



ROCKY
MOUNTAIN
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Balance of System for Building PV

Context, Motivation, and Broader Perspective

Presentation at ARPA-E PV Power Electronics

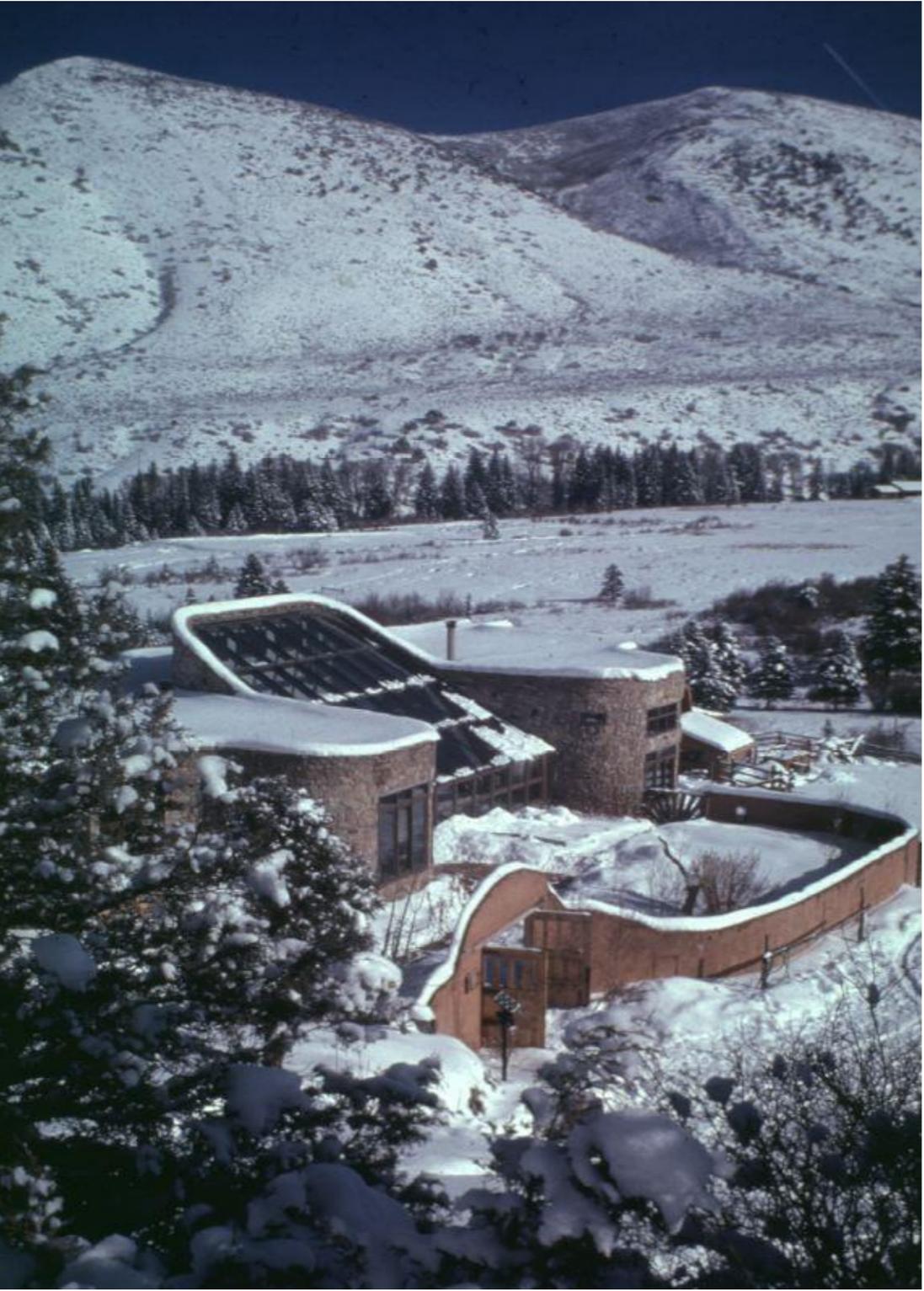
Workshop

February 8, 2011

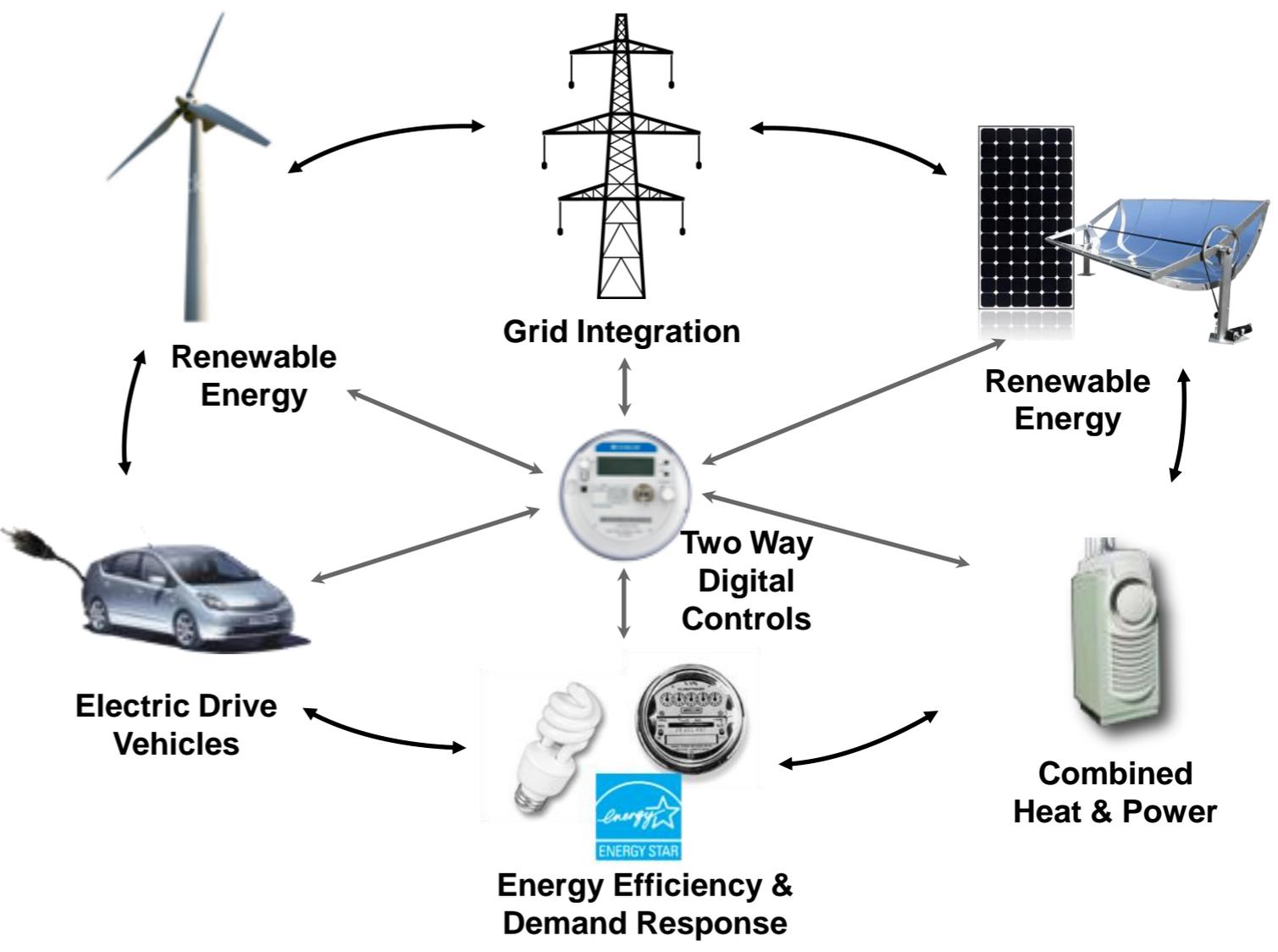
Stephen Doig

Sam Newman

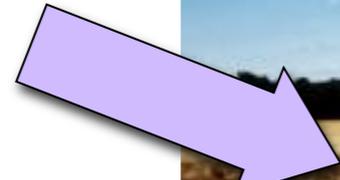
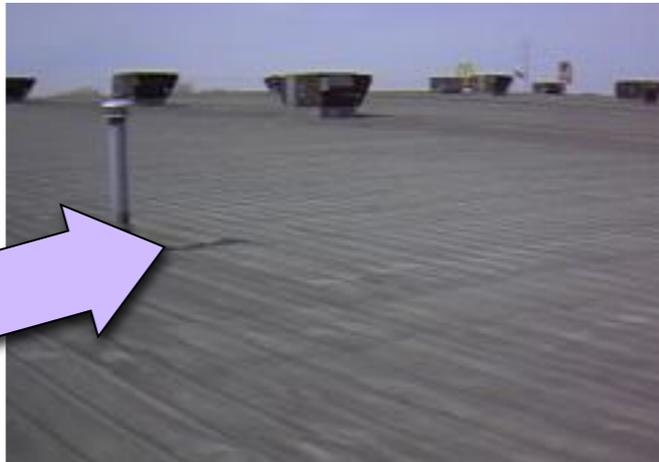
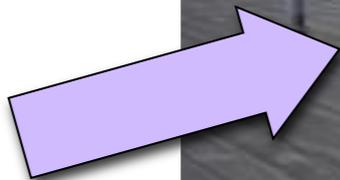
Rocky Mountain Institute works to find profitable and practical solutions to our energy challenges



Components of the Next Generation Utility

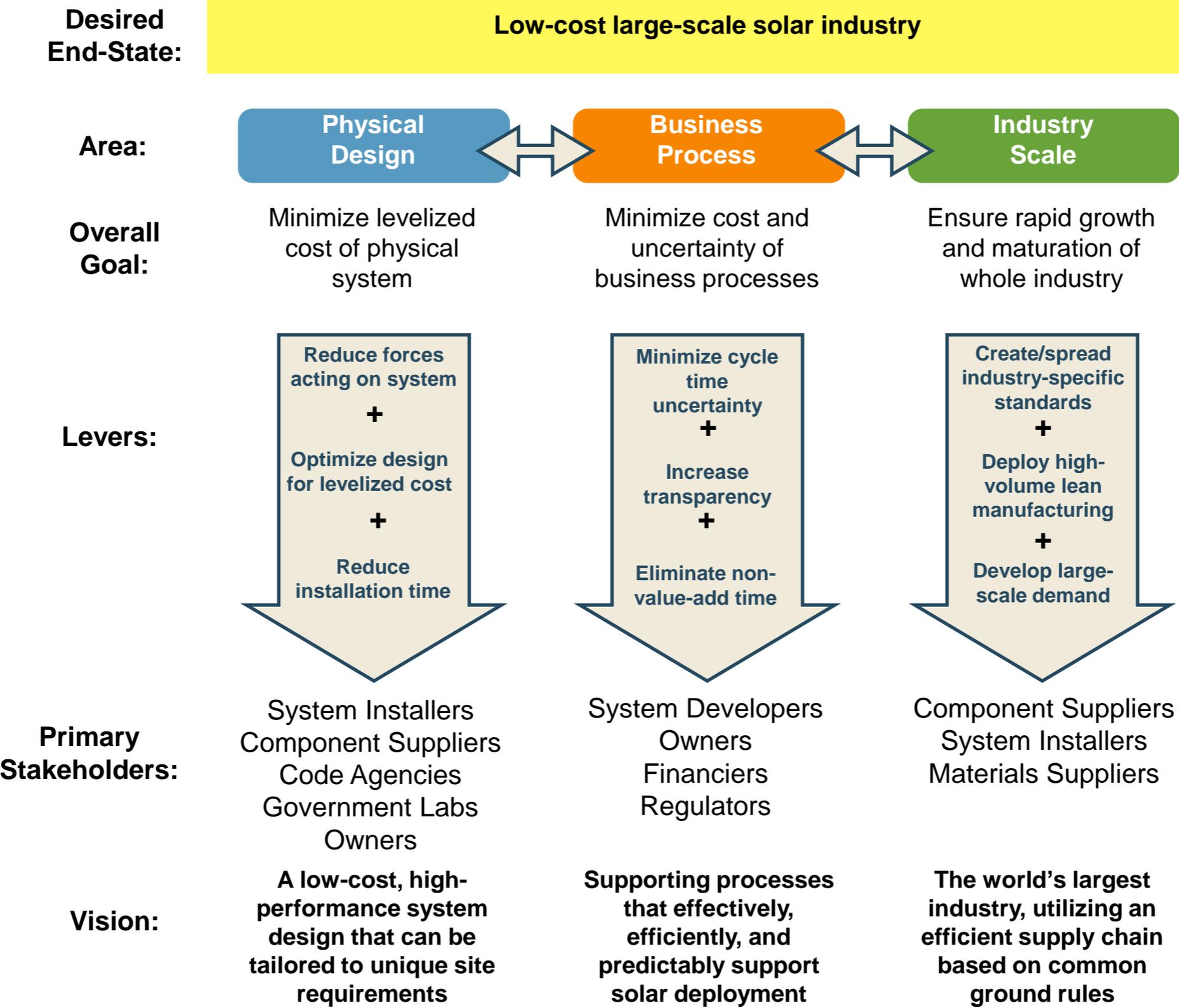


RMI convened a group of experts to bring coordinated thinking to PV BOS challenges



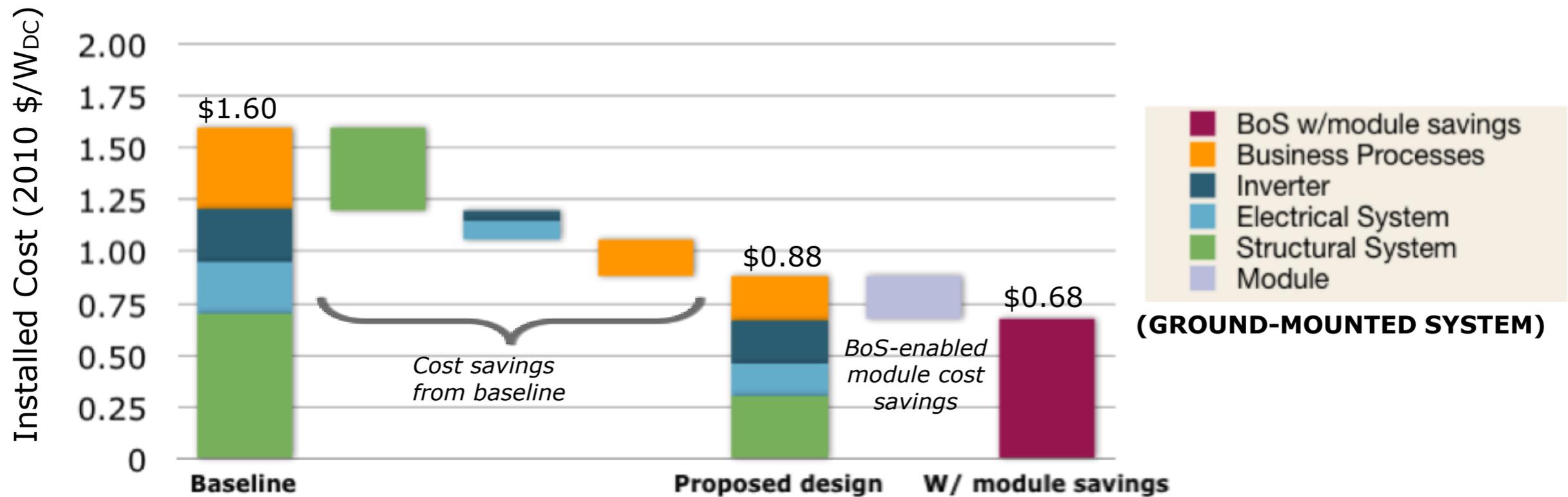
To Download RMI Report and Summary Presentation:
www.rmi.org/rmi/SolarPVBOS

Industry-wide collaboration is needed on a systems approach to reduce BoS costs



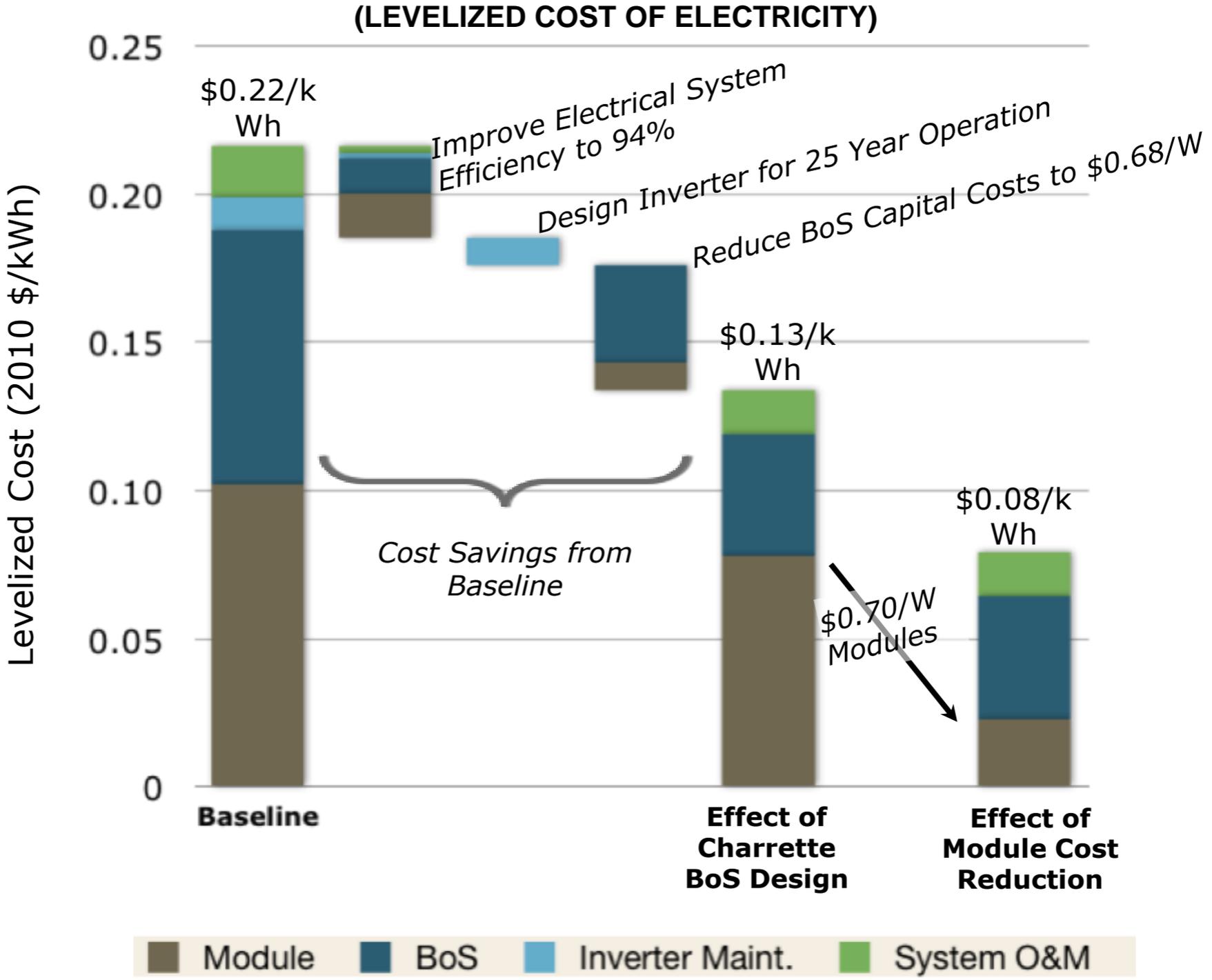
Charrette recommendations indicate potential to reduce BoS costs to \$0.60-\$0.90/watt in the near term

ESTIMATED IMPACT OF COST REDUCTION MEASURES (For Ground-Mounted Installation)



Power electronics play an important role, particularly when looking at the problem from perspective of LCOE

NEAR-TERM COST REDUCTIONS FOR GROUND-MOUNTED PV SYSTEM (LEVELIZED COST OF ELECTRICITY)



(GROUND-MOUNTED SYSTEM)

Power electronics design offers a number of strategies to address a complex system optimization challenge

**MINIMIZE
CAPITAL
COST**

**MAXIMIZE
PRODUCTION
(EFFICIENCY)**

**MAXIMIZE
LIFETIME AND
UPTIME**

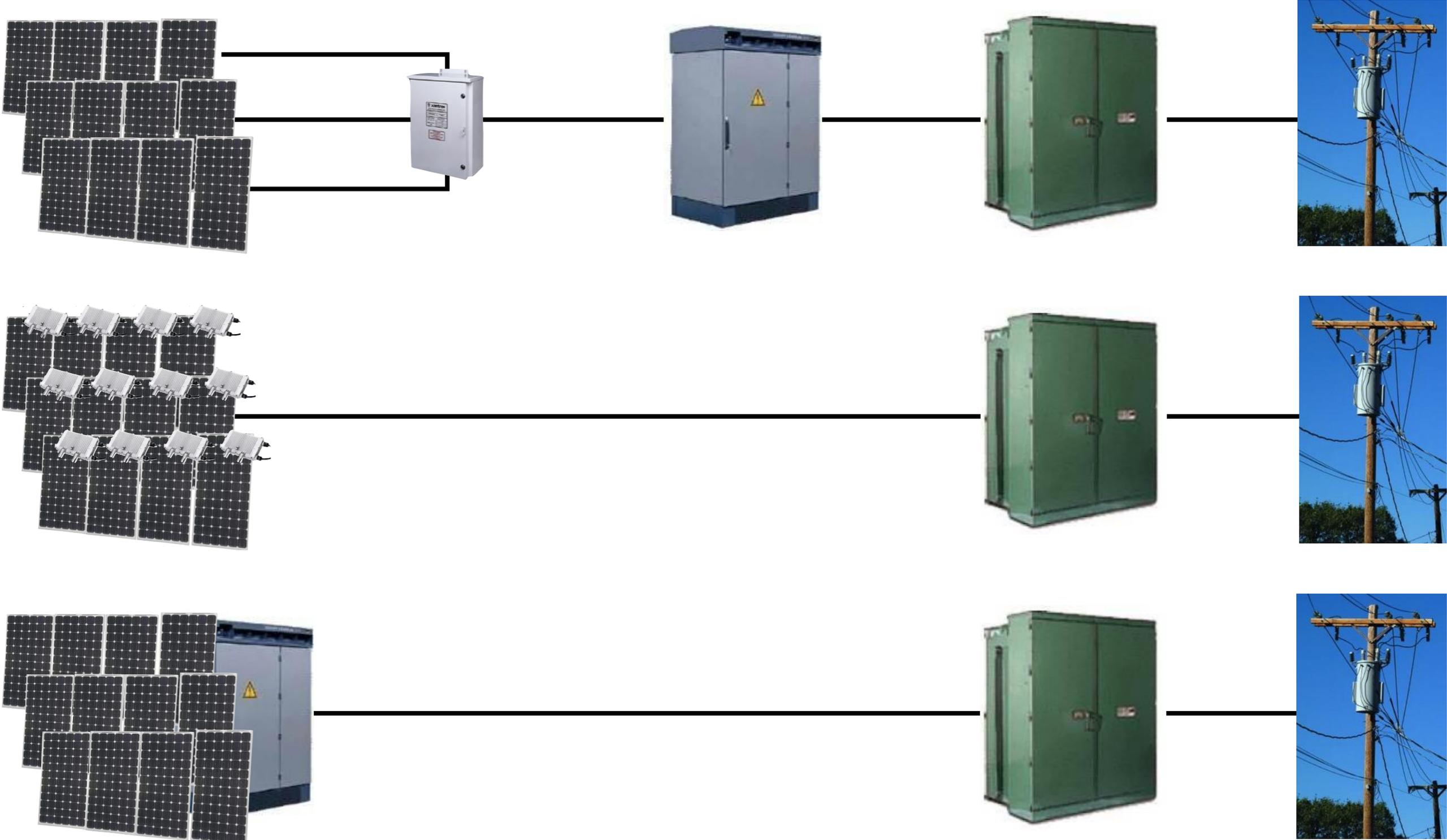
**MAINTAIN
HIGH DEGREE
OF SAFETY**

**PROVIDE
SERVICES TO
GRID**

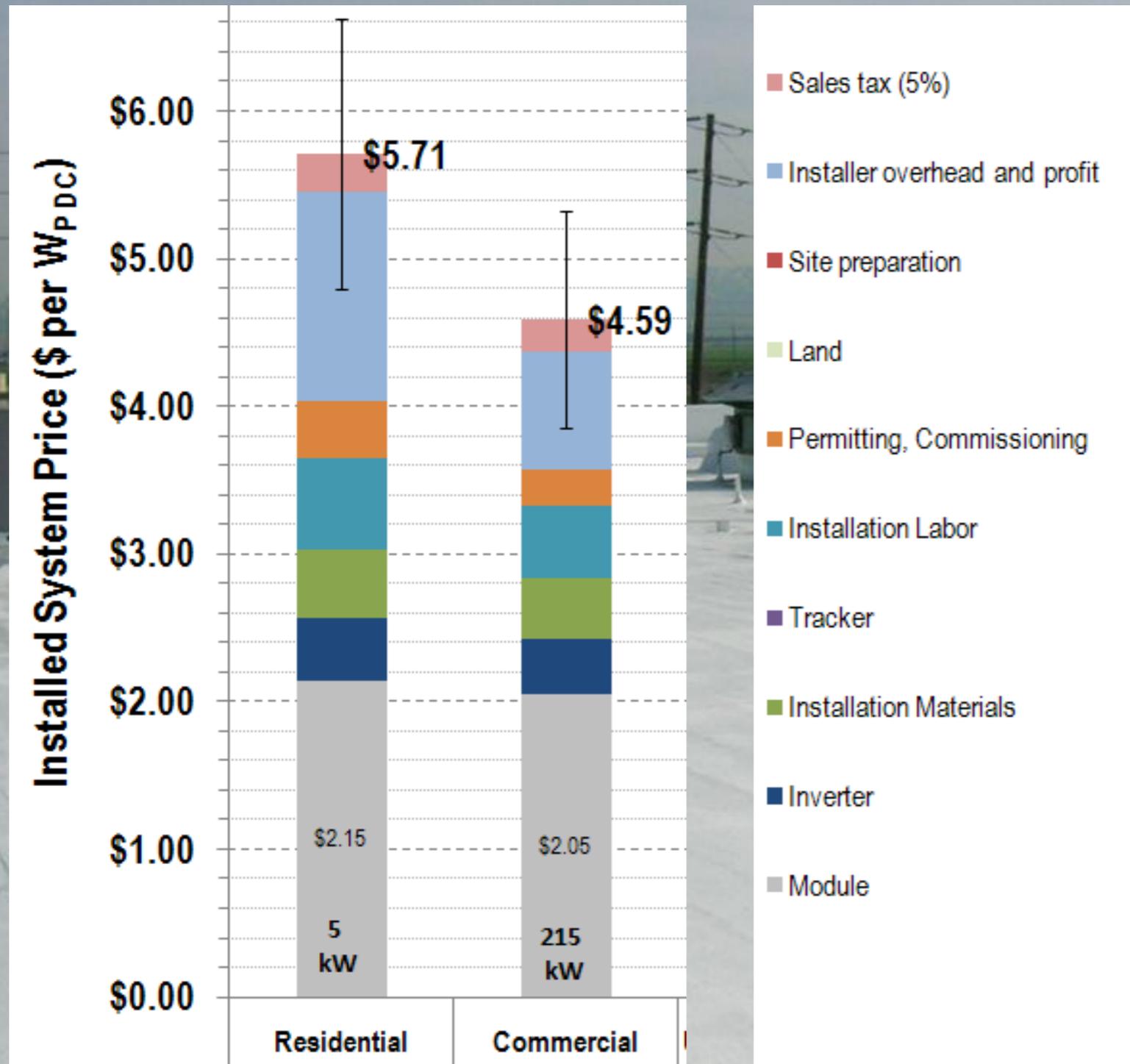
Design Themes from RMI Electrical Group

- 1. Decentralize inversion**
- 2. Raised voltage system**
- 3. Design to maximize utility services**
- 4. High frequency**
- 5. Constrain boundary conditions to allow module cost reduction**
- 6. Minimize serial conversion steps**

System architecture options



Implications for buildings: whole system design



Implications for buildings: expand solar market





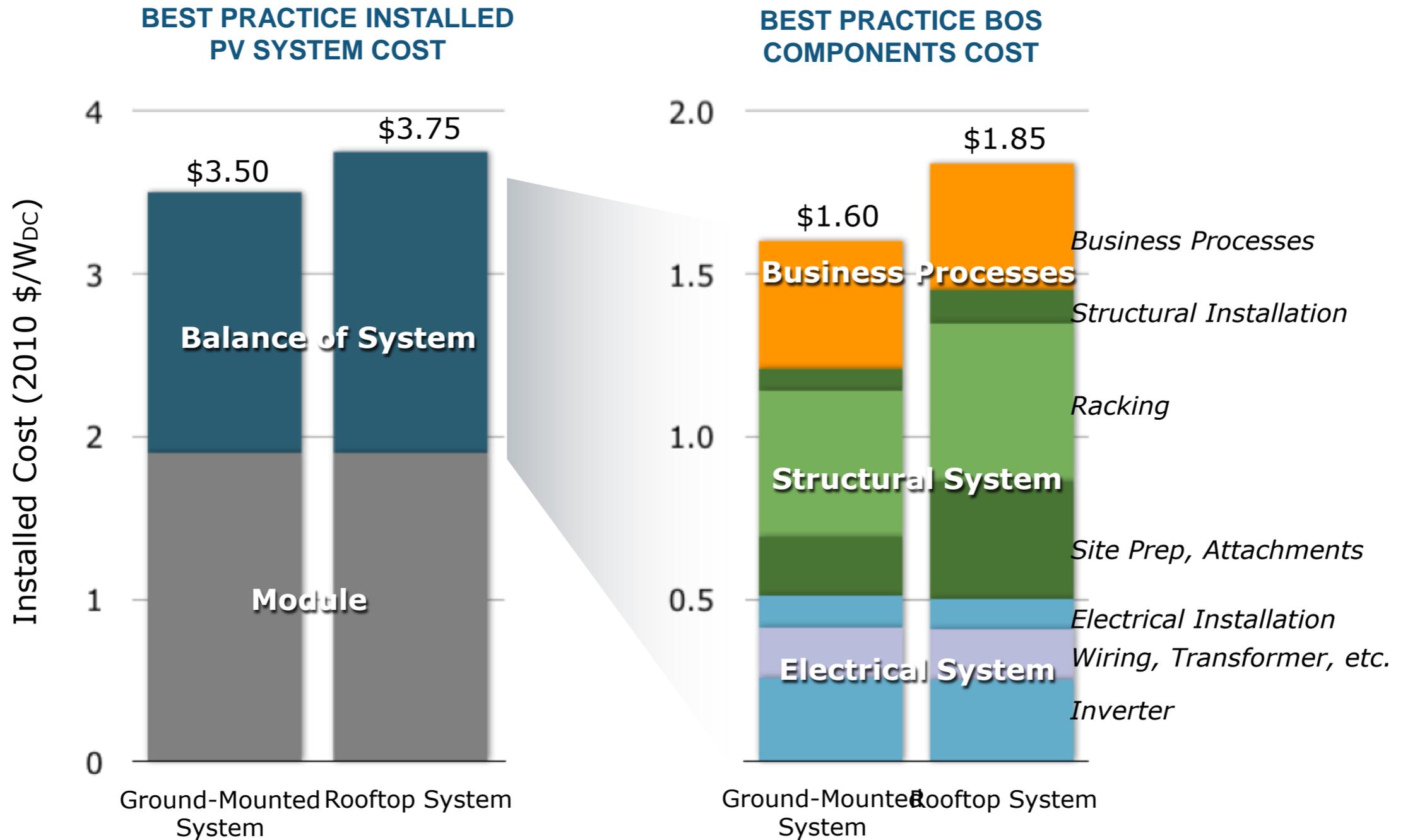
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Extra Slides

BoS Costs Account for ~50% of Total System Cost

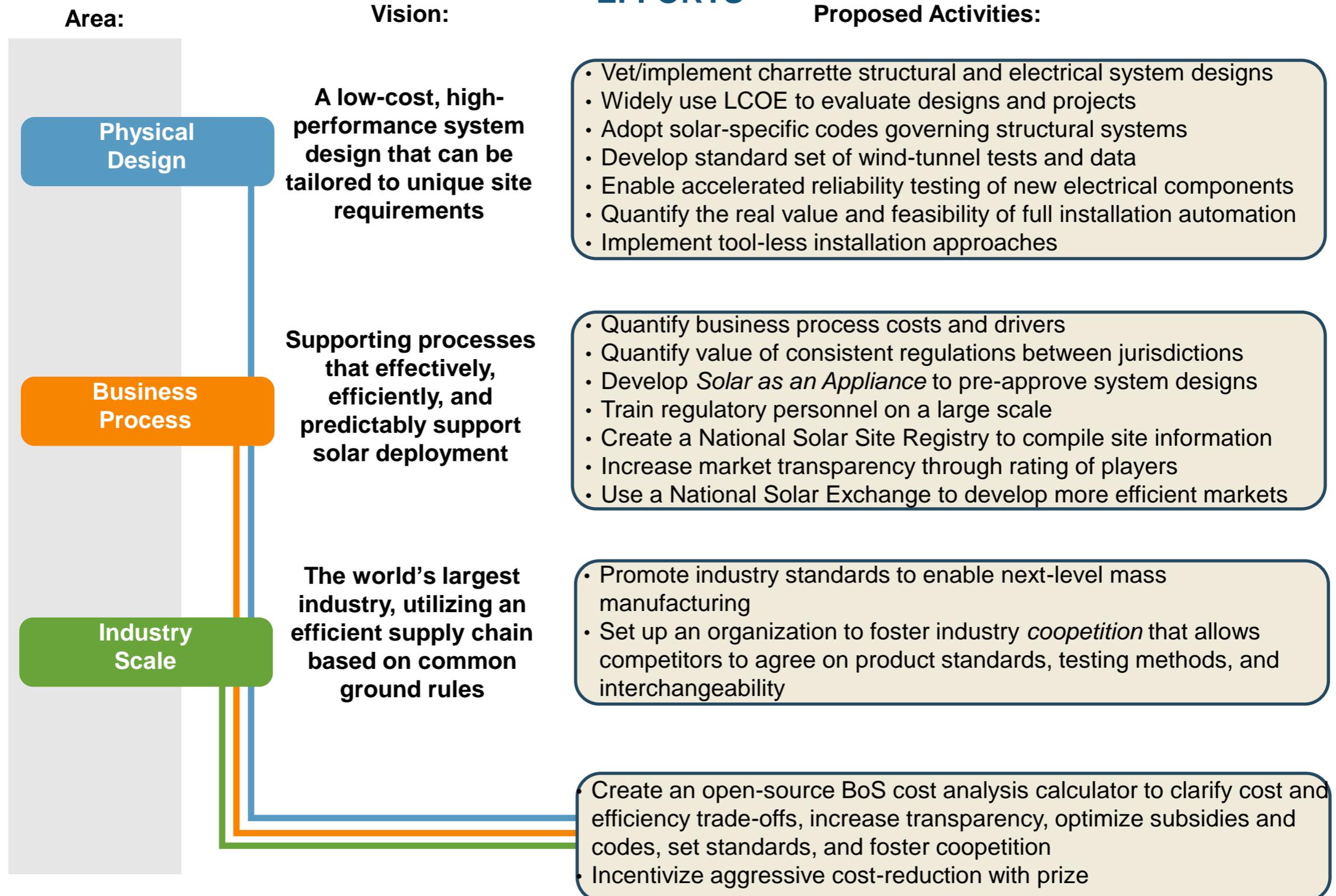


NOTE ON BASELINE COST ESTIMATES

These estimates for total system costs and specific cost components are based on discussions with PV industry experts and are intended to represent a best-practice cost structure for a typical commercial system (1-20MW ground-mounted, >250kW flat rooftop). Actual project costs are highly variable based on location and other project-specific factors.

Charrette Prioritized Recommendations For Near-Term Cost Reductions

RECOMMENDED HIGH-PRIORITY ACTIVITIES TO ENABLE AND ACCELERATE COST REDUCTION EFFORTS



There are Major Challenges to Cost Reduction in the BoS Industry

BoS costs are driven by value chain fragmentation and the need to accommodate high variability in sites, regulations, and customer needs. As a result:

- **Each PV system has unique characteristics and must be individually designed.**
- **There is no silver-bullet design solution for BoS.**
- **Many incremental opportunities for cost reduction are available across the value chain.**

In order to achieve transformational cost reductions, **a systems approach is needed that spans the entire value chain**, and considers improvements for one component or process in light of their impacts on, or synergies with other elements of the system. Also, **industry-wide collaboration will be necessary.**

Scale. Scale. Scale.

