Geothermal Power Plays

High Temperature Electronics for Downhole Environments

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Joule’s Niche:

Markets Served:

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Geothermal Power Plays

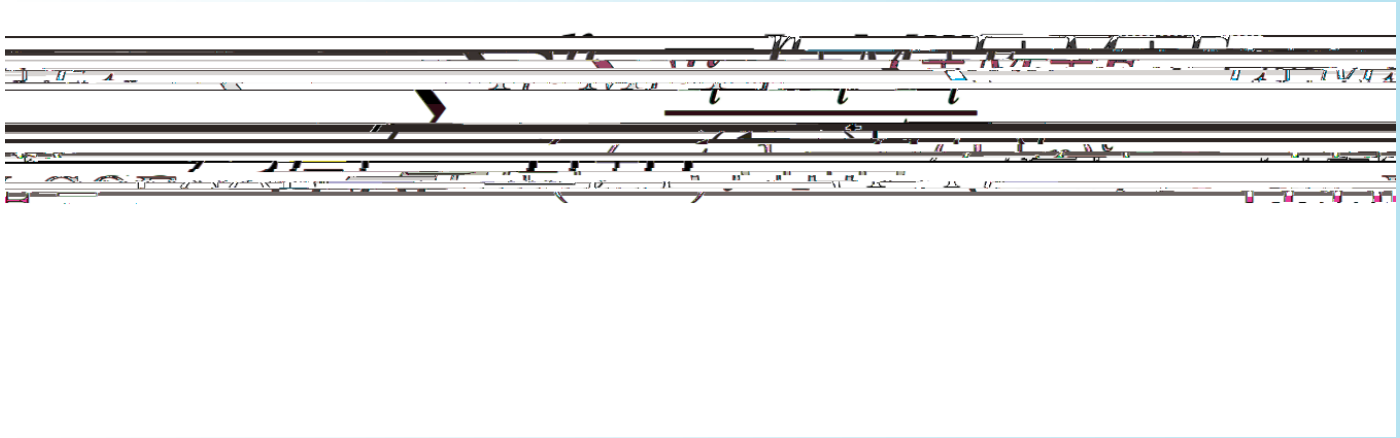
Given:

Geothermal drilling, formation evaluation, and downhole monitoring is the most challenging with hottest and hardest demanding conditions.

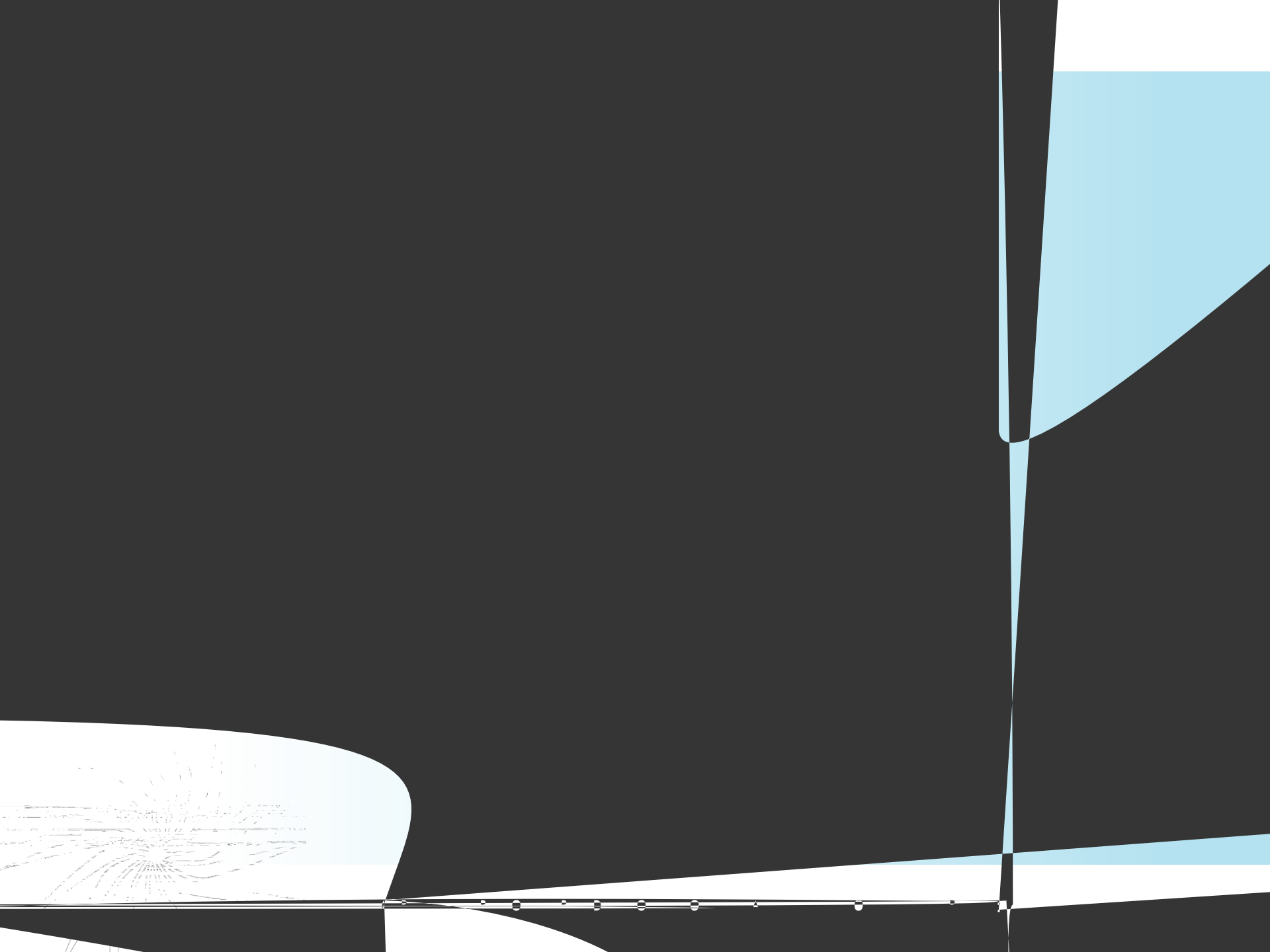
This environment severely limits the life and performance of electronic components, sub-systems, and turn-key designs.

Given:

LEVELIZED COST OF ELECTRICITY
LCOE Formula



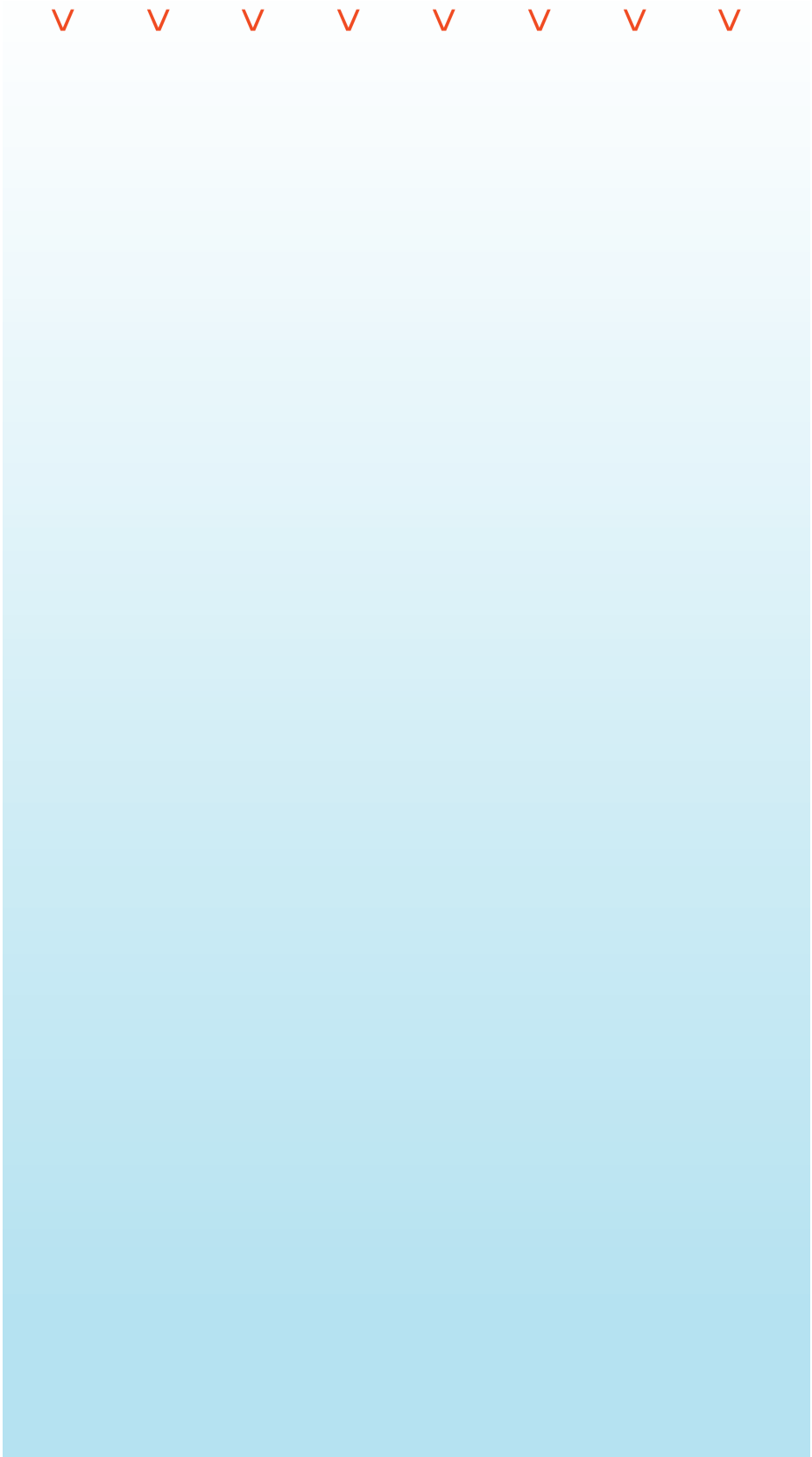
It = investment expenditures in the year t; Mt = O&M expenditures in the year t; Ft = fuel expenditures in the year



The definition of high temperD6tDe TJ-.D6to-.

Applications

High Temperature Downhole Disciplines:



High Temperature Electronics for Downhole Environments Applications

High Temperature Silicon Components

- 200˚C with appropriate high temperature

X-Rel Semiconductor

SOI Reliability Assessment

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High Temp Components:

EVANS CAPACITOR 200°C
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APEI 225°C
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SPJ Thick Film RESISTORS 300°C
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UNITED SILICON CARBIDE 260°C
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VECTRON INTERNATIONAL 230°C
>

VANGUARD ELECTRONICS 220°C
>

X-REL SEMICONDUCTOR 230°C
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CRITERIA LABS HT DIE PACAKGING 230°C
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High Temperature Sub-Systems And Design Services

Very Little “Off the Shelf” solutions exist above 175˚C

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200˚C

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Joule Design Services:

CAPACITOR MODULES 200°C
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POWER SUPPLIES 200°C
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SOI DATA ACQUSITION 225°C
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SILICON CARBIDE POWER MODULES 260°C
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REAL-TIME CLOCK MODULES 180°C

CUSTOM MAGNETICS 220°C

HIGH TEMPERATURE CHARACTERIZATION/AGING 230°C

DIE, MCM AND HYBRID PACKAGING 240°C

DOWNHOLE & SURFACE ELECTRICAL AND MECHANICAL ENGINEERING SERVICES -40°Cto 230°C
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Conclusion
Cost-competitive energy requires technology development

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