

# PV minigrid Cost Benchmark study

## Preliminary results

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## Preliminary results

tta

- I.** TTA Profile
- II.** PV minigrid Costing Benchmarks
- III.** CAPEX per Cost Category
- IV.** CAPEX per Customer

# TTA PROFILE

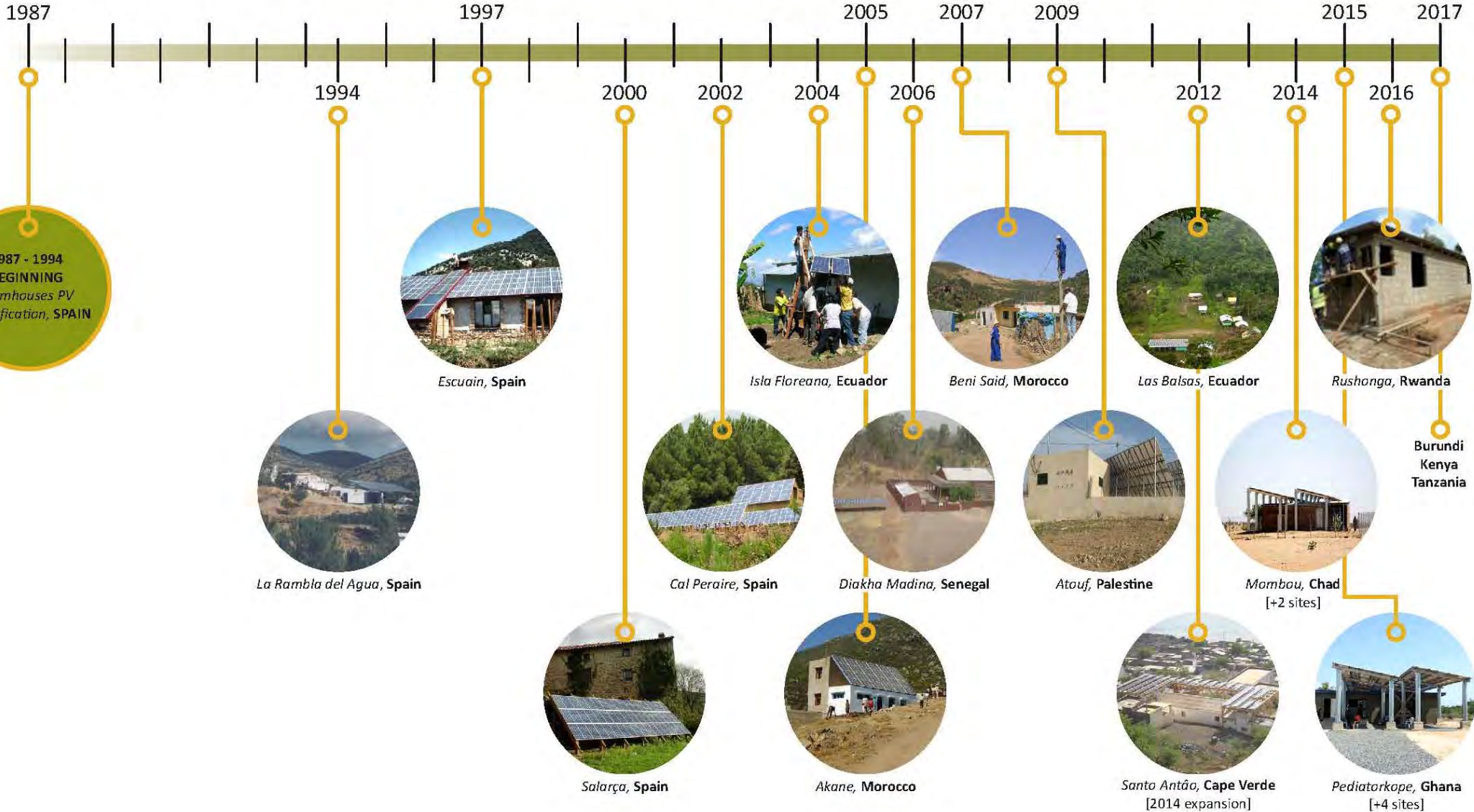
- SME - Founded in Barcelona en 1986
- Highly specialized in Renewable Energies and Sustainable Development
  - Energy management and distributed micro generation
  - Integration of renewable energies in buildings and bioclimatic design
- Independent consultancy, engineering, research, project management, social aspects, financial,...
- Reference in multiuser micro grids with solar hybrid generation for rural electrification – Off-grid practitioners since 1987
- Headquarters in Barcelona; Units in Brazil, Ecuador, Kenya and Ghana.



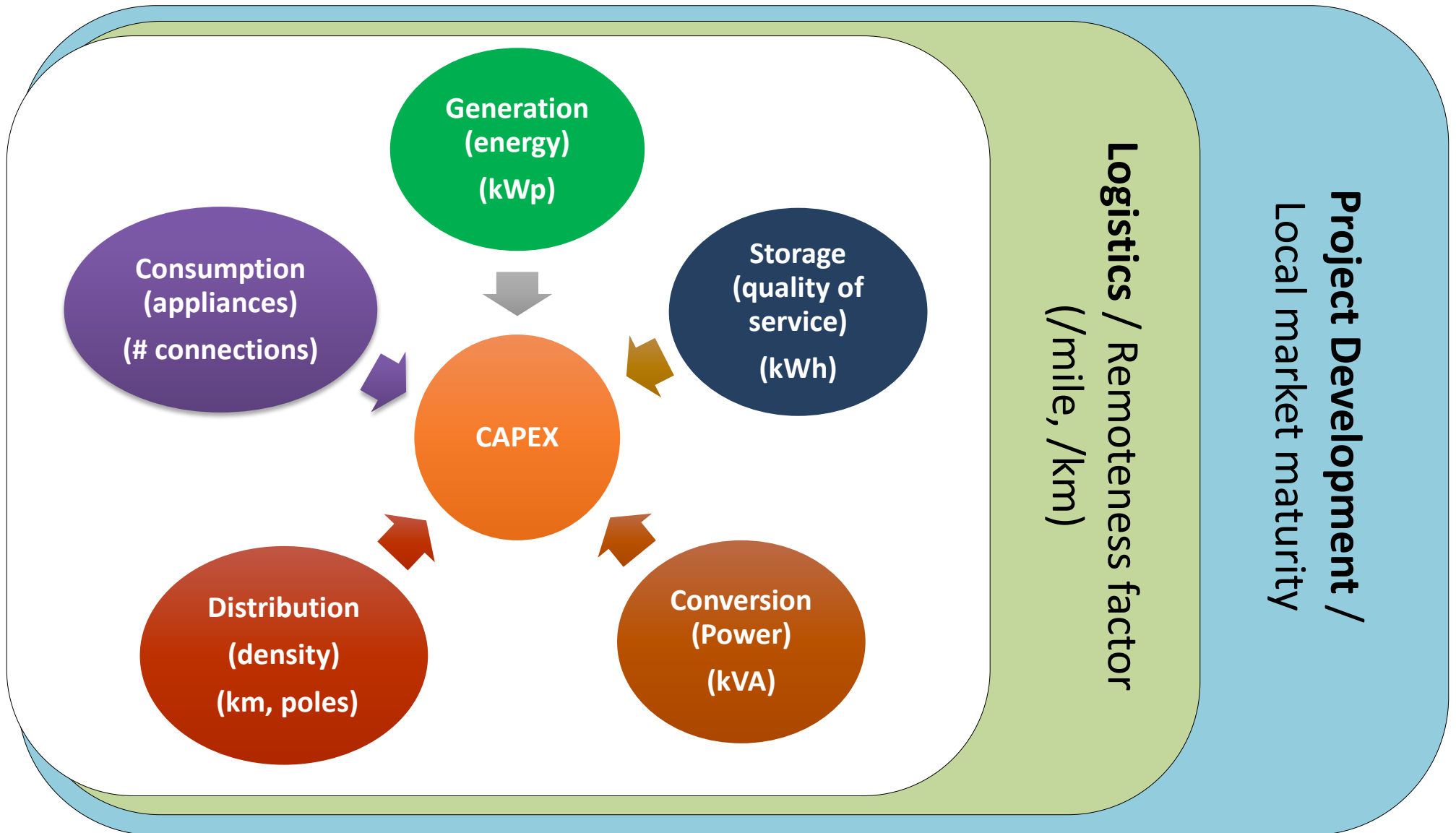


# TRACK-RECORD IN SOLAR PV MICROGRIDS

## EXCELLENCE IN MICROGRIDS



# ARE MINIGRID CAPEX WELL UNDERSTOOD?



# PV MINIGRID COSTING BENCHMARKS

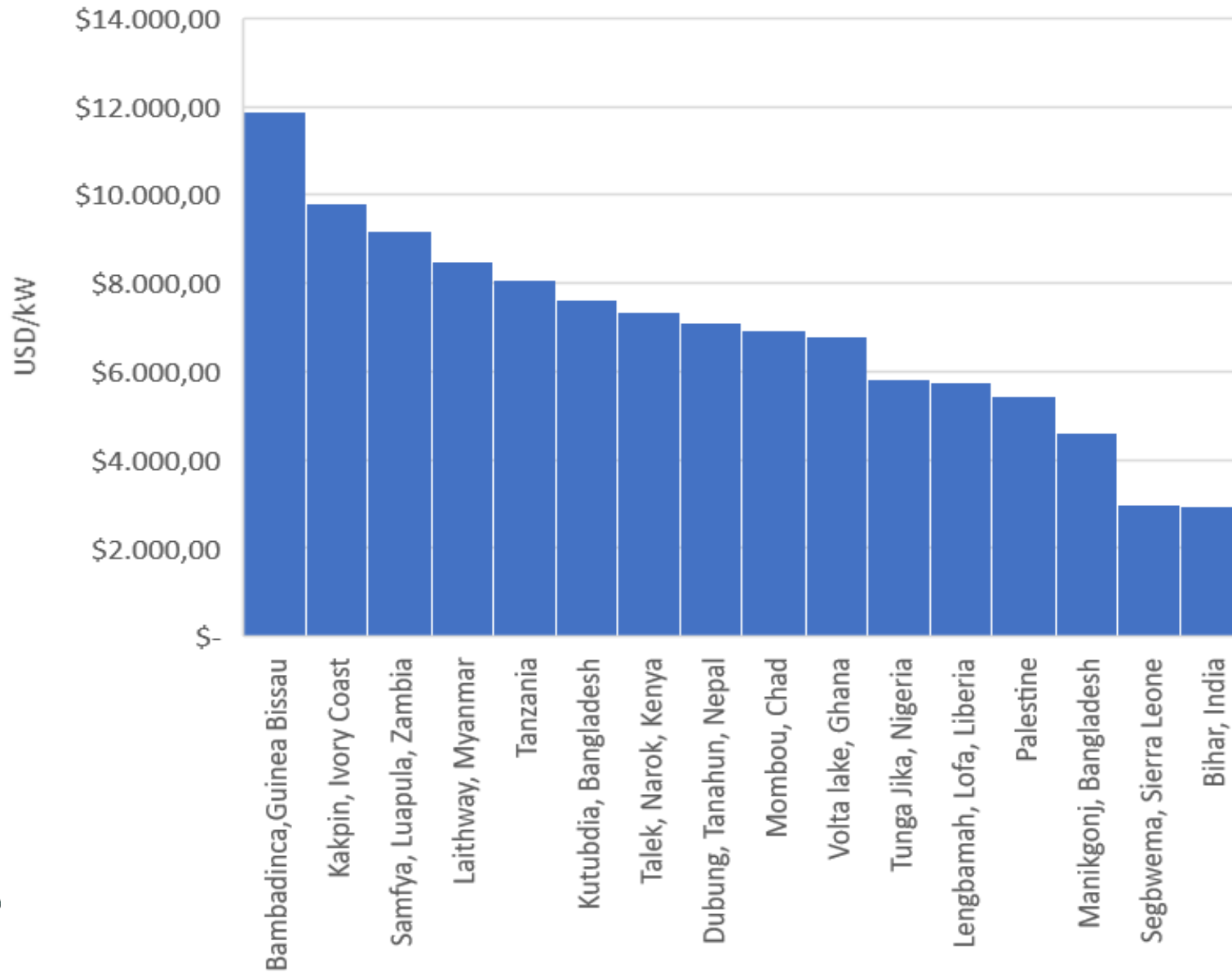
Hard cost Category	Unit
<b>1 Generation</b>	
PV modules (including spare parts)	kWp
PV modules Structure	ttt kWp
Charge regulators (MPPT) and protections – DC coupling or Solar Inverter (MPPT) and protection – AC coupling	kWp
<b>2 Storage and powerhouse</b>	
Lead acid (incl. cells, cabling, protection)	kWh
Lithium ion (incl. cells, cabling, protection)	kWh
Monitoring and control system	unit
Powerhouse (building, cabinet, container, incl. fence)	m <sup>2</sup>
<b>3 Conversion</b>	
Battery inverter incl. cabling	kVA
EMS Energy Management System	unit
Backup Diesel generator	kVA
<b>4 Distribution and Consumption</b>	
LV grid (incl. poles, cabling and protections)	km
LV distribution poles	km
Street lighting (if applicable)	n. customers or km
Smart meters and service connections	n. customers
<b>5. Customer systems (without installation)</b>	
End user indoor wiring (cabling, sockets and protections) (if applicable)	n. customers
End user appliances (if applicable)	n. customers

Soft cost Category	Unit
<b>6. Project development</b>	
Management and engineering	% overall hard costs or kW (AC service)
Capacity building and training (of local operators)	
<b>7. Logistics</b>	
International shipping costs (maritime), incl. customs	% overall hard costs or kW (AC service)
Local transportation costs (road)	
Storage of equipment	% overall hard costs or kW (AC service)
Insurance	

# PV MINIGRID CASES ASSESSED



# OVERALL CAPEX per kW (16 PV MINIGRID CASES)



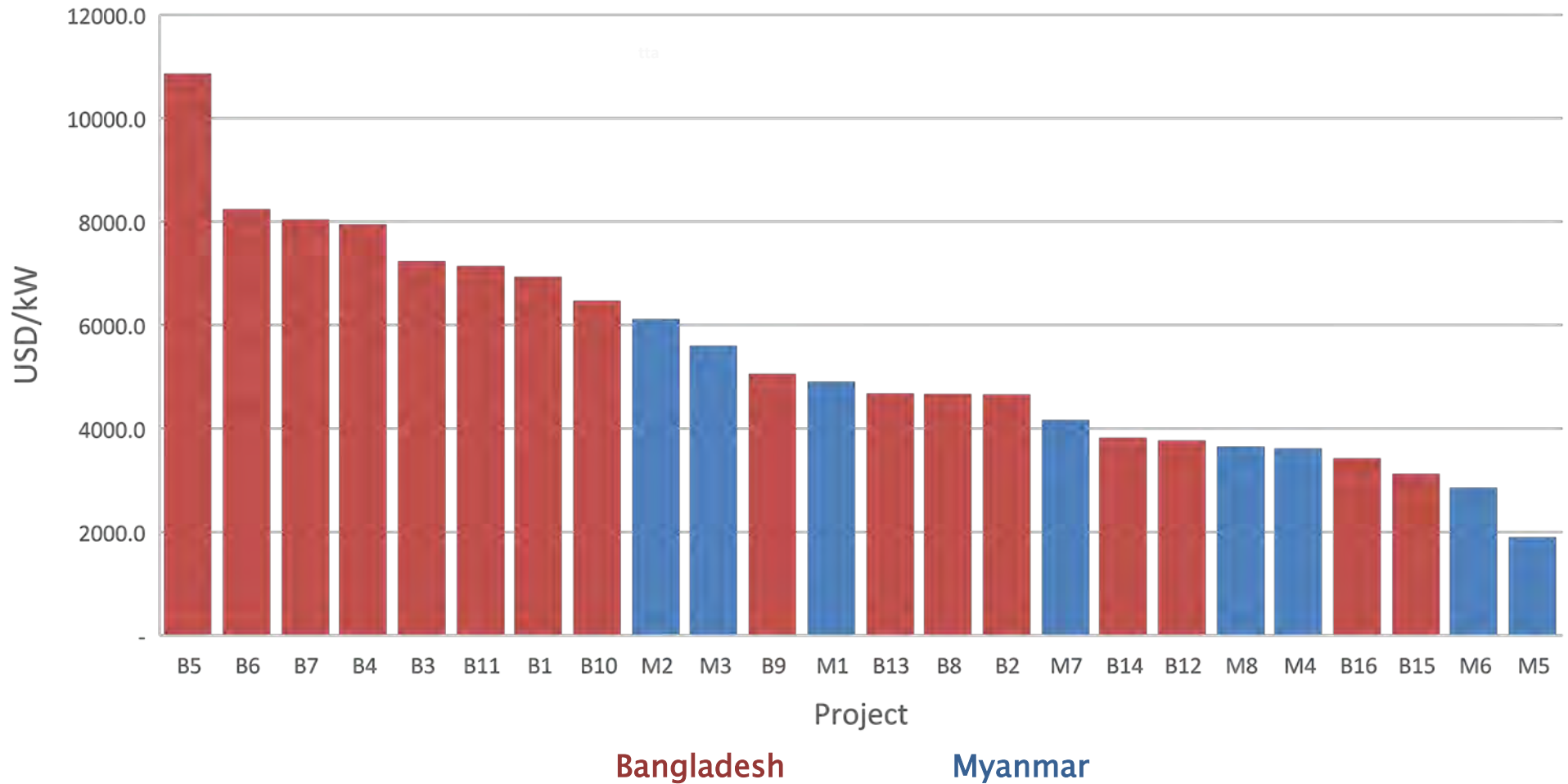
Wide Range of Costs

Studied Variables affecting this Cost



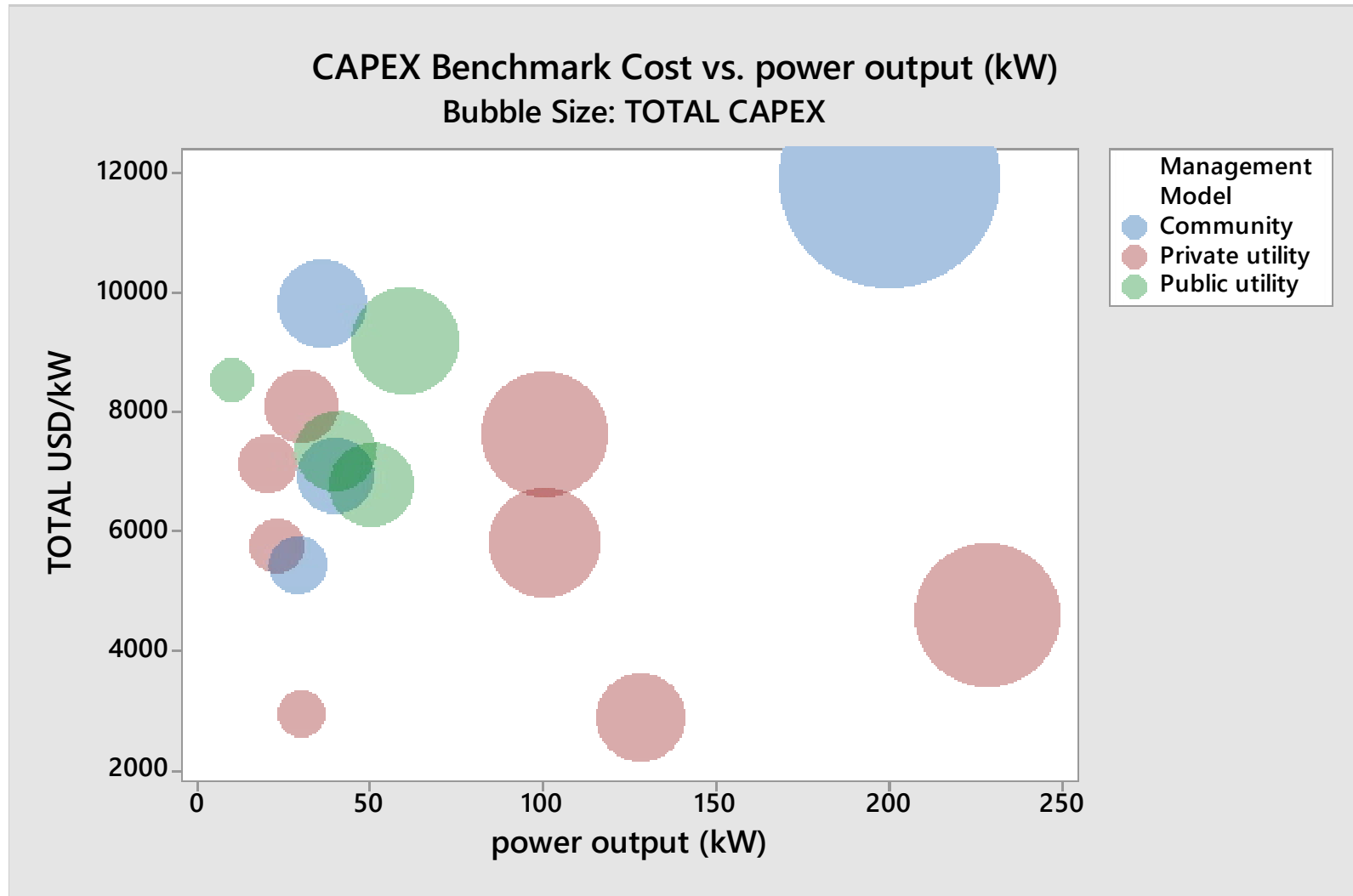


# OVERALL CAPEX per kW (24 PV MINIGRID CASES)



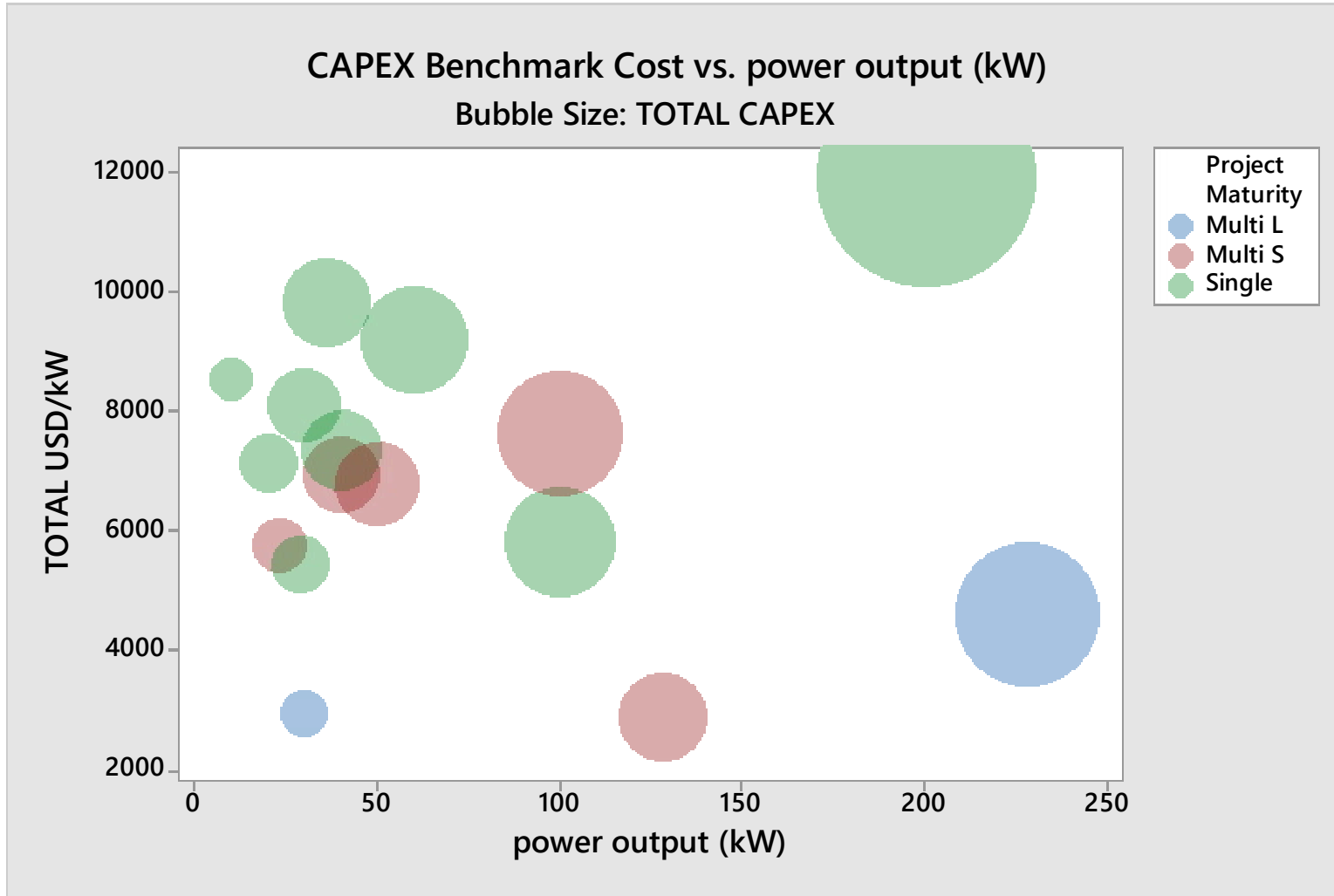
(source: ESMAP)

# INFLUENCE OF THE MANAGEMENT (BUSINESS) MODEL



- Private Models seem to offer lower prices
- Profitability: Key factor for private investments

# INFLUENCE OF PROJECT SCALE (or MATURITY)

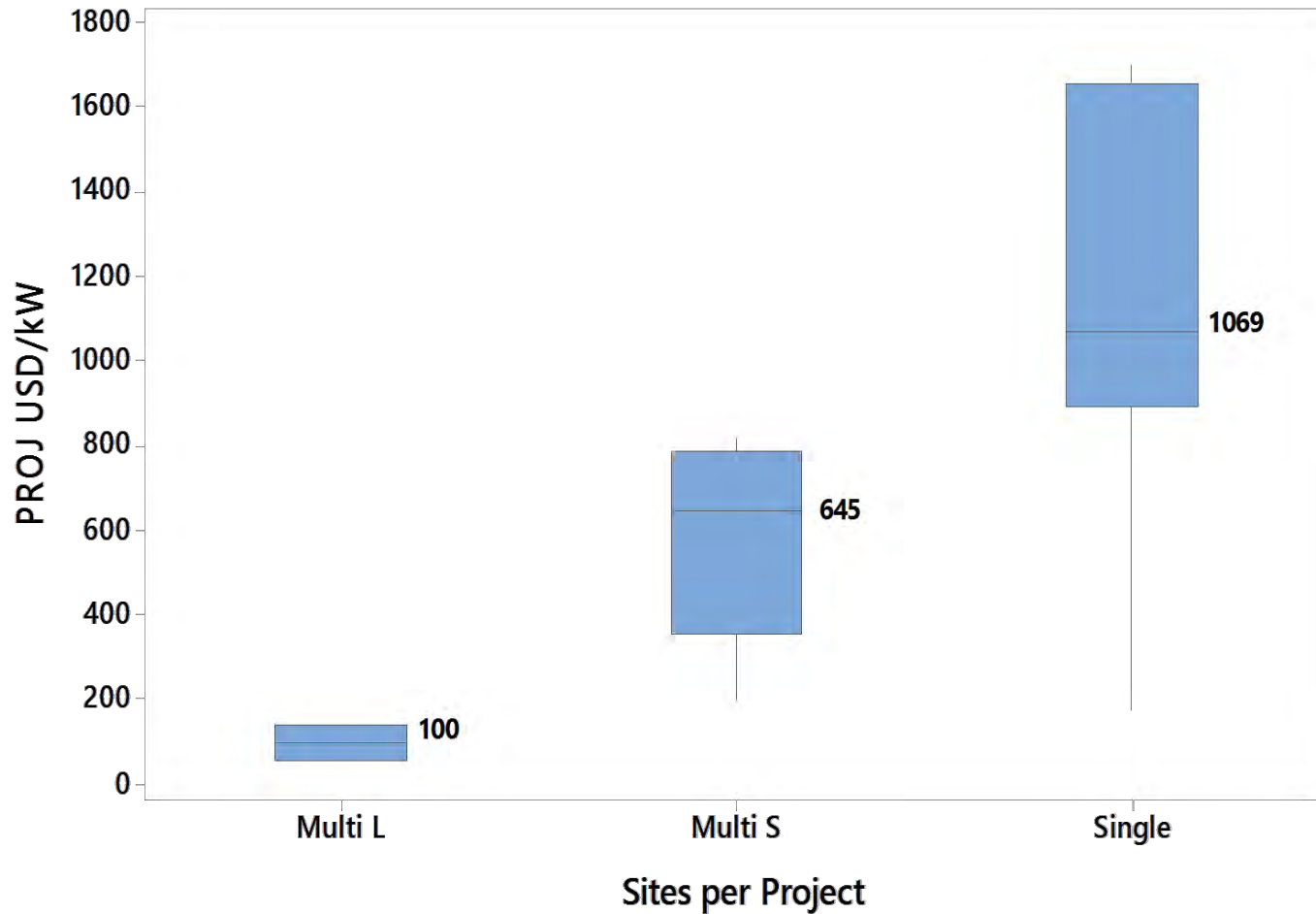


Single Projects significantly more expensive

Multi-project programmes offer lower prices

The more projects per programme, more chances of lowering overall costs

# PROJECT DEVELOPMENT COSTS



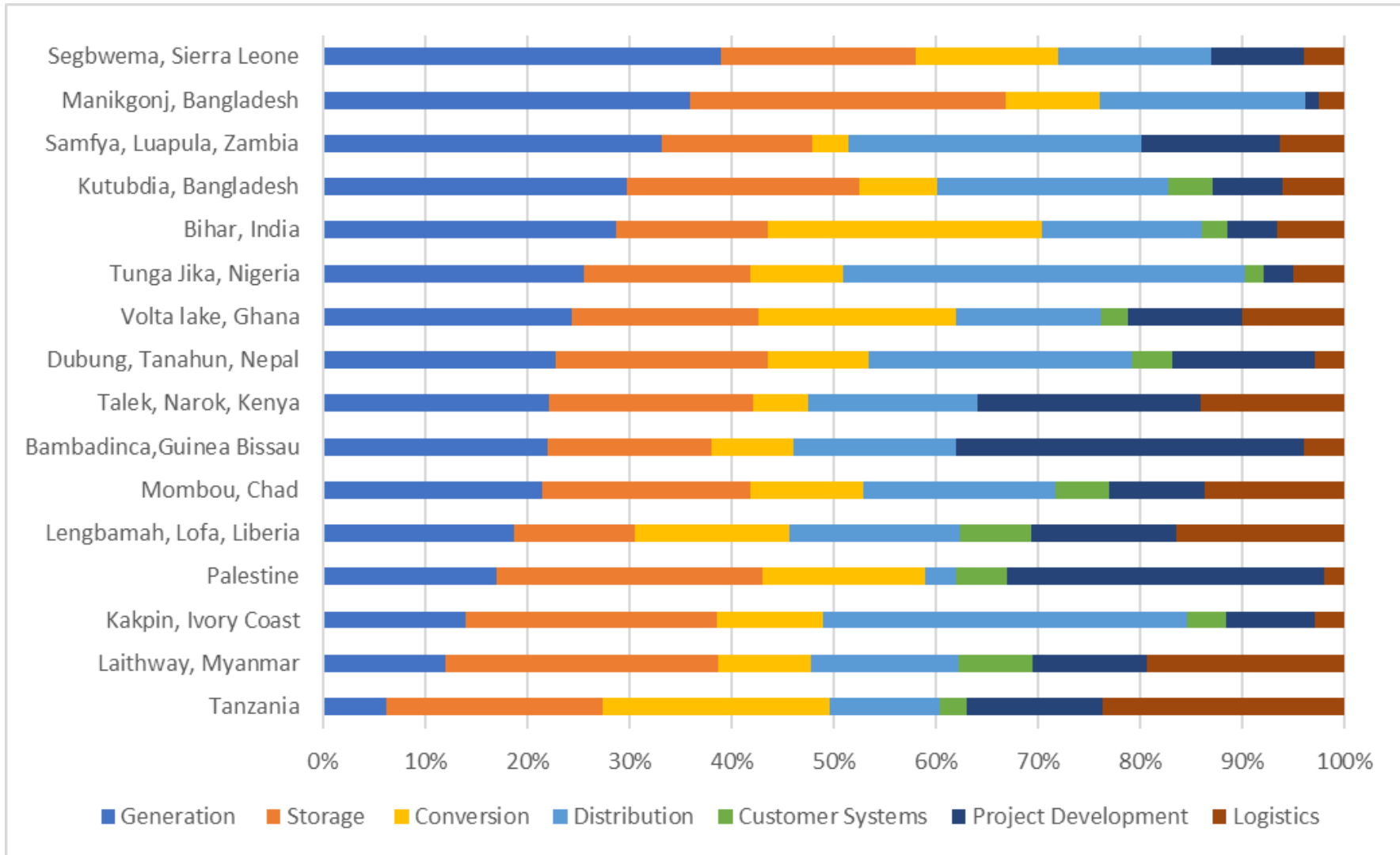
Programmes with more than 10 projects have substantially lower development costs

Convenient to develop and design several sites at a time

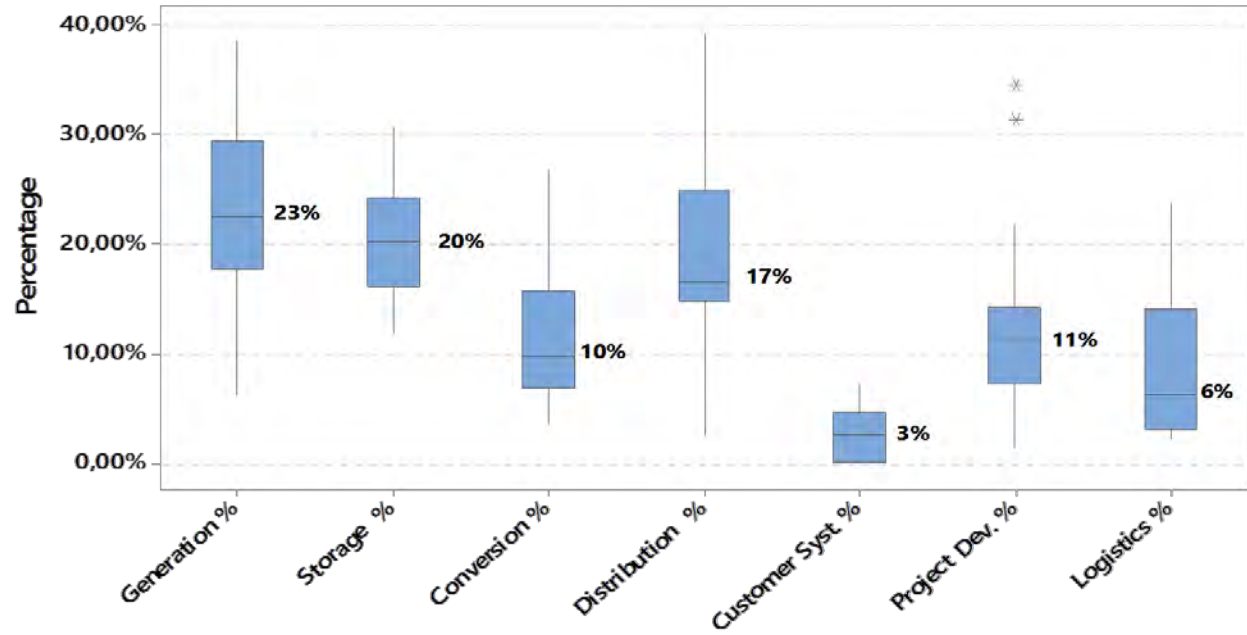
Individual Projects can have development costs 10x multiproject programmes.



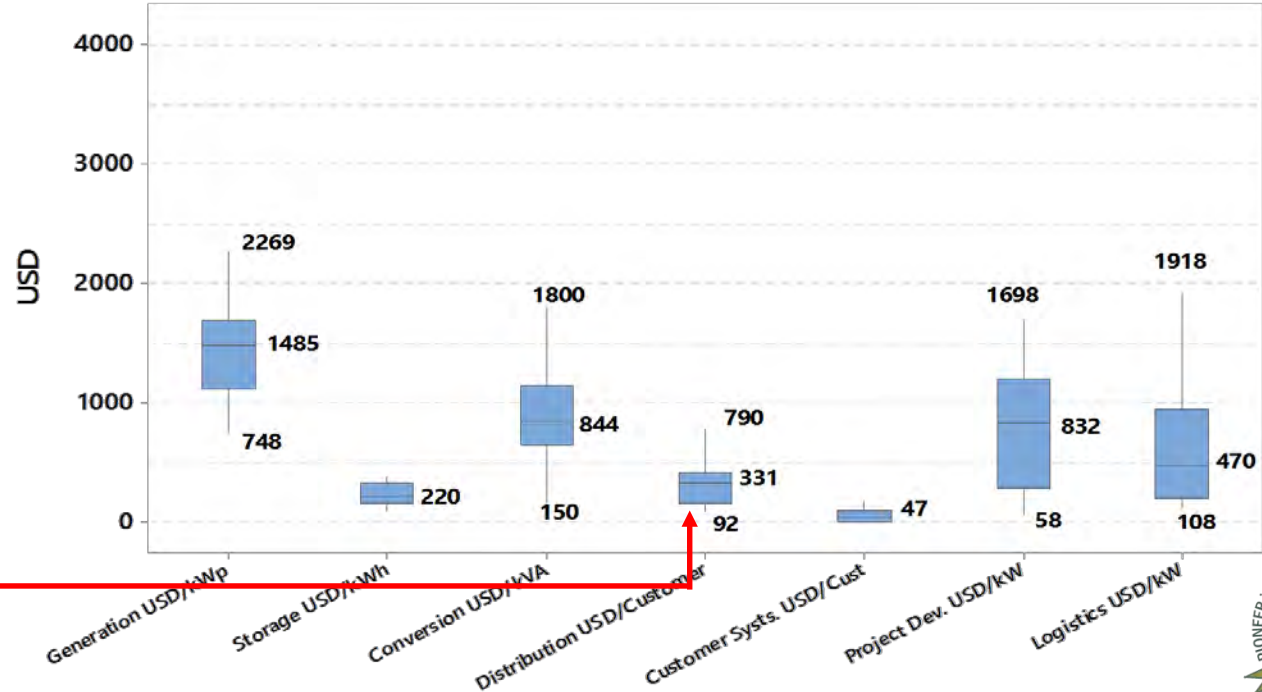
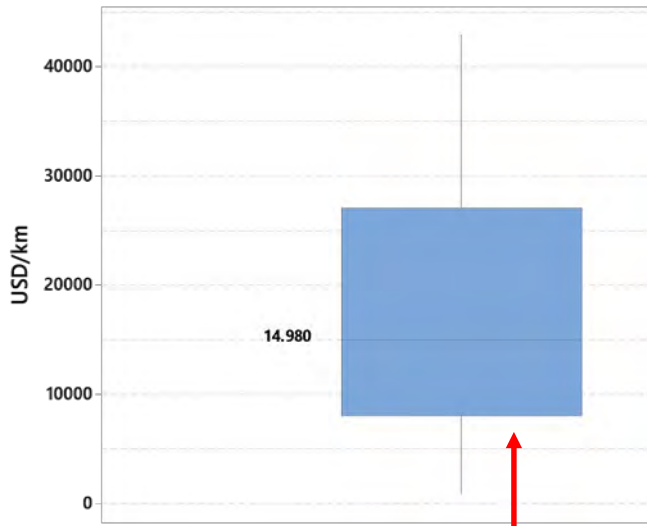
# CAPEX BREAKDOWN BY COST CATEGORY



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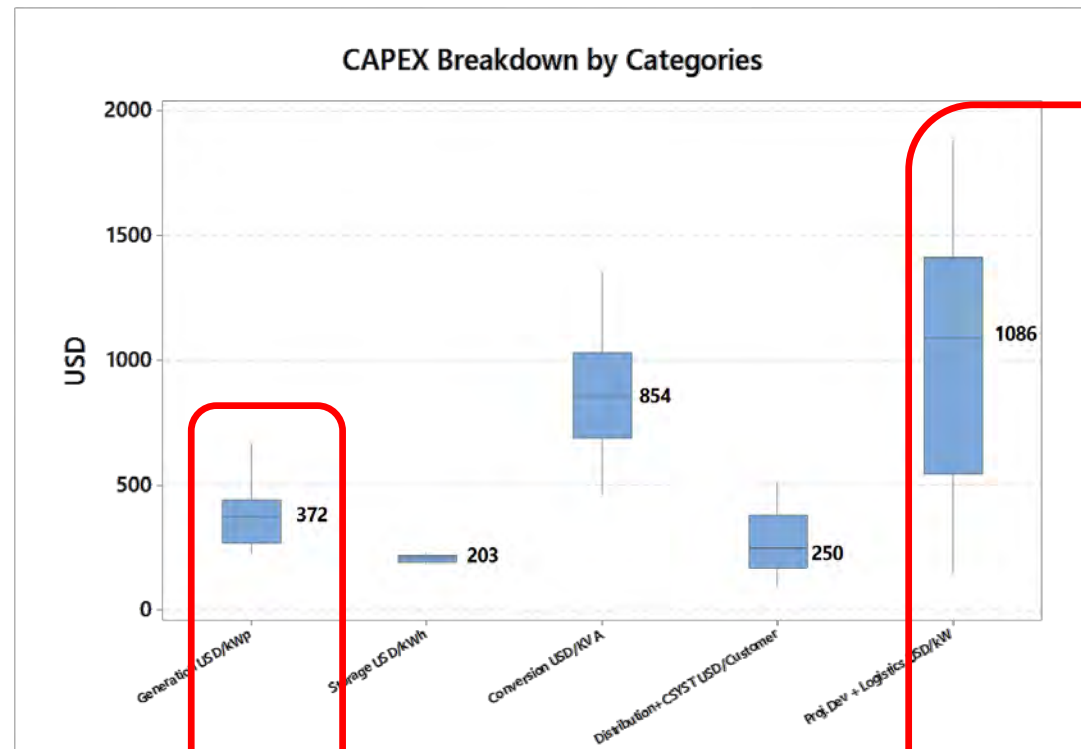


Distribution Costs (USD/km)

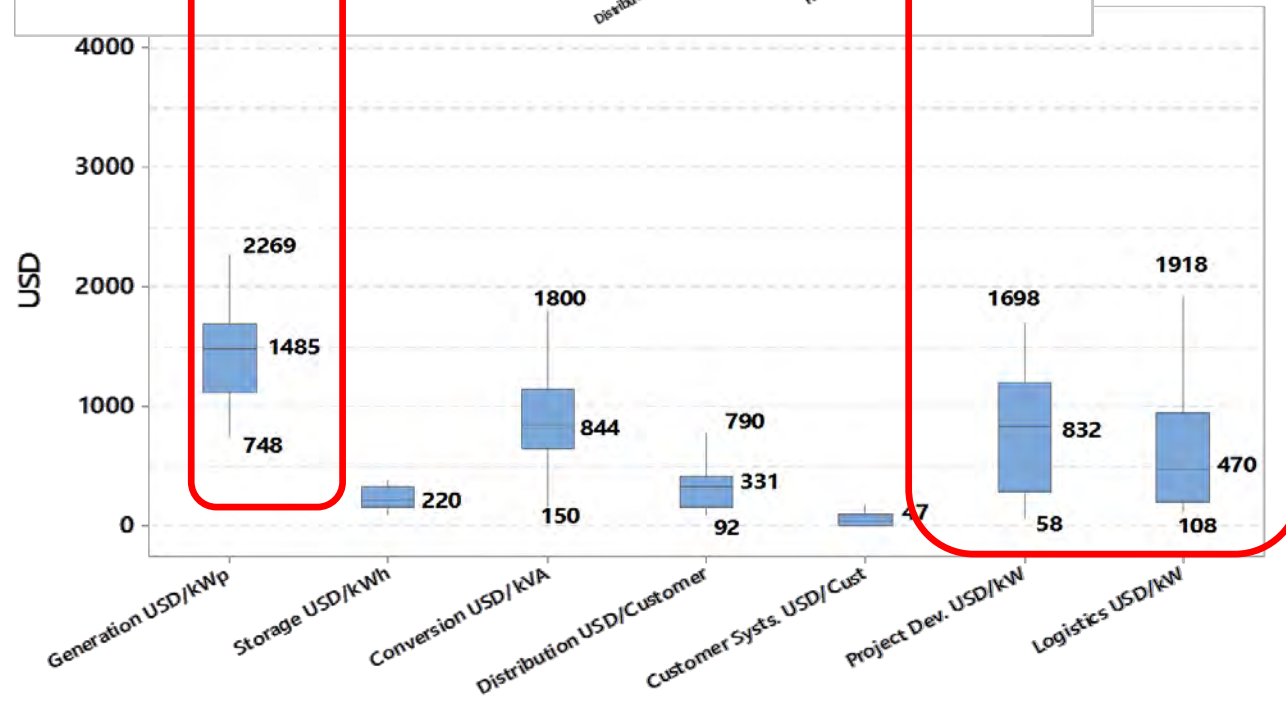


# CAPEX BREAKDOWN by COST CATEGORY

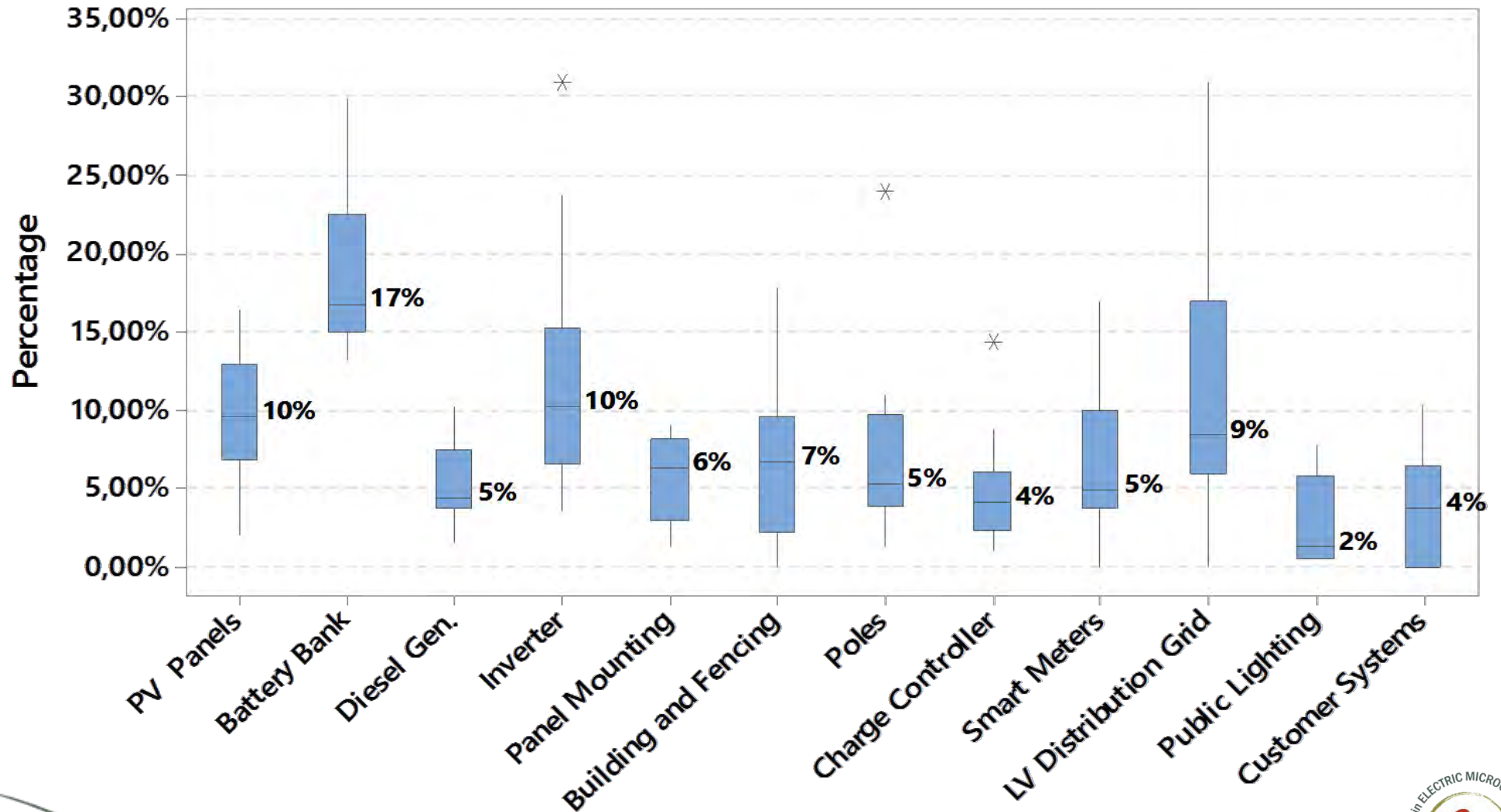
16 CASES AFRICA, ASIA



24 CASES  
BANGLADESH,  
MYANMAR

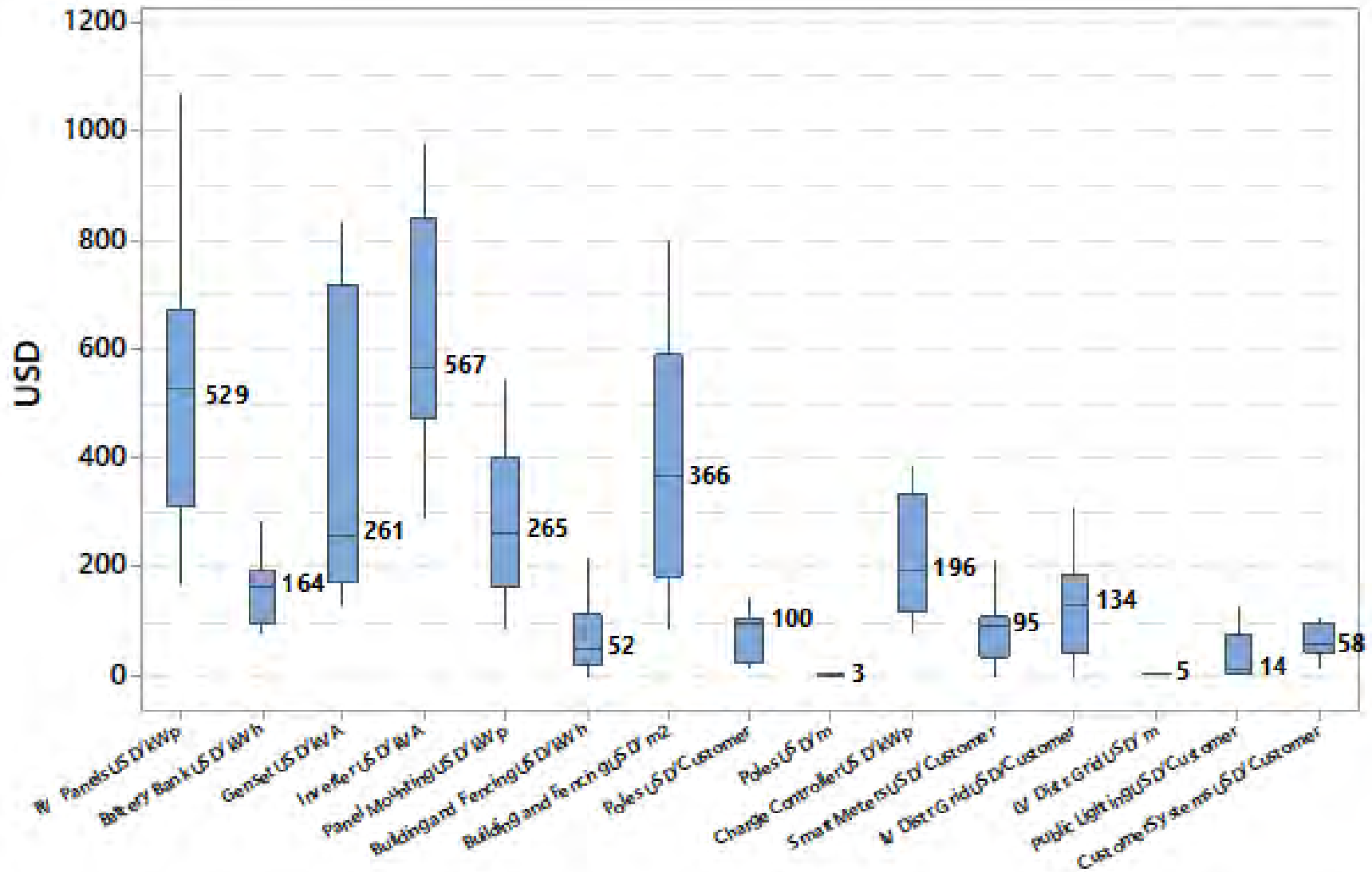


# CAPEX BREAKDOWN BY EQUIPMENT

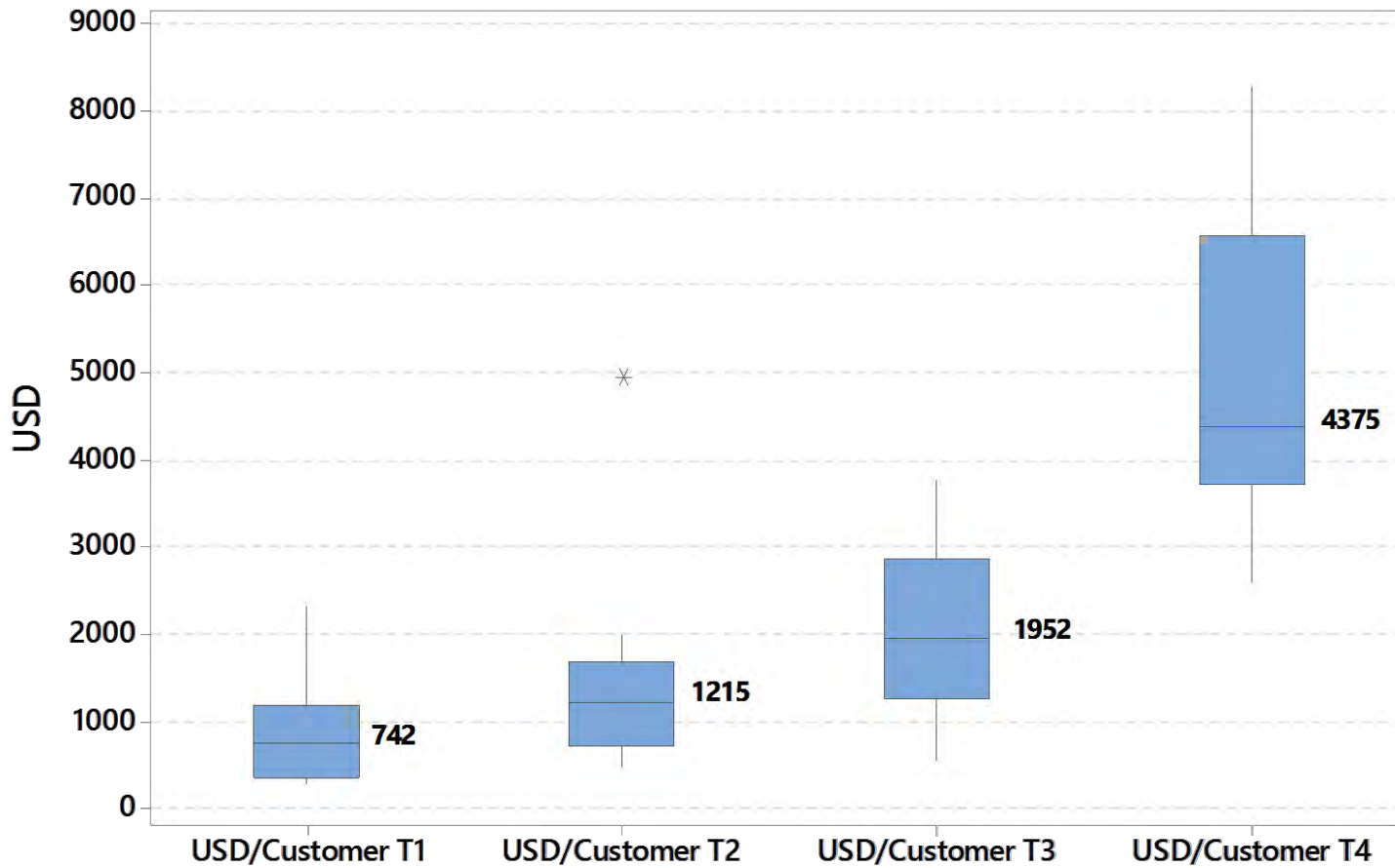




# HARDCOSTS



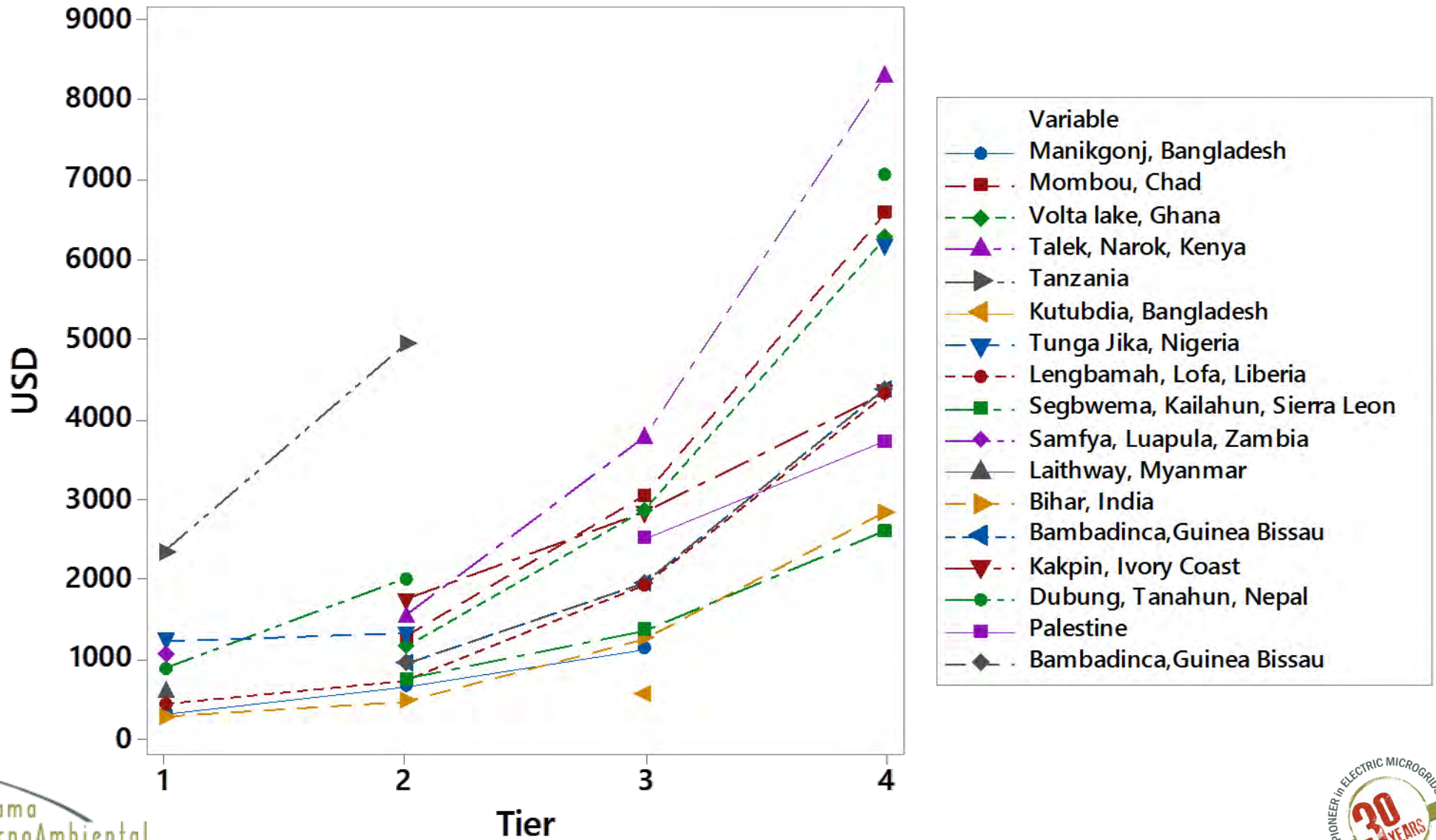
# CAPEX per CUSTOMER



- Tier 1 - Residential basic (<8kWh/month)
- Tier 2 - Residential med (<20kWh/month)
- Tier 3 - Residential high (<50kWh/month)
- Tier 4 - Productive (<110kWh/month)
- Anchor load(s) (110kWh/month and above)

	USD/Customer T1	USD/Customer T2	USD/Customer T3	USD/Customer T4	
MIN	\$288	\$484	\$559	\$2.597	\$1.215
MEDIAN	\$742	\$1.273	\$2.516	\$5.277	\$5.492
MAX	\$1.892	\$3.080	\$4.845	\$8.279	\$38.427

# CAPEX per CUSTOMER



**tta** Trama  
TecnoAmbiental

Renewable Energies • Energy Efficiency • Sustainable Buildings • Distributed Generation

**MOLTES GRÀCIES, THANK YOU !!**



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