)*

Narrative

You should answer each of the four questions listed below. The individual answers to the four questions do not have a word limit; however, **the aggregate response to these four questions must not exceed 2,500 words**. You may also include up to five supporting images, figures, or graphs.

Question 1 (Team): Why is your team well positioned to deliver a SiC packaging solution?

Question 2 (Solution): What makes your solution unique, relevant, and something that could be adopted by industry? Is you solution capable of achieving the metrics in Table 1 now, or is it likely your solution will achieve those metrics with further development during this prize?

Question 3 (Development Plan): What is your plan for product development over the course of the prize and into the future?

Question 4 (Industry Integration): What is your plan to develop this solution and integrate it into industry?

Phase 1 Submission Package Details *(cont.)*

Submission Summary Slide *(public)*

Make a **public-facing, one-slide submission summary** that introduces your team and/or organization and your mission. There is no template, so competitors are free to present the information in any format.

Letters of Support or Commitment *(optional)*

Attach one-page letters (of support, intent, or commitment) from other relevant entities to provide context. Letters of support from partners or others that are critical to the success of your proposed solution will likely increase your score.

General letters of support from parties that are not critical to the execution of your solution **will likely not factor into your score**.

Phase 2 Overview

Phase 2 – Initial Demonstration

- Winners from Phase 1 **will showcase and demonstrate the advancements made** during the prize competition in packaging solutions for SiC modules, meeting, exceeding, or making progress toward the Phase 2 performance metrics.
- This phase is designed to act as a milestone towards achieving the Phase 3 target with the goal of innovating towards an improvement over state-of-the-art packaging and creating transformative solutions.

Prizes: Up to 4 winners of $250,000 each

Phase 3 Overview

Phase 3 – Final Demonstration

- Winners from Phase 2 will demonstrate an advancement in packaging solutions for SiC modules, meeting or exceeding the Phase 3 performance metrics as outlined in the rules.
- The goal of the final phase is to achieve the high voltage and high current targets, while continuing to innovate towards an improvement over state-of-the-art packaging and creating transformative solutions.

Prizes: Up to 1 winner of $750,000

Prize Scoring Metrics

Performance Metrics		
Metric	Phase 2 Target	Phase 3 Target
Heat Flux**	500 W/cm2	1,000 W/cm2
Voltage Hold-Off***	4.5 kV	10 kV
Current Handling	1,500 A	2,000 A
Switching Characteristics	dI/dt > 80 A/ns dV/dt > 100 V/ns Voltage Overshoot < 5%	dI/dt > 150 A/ns dV/dt > 150 V/ns Voltage Overshoot < 5%
Max Case Temperature	85ºC	85ºC
Demonstrated Operational Time	90 minutes continuous at 20 kHz inductive switching	90 minutes continuous at 20 kHz inductive switching

** Benchmarked against a half-bridge module configuration with antiparallel diodes.*
*** Assumes liquid cooling.*
**** Using commercially available die ≤1,700 V rated.*

Silicon Carbide (SiC) Packaging Prize

Timeline

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Phase 1

Design Study - Up to 10 winners

$50,000

($500,000 total prize pool)

8 Months

Submission Opens:
February 2024

Submission Closes:
6 months from
submission open

Winner Announcement:
2 months from
submissions close

Phase 2

Initial Demonstration - Up to 4 winners

$250,000

($1,000,000 total prize pool)

14 Months

Submission Opens

Submission Closes:
1 year total from
open to close

Winner Announcement:
2 months from
submissions close

Phase 3

Final Demonstration - 1 grand prize winner

$750,000

($750,000 total prize pool)

14 Months

Submission Opens

Submission Closes:
1 year total from
open to close

Winner Announcement:
2 months from
submissions close

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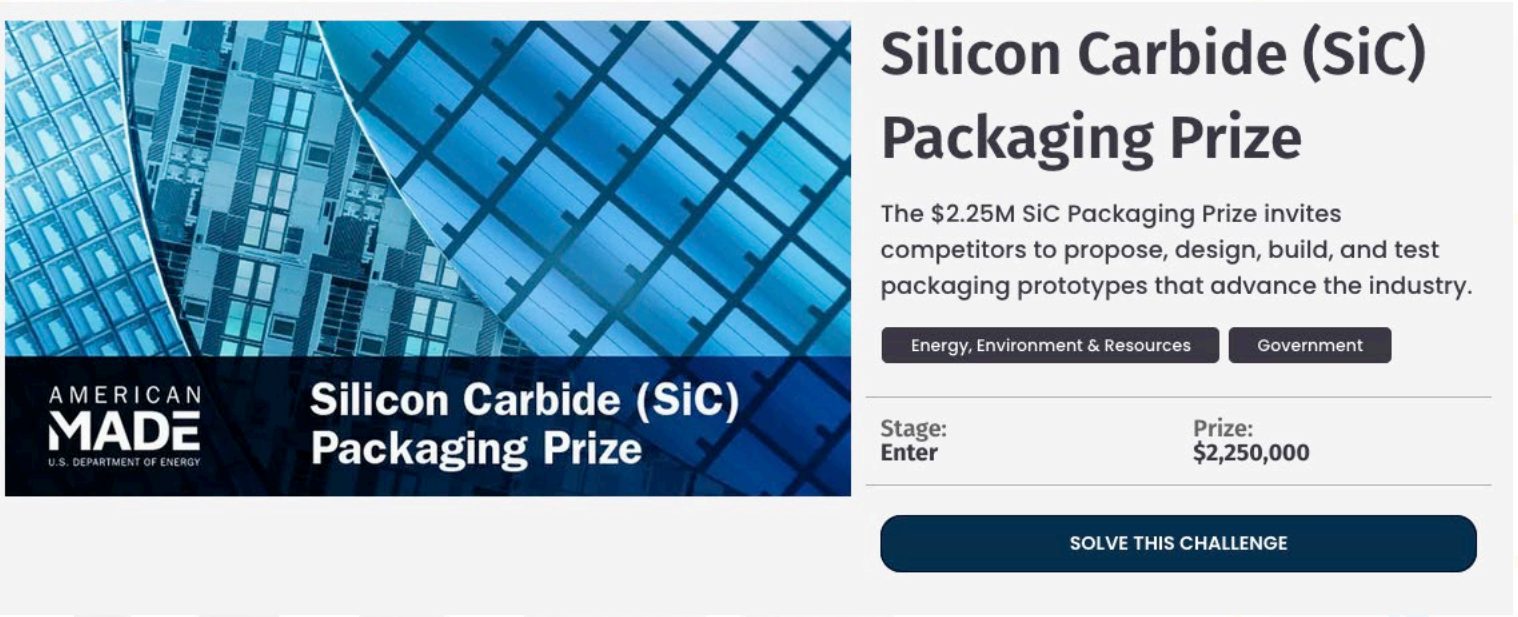
Submitting to the Prize (on HeroX)

HeroX Demo



- Create a free account to start your prize submission
- Find prize information, key dates, and other helpful resources on HeroX
- Ask questions in the public forum where prize administrators will answer ASAP

Next Steps

1. Follow SiC Packaging Prize on HeroX: https://www.herox.com/SiCPackagingPrize.
2. Read the **Official Rules**.
3. Submit your application through HeroX **before** Aug. 30, 2024, at 5 p.m. ET.

Contact Us

Should you have any questions or need further clarification, please contact us at: electricity.prize@nrel.gov

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