Innovating for Sustainability and Profitability

Balu Balakrishnan
Chairman and CEO, Power Integrations, Inc.
Power Semiconductors are Critical to a Lower-Carbon Future

Efficiency and renewables hold the key to achieving carbon-reduction targets

- 37% - Better Efficiency
- 32% Renewables
- 3% Nuclear
- 28% Other

69% of targeted carbon savings

Source: IEA
Partnering and Innovating for Sustainability

Engagement with Energy Policy Makers and Leading Researchers To Understand Global Problems

Elimination of Standby Waste Through Clever Circuits and Control Systems

Driving Efficiency Through New Power Conversion Topologies and Technologies

Healthy Growth and Profitability
My Golden Rules of Innovation for Sustainability & Profitability
Rule #1: Don’t Design Only to Meet Standards – Innovate to Set New Ones

- Lawrence Berkeley National Lab investigation showed standby waste accounted for ~10% of electricity usage in the US

**Results from the investigations on leaking electricity in the USA**

Alan Meier, Wolfgang Huber  
Environmental Energy Technologies Division  
Lawrence Berkeley National Laboratory  
Berkeley, California

- Executive order by US President Bush limited standby energy use  
  - One watt on government purchases  
- Our first “low standby” product was capable of 30 mW no-load
>20 Billion
EcoSmart Chips Sold since 1998

Estimated 16 TWh
of standby energy saved in 2022
• Saved ~7 M tons of CO₂ emissions*

Low standby
now ubiquitous in power supplies

*Based on 2021 U.S. average of 0.855 lbs./kWh, per U.S. Energy Information Administration
Rule #2: Think Systems, Not Components

- Power Process Technologies
- Systems & Applications Know-How
- Package Innovations
- Design and Systems Software

Power System in a Package
System Focus Delivers Superior Performance

**GaN switch +**

Innovative control  +  Digital USB PD MCU  +  Custom power package  

=  

Highest efficiency across load and insignificant “no-load” consumption

Smallest notebook fast charger with no cost penalty

**Efficiency Comparison Over Load at 5 V Output**

- **GaN + highly integrated controller**
- **Dramatically higher efficiency**
- **Discrete GaN design**
Rule #3: Integrate To Reduce Materials, Ease Design
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101 ⇒ 45 Parts
Rule # 4: Advance Efficiency With Each New Product

- **12 V Constant Voltage**
- **30 V LED Constant Current**
- **5 V Constant Voltage**

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### PSU Approach | Conversion Efficiency (%)

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Flyback Stage</th>
<th>DC DC Stage</th>
<th>System Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Output: 12 V O/P</td>
<td>92%</td>
<td>-</td>
<td>92%</td>
</tr>
<tr>
<td>Multi O/P + Post regulators: 5 V CV</td>
<td>92%</td>
<td>87%</td>
<td>80%</td>
</tr>
<tr>
<td>12V CV</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>30 V CC</td>
<td>-</td>
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Rule # 4: Advance Efficiency With Each New Product

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Rule #5: Reduce Upstream Impacts for Sustainability

Source and quantity of upstream energy use are crucial

GaN requires substantially less energy to produce than SiC
Net Zero: World Response to Climate Change

Total carbon budget for the energy sector

Opportunity for electrical power engineering impact

Source: BloombergNEF
Spectacular Levels of Investment!

Annual average capital investment in the NZE

~ $4 Trillion/year! (>100 Trillion over next 30 years)

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Thank You

Balu Balakrishnan