About the Speaker

Scott Daniels, Head of Power & Energy Storage at CSA Group, a nationally recognized test laboratory that provides global testing, inspection, and certification services. Scott is an emerging technology and advanced energy resources professional with over 20 years of experience in the energy and clean technology sectors. A respected leader in distributed energy resources, electrification, and energy management. Scott has expertise in technology and business strategy focusing on energy, sustainability, technology commercialization, and investment strategy.

August 3, 2023

CSA Group

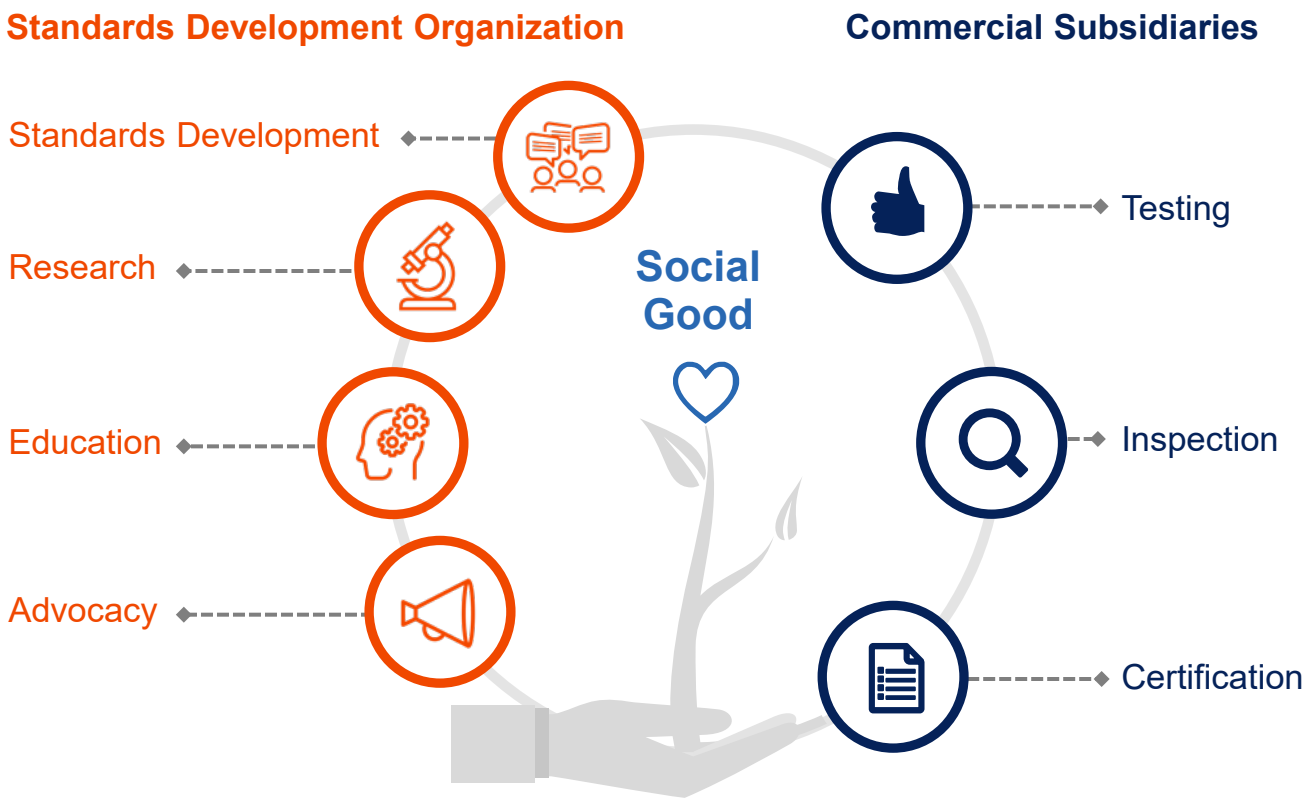
Gaining Market Access for Disruptive Technologies

Scott Daniels

CSA Group At-a-Glance

Holding the future to a higher standard

CSA Group laboratories are Nationally Recognized Testing Laboratories (NRTL)



Commercializing technologies may require new standards or modifications of existing standards

Standards Development - Member Driven. Globally Relevant.

12	+10,000	+3,000	+1,000
Areas of focus	Dedicated members	Standards	Committees

Testing, Inspection and Certification

3	2,000	+2,550	36	+140
Business Units	Employees	Accredited Certification Programs	Offices	Countries

Solutions Portfolio

Delivering solutions that enable your business

Consumer Product Evaluation

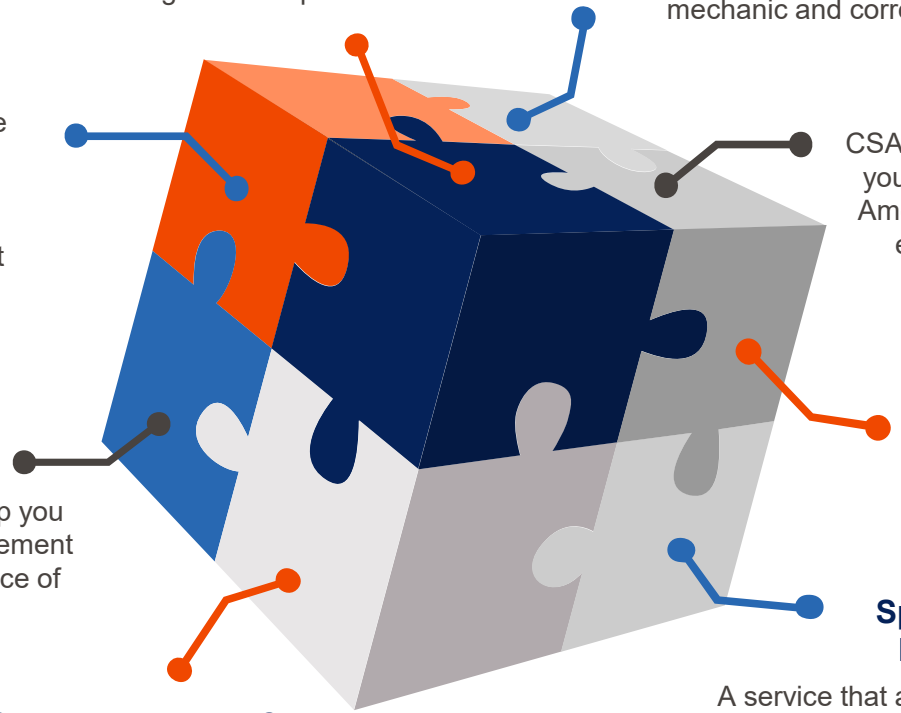
Offers third-party, independent verification, inspection and testing for a range of retail products

Environmental Testing

Helps customers to test their product under different environmental conditions such as climatic, mechanic and corrosive influences.

Certification

CSA Group will test your products' compliance with applicable safety, environmental, and operating performance standards for markets around the world. We can help you take full advantage of today's global economy and test against the approvals you need to enter new markets worldwide.



Energy Efficiency Verification

CSA Group's energy efficiency verification services allow you to demonstrate whether your products meet North American energy efficiency requirements. Our services encompass the complete set of energy efficiency standards, including ENERGY STAR®.

Electrical & Functional Safety

Offers customers valued peace of mind through fast and efficient safety and evaluation services, technical guidance and training.

Cybersecurity

We develop tailored solutions that help you identify potential issues, and then implement security measures to reduce the chance of malicious intrusions and attacks.

Special Inspection/ Field Evaluation

A service that allows a technical expert to assess your uncertified product against required safety and other applicable standards and codes.

Electromagnetic Compatibility (EMC) & Wireless

Testing to help you with various regulations and access to sell your electronics around the world.

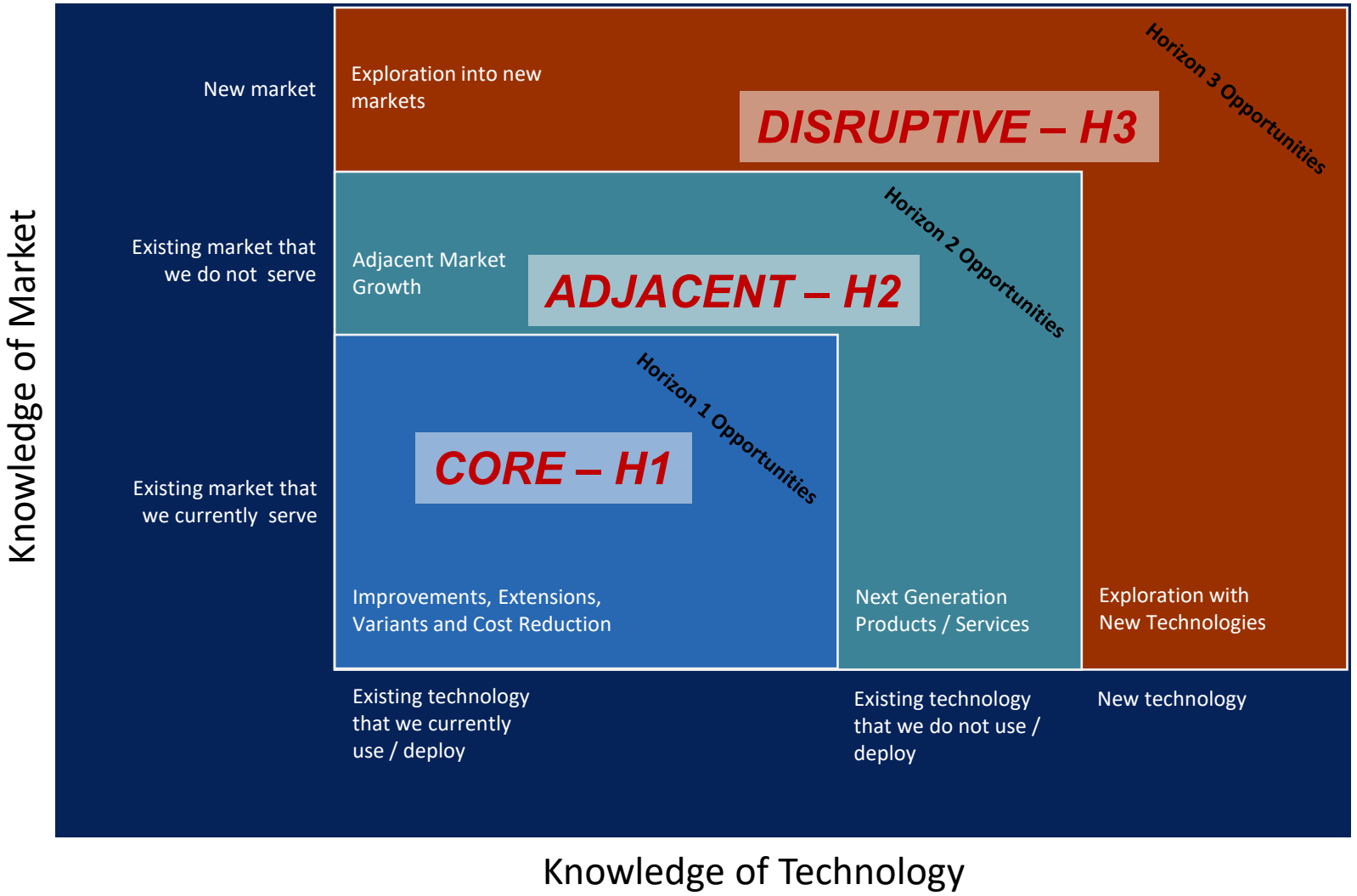
Three Horizons of Market and Technology

Market & Technology are not always linked together

H1 = Innovation in the Core Offer sustaining and renewing/reinventing the Core offer

H2 =Innovation introduced in Adjacent Offer, either from a Market or Technology standpoint"

H3 = Disruptive innovation New Technology or New Market



Standards that Apply to Inverters & Challenges of Disruptive Technologies

What changes when we move from a legacy technology to a disruptive technology?

Current Inverter Tech: DC/AC Unit Level / Stand Alone

New disruptive inverter tech: Multi Level Cascade Inverter (MLCI)

- Cascading inverters at the battery module level (& fuel cell stacks)
- May have mixed battery modules of differing capacities / State of Health (SOH)
- May be married to a variety of battery module technologies / chemistries
- If one or more modules are changed out with a differing technology is the certification or prior test results now invalid?

Example of standards that include Power Conversion:

- **UL 1741** - Inverters, Converters, Controllers and Interconnection System Equipment for Use With DER (Functional Safety)
- **UL 9540** - Energy Storage Systems and Equipment
- ***UL 9540A** - Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- **UL 3001** – Distributed Energy Resource Systems (Not Released)
- **IEEE 519** - Voltage and Current Harmonics Distortion criteria for the Design of Electrical Systems
- **IEEE 2800** - Interconnection & Interoperability of Inverter-Based Resources Interconnecting w/ Transmission Electric Power Systems
- **ENERGY STAR®**. – Energy Efficiency Verification

Is there a need for new or modified standard?

Is there a need for new test equipment to support new testing requirements (important to CSA)?

*Note: UL 9540A will include Power Conversion for MLCI at the unit level

Standards that Include or Impact Power Conversion

ES – PC – EVSE

ES – PC

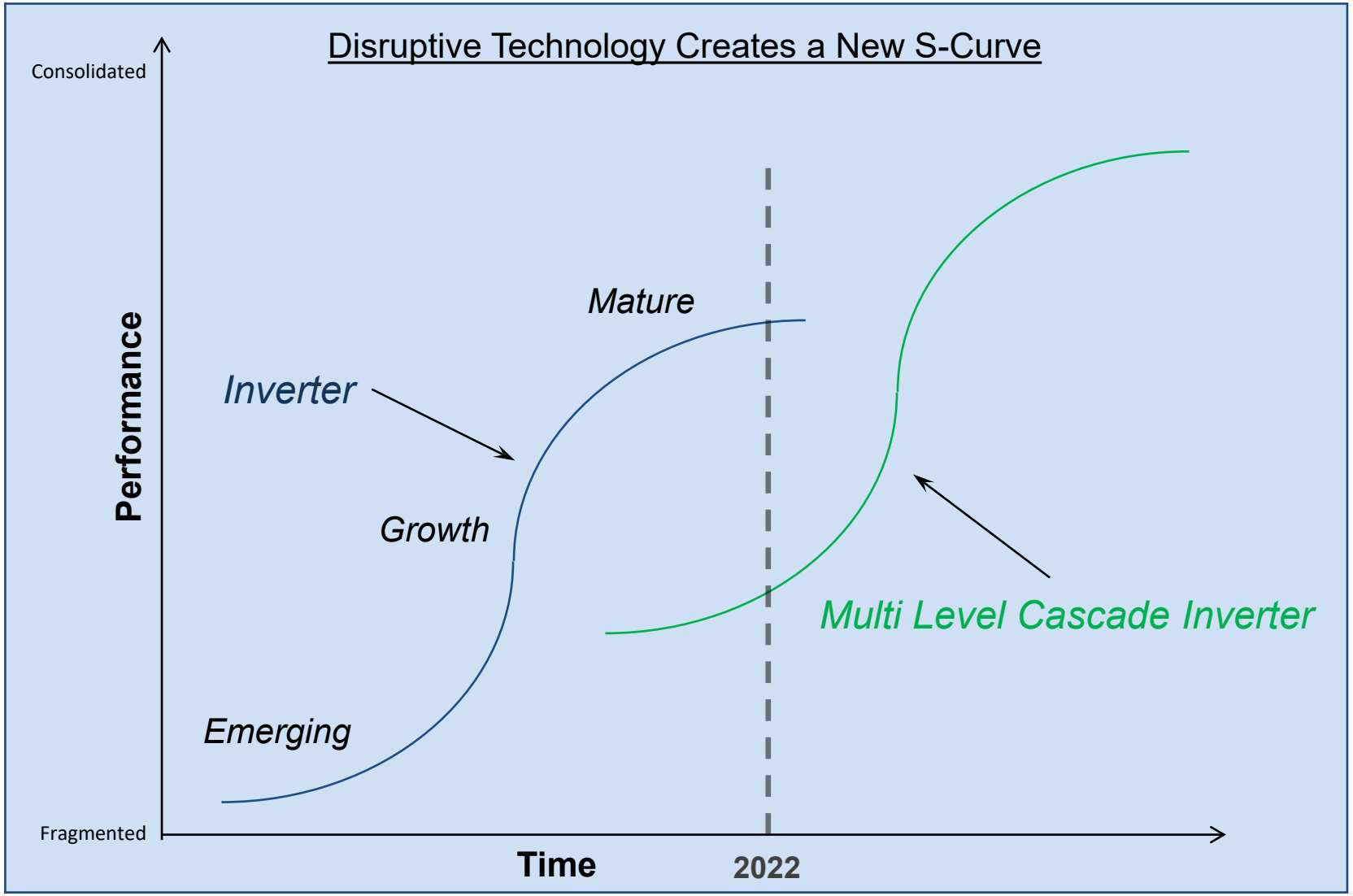
- **UL 1741** - Inverters, Converters, Controllers and Interconnection System Equipment for Use With DER (Functional Safety)
- **UL 9540** - Energy Storage Systems and Equipment
- **UL 3001** – Distributed Energy Resource Systems (Not Released)
- **IEEE 519** - Voltage and Current Harmonics Distortion criteria for the Design of Electrical Systems
- **IEEE 2800** - Interconnection & Interoperability of Inverter-Based Resources Interconnecting w/ Transmission Electric Power Systems
- **IEEE 1547**
- **ENERGY STAR®**. – Energy Efficiency Verification

EVSE

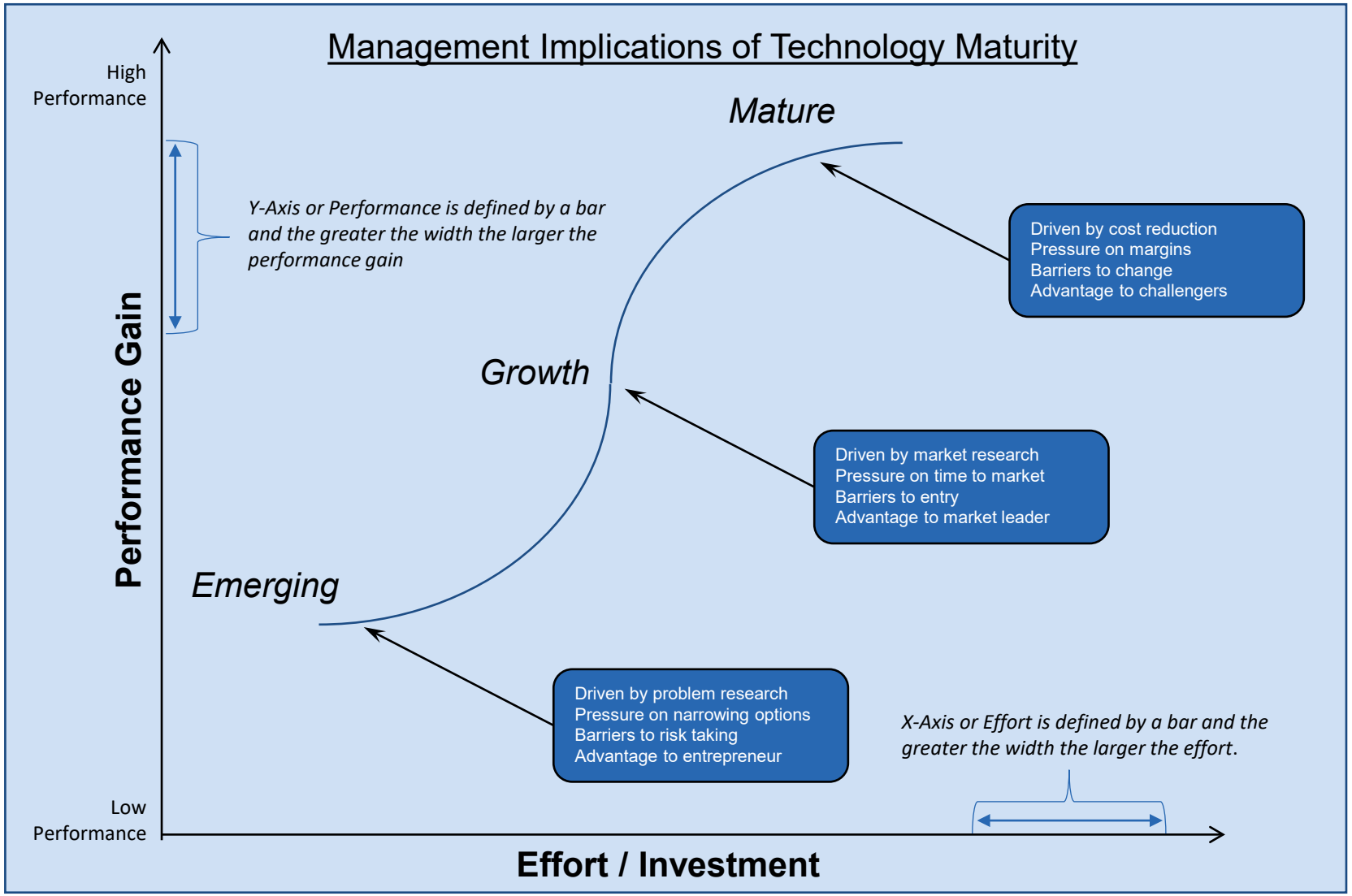
- **UL 2202** DC Charging Equipment for Electric Vehicles
- **CSA C22.2 No. 107.1** Power Conversion Equipment
- **CSA C22.2 No. 280 / UL 2594** Electric Vehicle Supply Equipment
- **SAE J3072** Interconnection Requirements for Onboard, Grid Support Inverter Systems (EV AC charger V2G)

Technology Maturity S-Curve

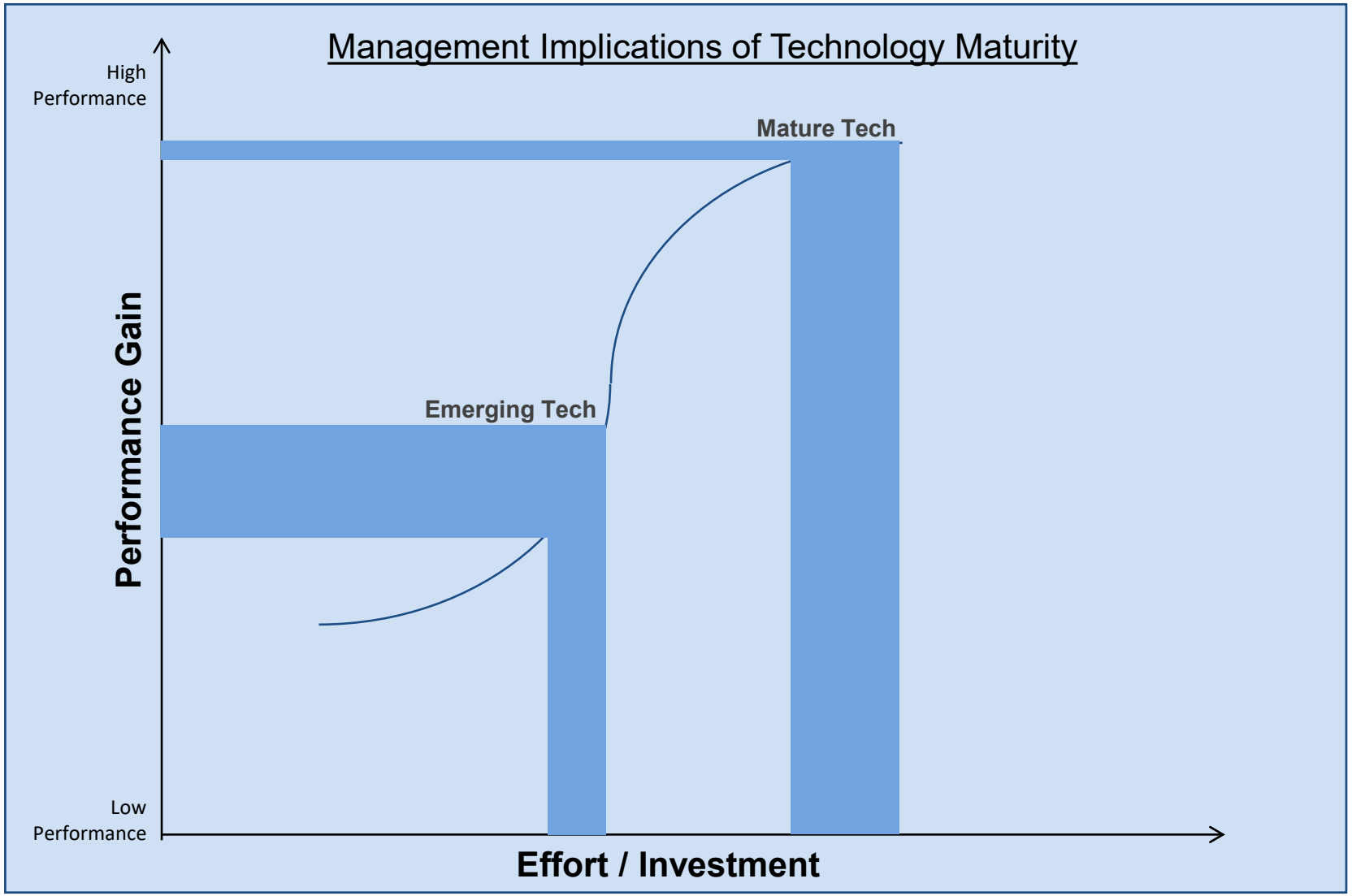
What happens to S-Curves with the emergence of a Disruptive Technology?



Technology Maturity S-Curve: Performance vs. Investment



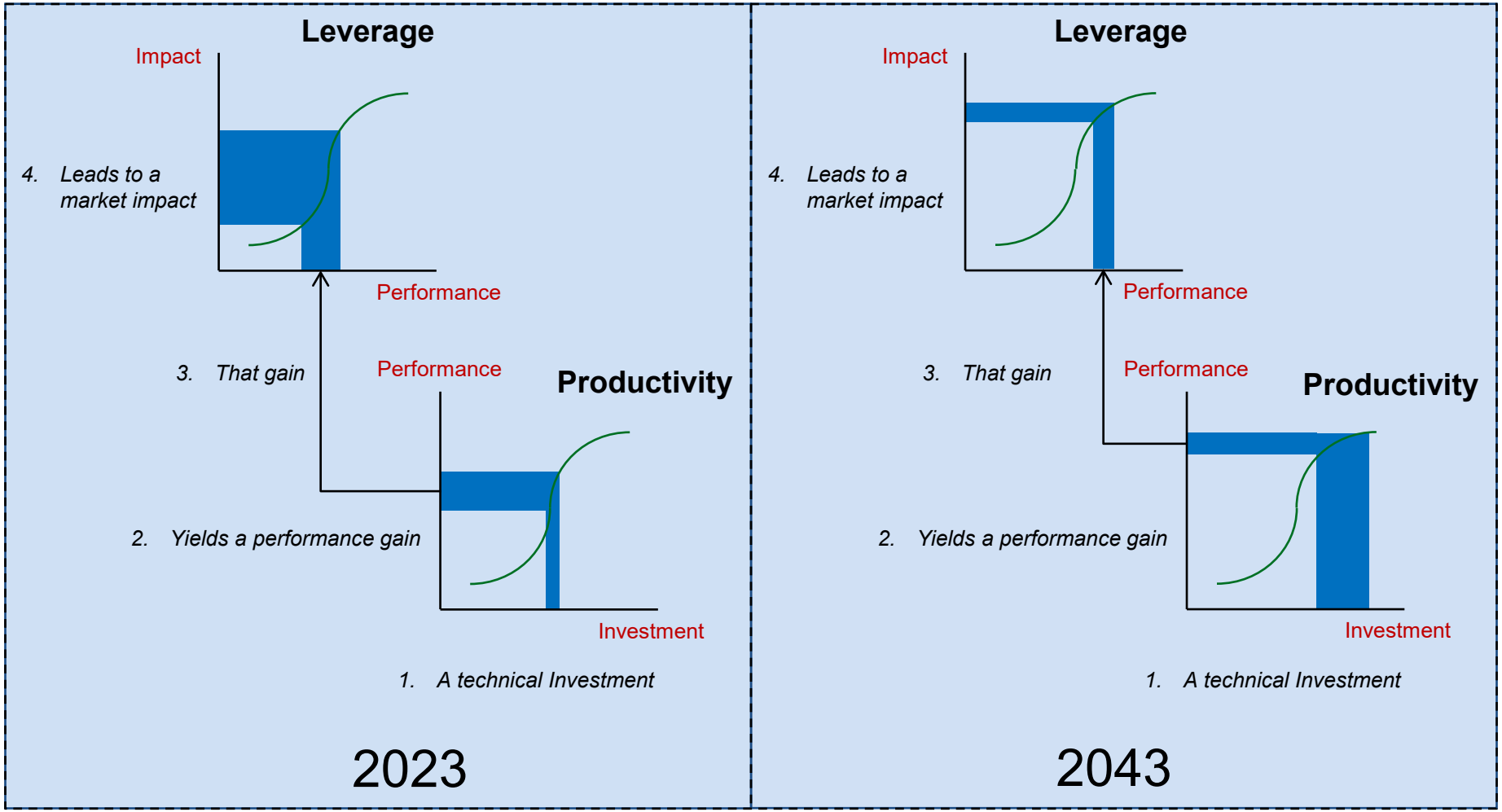
Technology Maturity S-Curve: Performance vs. Investment



Technology Maturity: Productivity and Leverage

Distributed Energy Resources (DER) / Microgrid

Disruptive Power Electronics Technology for DER / Microgrid

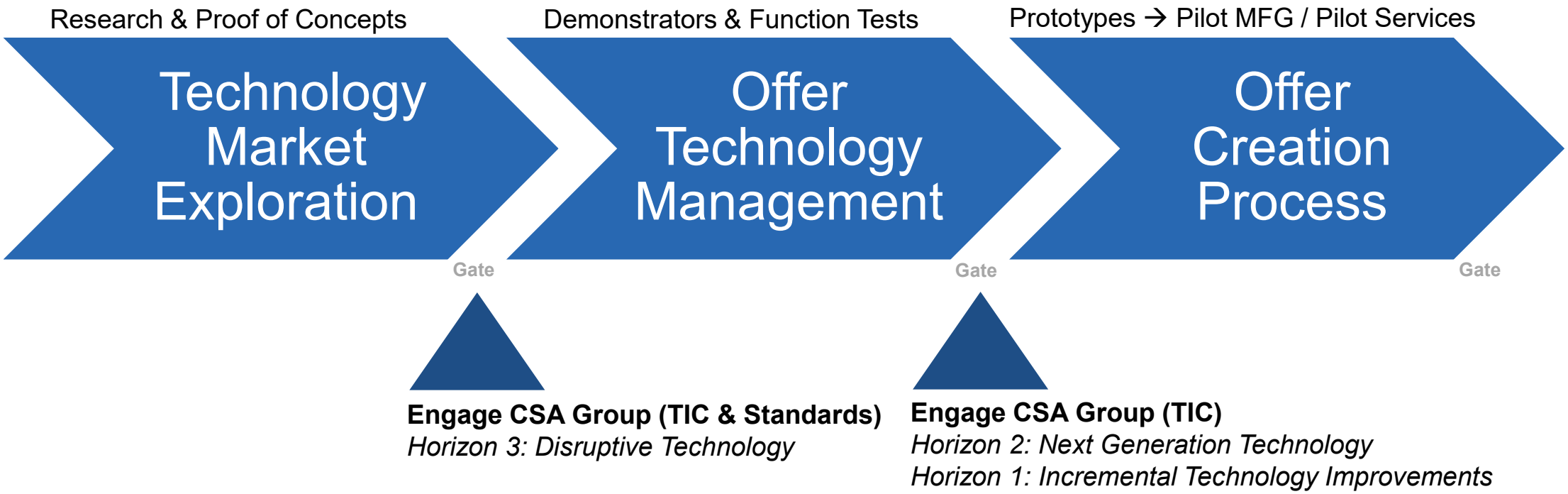


Offer Creation & Commercialization Challenges

When to engage CSA Group during Offer Creation

"Three Phases of Offer Creation"

An "Offer" can be a Product, Service or a combination of Products & Services



Disruptive technologies may require new standards or modifications of existing standards

Distributed Energy Resource Lab

New state of art laboratories located at the CSA Group US Headquarters site in Cleveland, OH

- New North American “Distributed Energy Resource Lab” 40k square-foot facility encompassing:
  - Certification
  - Electrical & Functional Safety
  - MW scale fire test lab
  - Environmental testing, Energy Efficiency Verification
  - Cybersecurity and communications
  - Performance testing & Reference Performance Testing
- Services for:
  - Power conversion systems including inverters & converters
  - Electric vehicle supply equipment (EVSE) including AC & DC EV chargers
  - Battery systems including portable power, e-mobility, and stationary
- On-site employees include highly qualified technical experts, certifiers, and laboratory technicians

Thank you.

Scott Daniels
Head of Energy & Power
Energy Storage

Address:
8501 E. Pleasant Valley Road
Independence, OH 44131

Phone Number:
+ 1 800 463 6727

Email/Web:
Scott.Daniels@csagroup.org
csagroup.org

Testing, Inspection and Certification

Mission

Our commercial subsidiaries **provide expert testing, inspection, and certification** services that enable manufacturers to demonstrate that their products are in **compliance with applicable safety, environmental, and operating performance standards for markets around the world.**