Introduction to Power Electronics R&D

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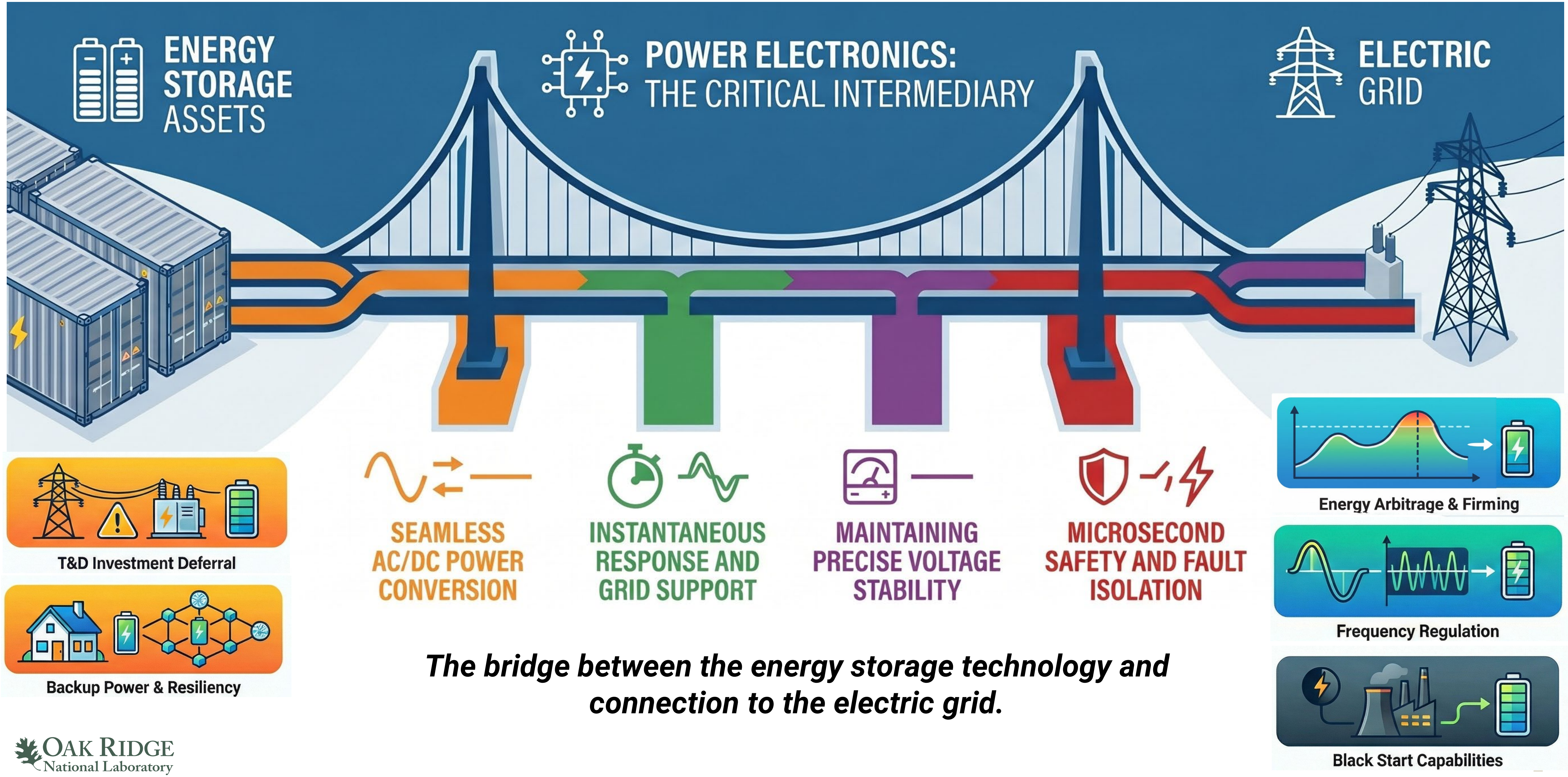
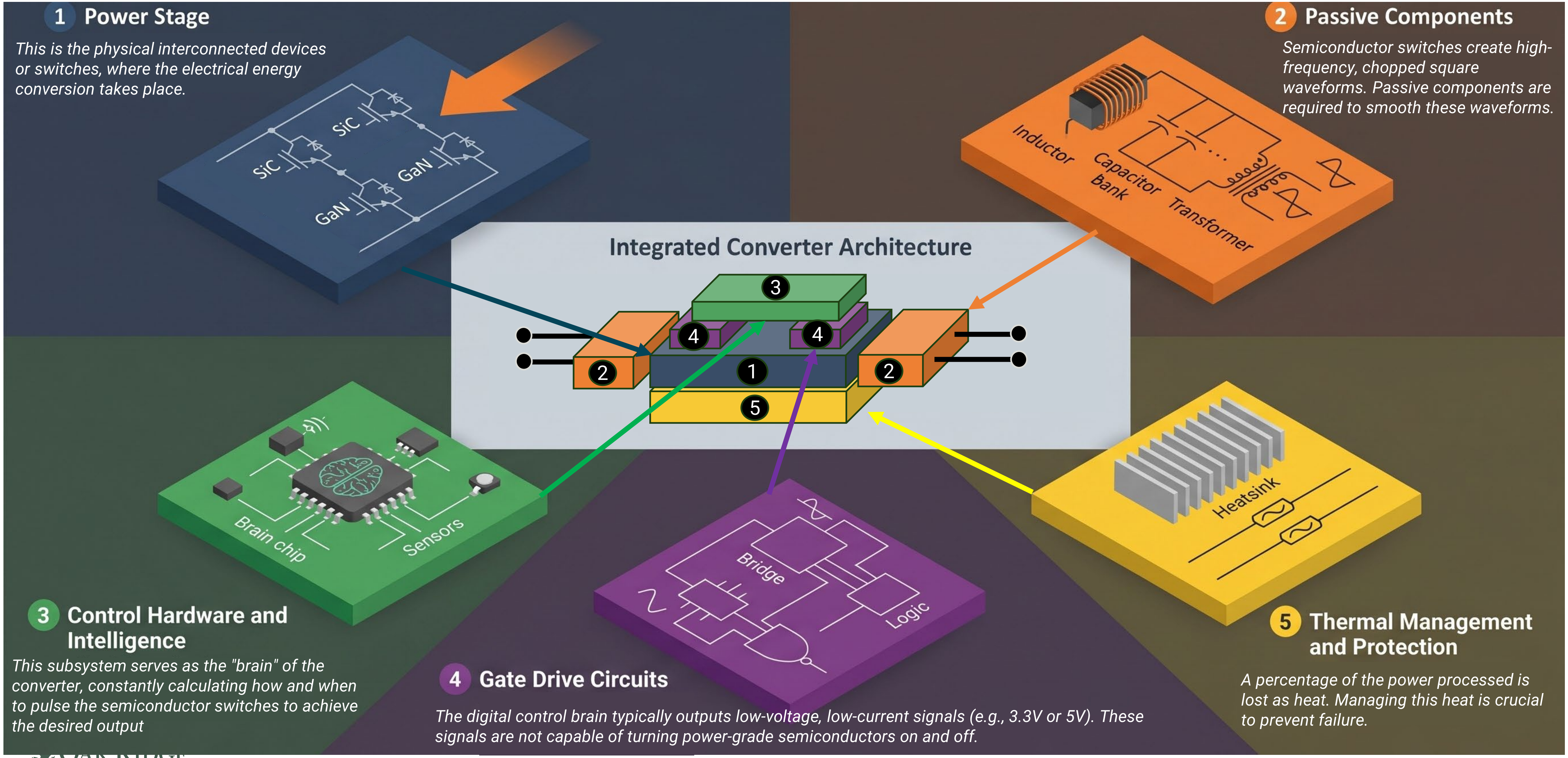
Importance of Power Electronics in Energy Storage Systems



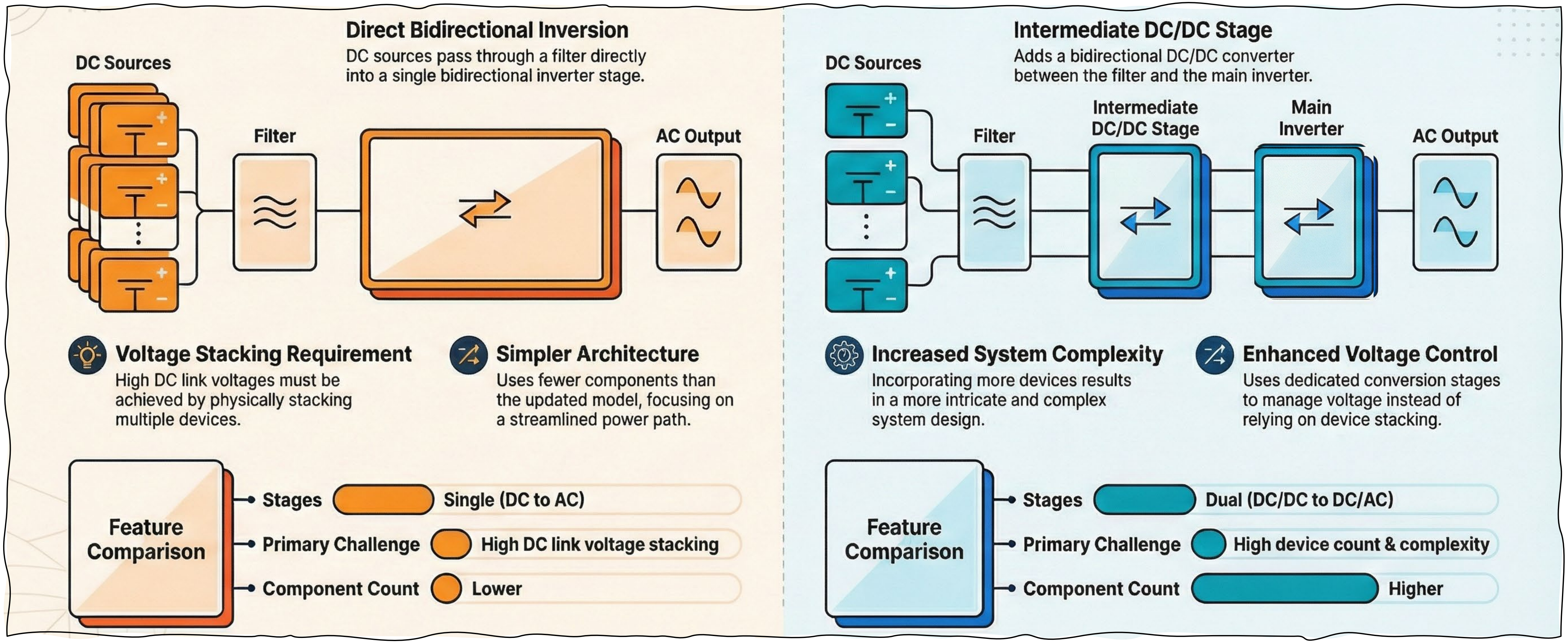
The bridge between the energy storage technology and connection to the electric grid.

Oak Ridge National Laboratory

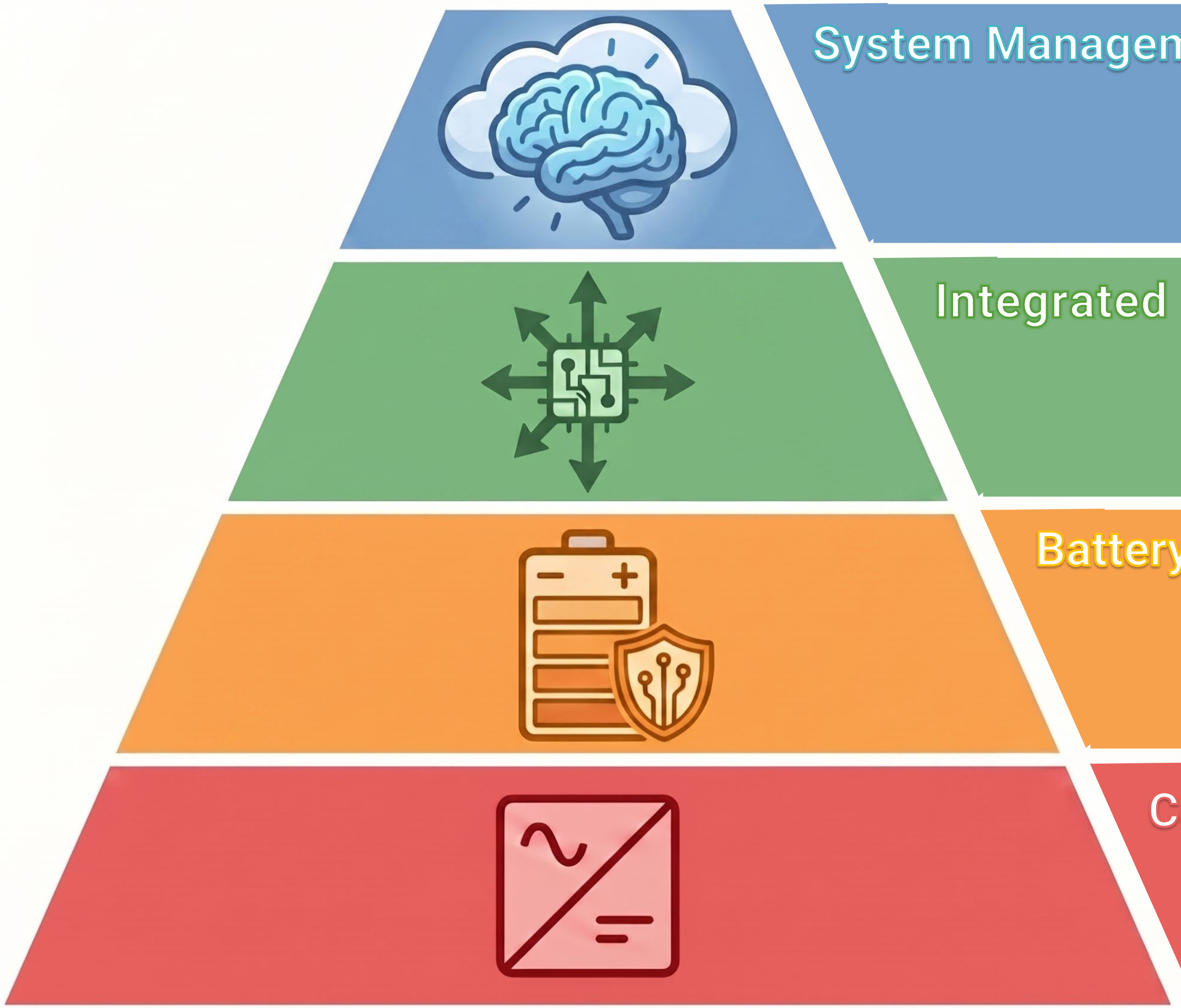
Single Converter Power Electronic System Makeup



Power Electronic Topologies in Architecture



Systems Architecture



System Management and Optimization

- Plant Controller and System Optimizer

Integrated System

- Resource Coupling
- Communication Modules

Battery System

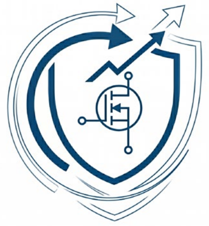
- Battery Management System
- Communication Modules

Converter System

- Digital Signal Processors
- Communication Modules

R&D in Power Electronics

OBJECTIVES



Improving Reliability / Lifetime
Improve Mean Time Between Failures (MTBF) to 15–30 years

Lowering Cost / Increasing Value
Minimize the bill of materials, manufacturing complexity

Optimizing Space Utilization
Packing systems into smaller, lighter volumes

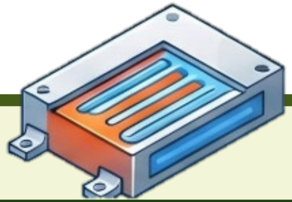
Maximizing Throughput/ Minimize Loss
Higher power and more efficient designs/components

Integrated System Applications
Integrating power electronics to assets

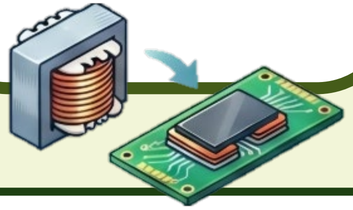
R&D TECHNOLOGIES

Advanced Semiconductor Materials & Devices
- Wide Bandgap Semiconductors
- New Materials for Devices
- High Voltage Systems

Packaging & Thermal Management
- Improved packaging to improve lifetime
- Increased thermal transfer to reduce aging



High-Frequency Magnetics & Passive Components
- Modular Designs
- Printed Circuit Board designs
- Planar & Integrated Magnetics



Artificial Intelligence for Power Electronics
- Design of components/systems
- Advanced dynamic control responses
- Diagnostics & Prognostics

Converter Topologies & Control Architectures
- New battery technologies
- New use cases and system needs
- Electrical system safety and integration

Esteemed Panel

Time	Lead	Title	Entity
10:25 AM	Renata Kimpara	Power Electronics for Flow Batteries	Oak Ridge National Laboratory
10:40 AM	Armando Montoya	Modular Energy Storage Platforms for Advanced Control, Diagnostics and Grid Integration	Sandia National Laboratories
10:55 AM	Jack Flicker	Immersion Cooling of Power Electronics	Sandia National Laboratories
11:10 AM	Jin Wang	Low-cost Magnetics-less Isolated Bidirectional GaN Power Converters for Grid-Ted Storage	Ohio State University
11:25 AM	Andrew Binder	Hafina Gate Dielectrics for Energy Conversion	Sandia National Laboratories