

The top banner features a dark orange background with silhouettes of palm trees. The APEC 2024 logo is prominently displayed in the center-left. APEC is in white, with the 'E' stylized as three horizontal bars. 2024 is in a large, bold orange font.

APEC
2024

LONG BEACH
CALIFORNIA
CONVENTION CENTER

February 25th - 29th

THE DRIVE FOR SILICON CARBIDE:

A Look Back and the Road Ahead

Gregg Lowe
CEO, Wolfspeed



Cree to Wolfspeed

Built the world's first,
largest, and only 200mm
Silicon Carbide fabrication
facility in Marcy, New York

Applications include
transportation, power
supplies, power inverters,
and wireless systems

Focused on silicon carbide
and gallium nitride materials
and devices for power and
radio frequency

Develop + manufacture
wide-bandgap
semiconductors

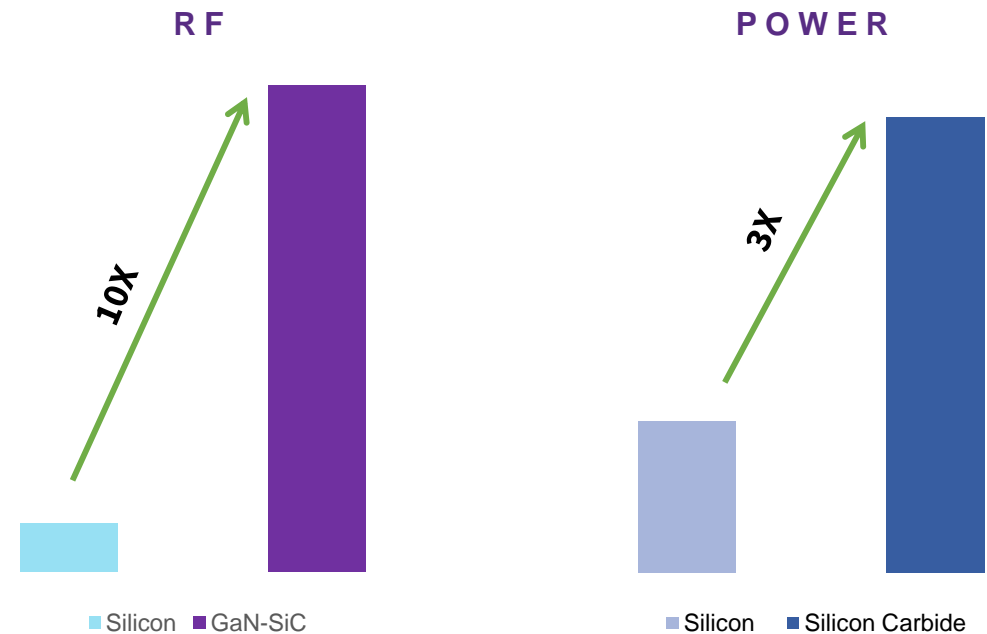
Revenue: \$922 million
(2023)

“What are you doing here?”

John Palmour
Co-founder of
Cree Research



The next generation in power semiconductors will be driven by silicon carbide technology



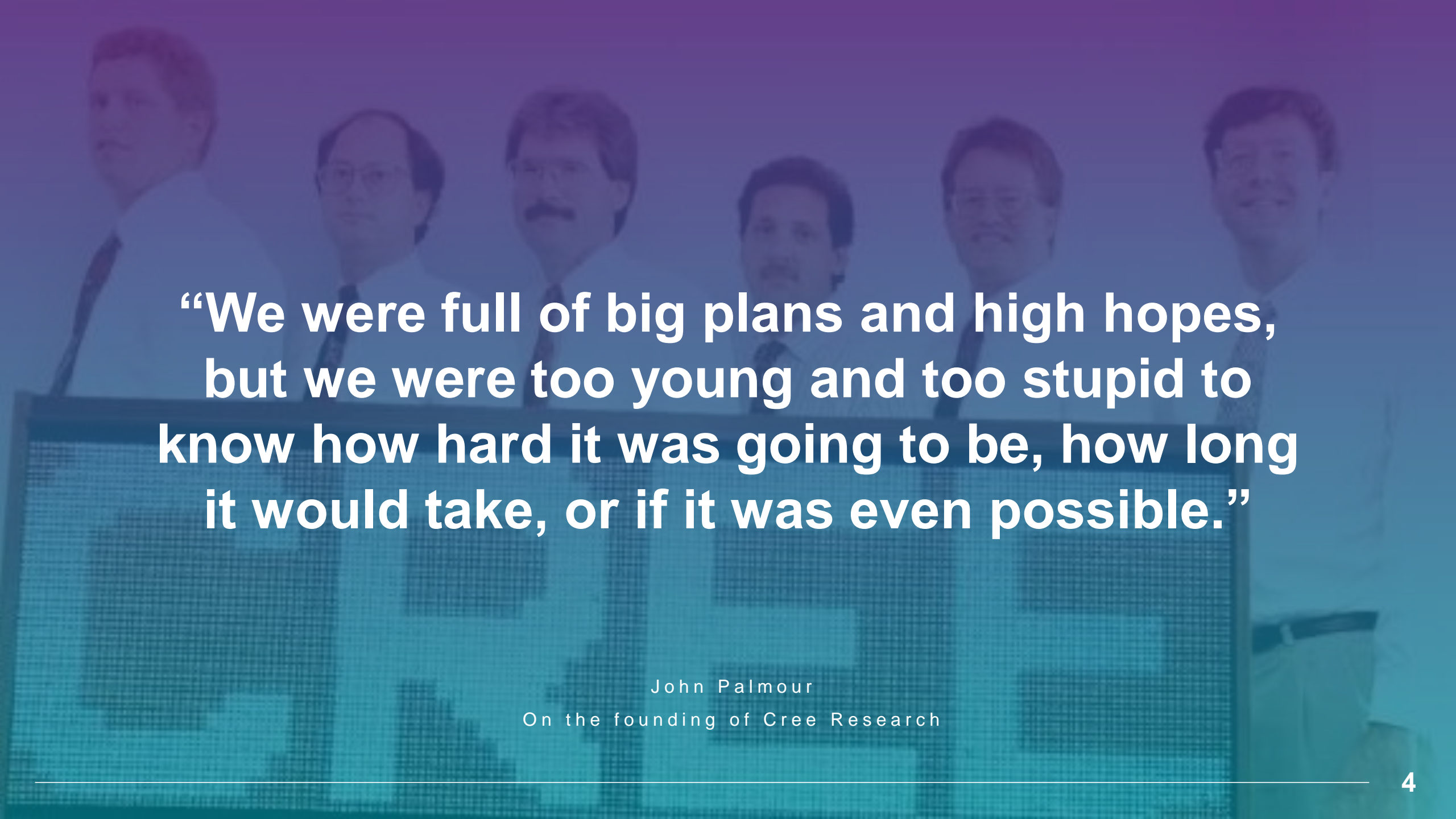
POWER DENSITY COMPARISON VS. SILICON

SiC Inverters are:

- Lighter
- Smaller
- More efficient, 5% - 10% increase in vehicle range

GaN-Silicon Carbide in 5G enables:

- Increased capacity and coverage
- 2X more users per tower
- More than 10X increase in data

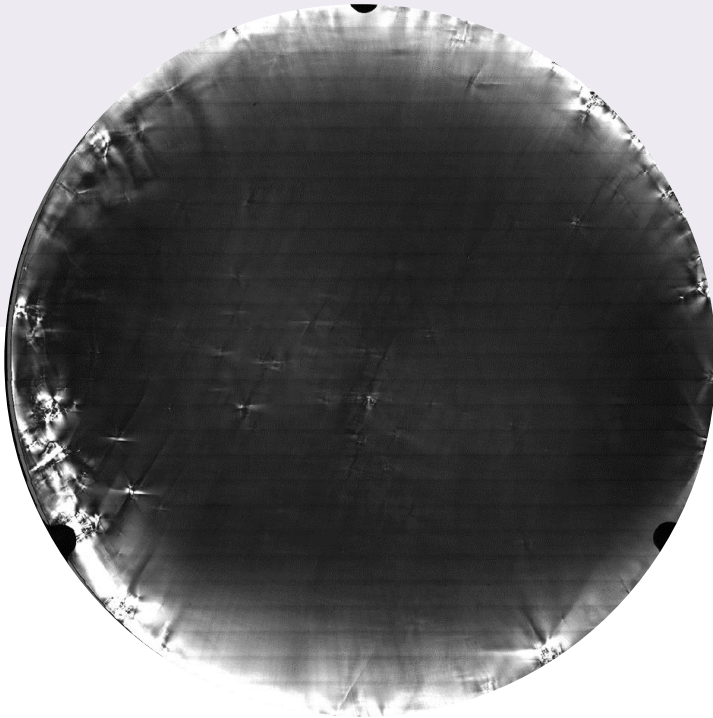
A group of six men in business attire (shirts and ties) are standing behind a large screen. The screen displays a bar chart with several bars of varying heights. The image has a blue and purple color overlay.

**“We were full of big plans and high hopes,
but we were too young and too stupid to
know how hard it was going to be, how long
it would take, or if it was even possible.”**

John Palmour
On the founding of Cree Research

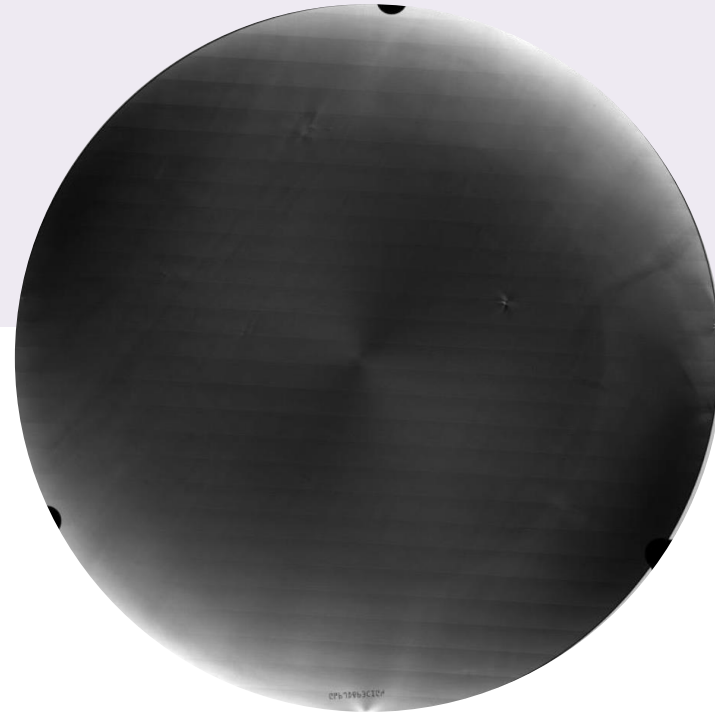
Manufacturing SiC: Not for the faint of heart

CROSS POLARIZATION (XPOL)
Image shows structural imperfections



200mm wafer

CROSS POLARIZATION (XPOL)
Image shows quality improvements



200mm wafer

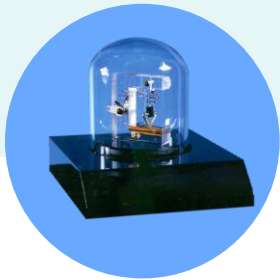
A photograph of Ken Olsen, founder of Digital Equipment Corporation, smiling and standing next to a computer monitor. The image is overlaid with a blue and purple gradient. The monitor screen shows some text, possibly a list of software or hardware specifications.

“There is no reason anyone would want a computer in their home.”

Ken Olsen

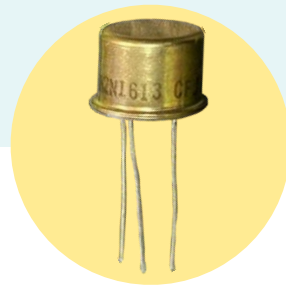
Founder, Digital Equipment Corporation, 1977

Major semiconductor market changes don't happen often



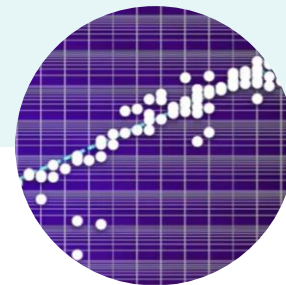
1947

Bipolar Transistor
invented



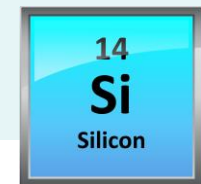
1963

CMOS Transistor
commercialized



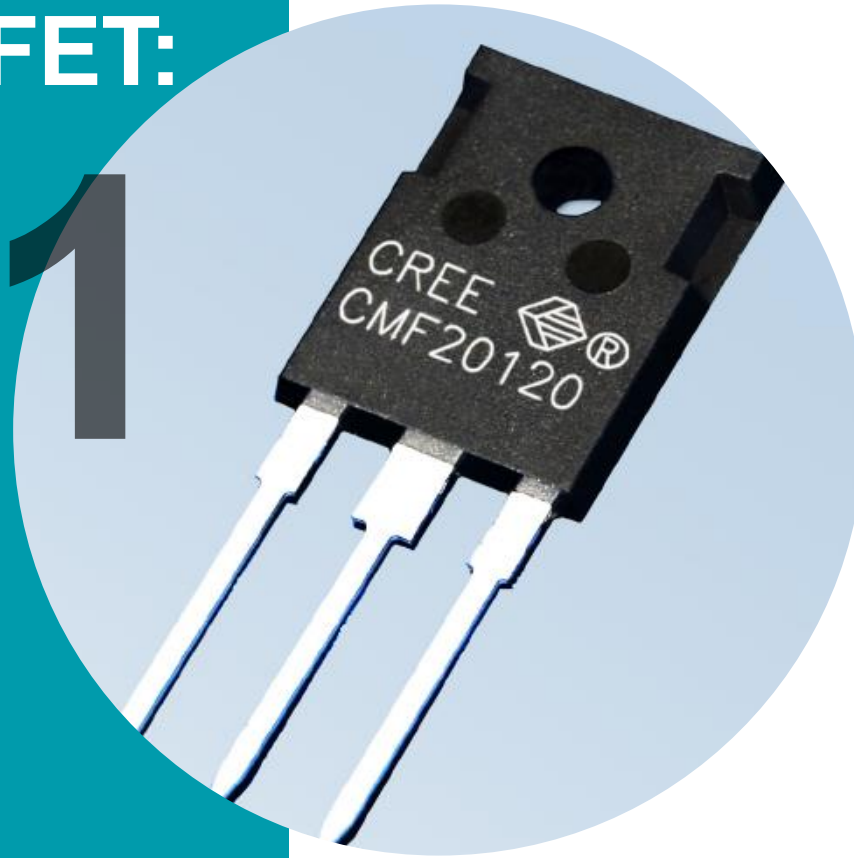
1963 - PRESENT

Moore's Law



SiC
TODAY

First silicon carbide MOSFET: 2011



New benchmark for energy-efficient power switches

Initial uses: solar inverters, high-voltage power supplies and power conditioning in industrial power applications

Key building block for more efficient power conversion systems, decreasing size, weight and bill of materials

SiC Inverter: Higher upfront price but lower system cost



**\$300-\$600 savings
in battery costs**

**Up to \$1,000 savings
in cooling system costs**

**\$3.50 to \$7 return on
every dollar for SiC
over silicon**

– Goldman Sachs, 2019

Accelerating EV adoption is driving \$1.2 Trillion+ investment – the secret is out

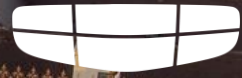
GLOBAL OEMS AND CORPORATES HAVE MADE SIGNIFICANT COMMITMENTS TO EVS



EVs in Munich



NIO

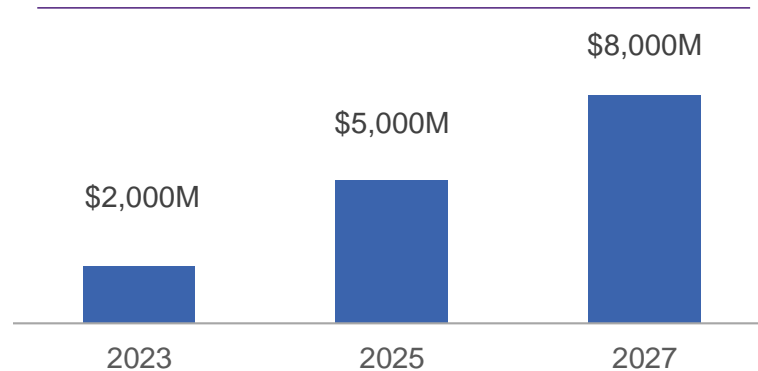


GEELY

Attractive markets with ample runway to support rapid growth

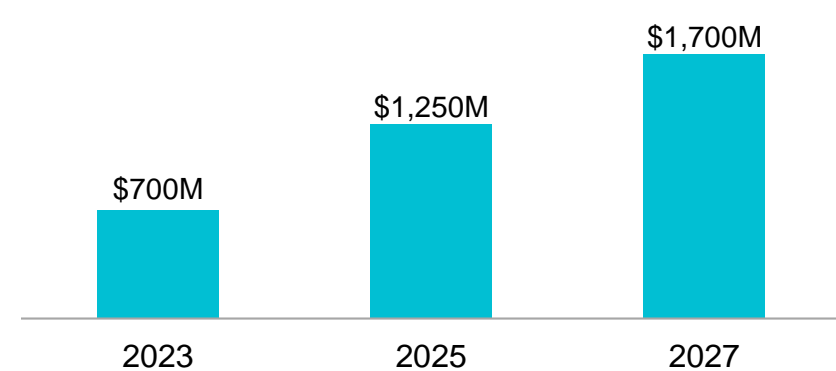
SERVICEABLE MARKET OPPORTUNITY (M)

POWER DEVICES



- Auto devices account for 50% of the opportunity, with a 30% CAGR
- As device cost decreases, Industrial markets expand, creating a \$40B+ opportunity

MATERIALS



- Demand is expected to outstrip capacity
- Overall supply will continue to increase, but nominal impact on overall market share as 150mm to 200mm transition continues to reduce overall wafer cost

The car as the solution to the power grid?

Bidirectional EV chargers supply power from an EV car battery to the grid during peak hours

The EV can charge during off-peak times

Grid demand more consistent + lower charging costs



SiC: A powerful sustainability story

GLOBAL OEMS AND CORPORATES HAVE MADE SIGNIFICANT COMMITMENTS TO EVS

400V Si IGBT
to 400V SiC
MOSFET

7:1

400V Si IGBT
to 800V SiC
MOSFET

13:1

800V SiC
MOSFET
Taxi/Uber
Scenario*

24:1

Increasing bus voltage from 400V to 800V:

Reduces total chip area (assumption is by 20%)

Reduces marginal energy investment by ~1 gj

Increases **Energy Saved on Energy Invested (ESOI)** by 85%

Dramatic ESOI for SiC MOSFETs in PV Systems

ESOI FOR 50 kW PV SYSTEM WITH
SiC STRING INVERTER

PHOENIX, AZ

77:1

+1,078 kWh/yr

ALBANY, NY

55:1

+738 kWh/yr

BEIJING

63:1

+862 kWh/yr

SHENZHEN

59:1

+797 kWh/yr



A new world of industrial applications

Creating the next generation of jobs

SUNY POLYTECHNIC
INSTITUTE

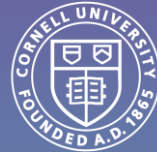
MVCC
MOHAWK VALLEY COMMUNITY COLLEGE

UTICA
COLLEGE

 **Alfred University**
OUTSIDE of ORDINARY



RIT



Rensselaer

Herkimer
STATE UNIVERSITY of NEW YORK



Wolfspeed is a proud
member of Power America

**WOLFSPEED, A&T TO ESTABLISH JOINT R&D FACILITY
TO FURTHER ADVANCE SILICON CARBIDE INNOVATION**

– North Carolina agricultural & technical state university

The pace of change: Fifth Avenue, New York City



EASTER 1900: FIND THE CAR



EASTER 1913: FIND THE HORSE AND CARRIAGE

The background features a repeating pattern of semiconductor wafers and dies. The wafers are circular and show a grid of small squares representing individual dies. The dies are rectangular and have the 'WolfSpeed' logo on them. The pattern is set against a gradient background that transitions from purple at the top to blue in the middle, and then to a teal/cyan at the bottom.

Thank you

QUESTIONS?

FULLY FABBED 200mm MOSFET WAFER FROM SUNY POLY PILOT LINE

Thank you
QUESTIONS?

LONG LIVE ROCK