

OBJECTIVES

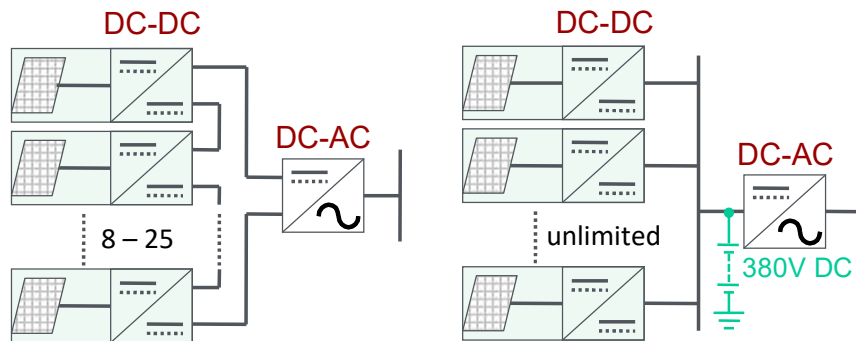
- To develop an ultrahigh efficiency and ultra compact low-cost paralleled type DC power optimizer
- To configure universal DC/AC microgrid with paralleled-type DC power optimizer for solar PV applications.

BACKGROUND

- Solar PV DC power optimizers represented \$1B market in 2018 and its CAGR is forecasted to be 11.9%. The growth is somewhat limited by the current designs due to inflexibility.
- To further reduce levelized cost of electricity (LCOE), efficiency of power electronics needs significant improvement.

ISSUES AND SOLUTIONS

- **Issues with series-connected DC power optimizer (a),**
 - ✗ Limited number of modules to match down-stream inverter
 - ✗ Output voltage may be insufficient for grid connection
 - ✗ Non-isolated, PV panels are impacted when there is a fault
- **Solutions with parallel-connected DC power optimizer (b),**
 - ✓ Power output directly proportional to non-shaded panels
 - ✓ Flexible, not limited by the number of panels for a complete system
 - ✓ Isolated, better safety feature
 - ✓ **Form a common DC bus for energy storage and DC microgrid**



(a) Series-connected type

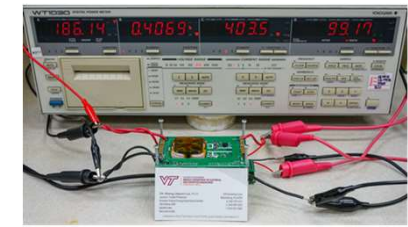
(b) Parallel-connected type

TECHNICAL APPROACHES AND ADVANCES

- Utilize wide bandgap semiconductor devices for mega-hertz switching to reduce magnetic component
- Develop a compact DC power optimizer with the size smaller than a business card to **fit into junction box for cost reduction (a)**
- Measured **efficiency at 400-W output exceeds 99% (b)**

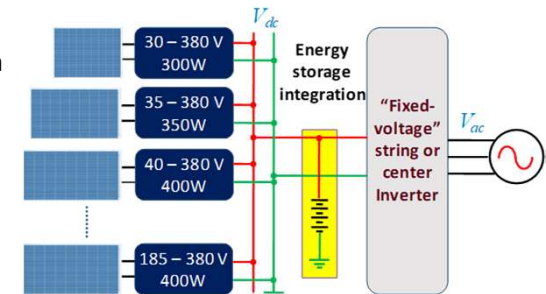


(a) Junction box integration



(b) Measuring efficiency >99%

- **Expand portfolio to cover wide range PV voltages with high-voltage DC (nominal 380 V) output for paralleled connection.**
- **Connect high-voltage DC outputs to battery energy storage or DC grid**



EXPECTED OUTCOMES

- Develop and manufacture small quantity parallel-connected type power optimizers
- Install two sets of power optimizers, one being series-connected type and the other being parallel-connected type to showcase the superiority of paralleled architecture
- Add on DC-AC to form hybrid microgrid with both DC and AC voltages available for energy storage and EV charging