

Rebuilding Rural Livelihoods in Conflicted-affected Northeast Nigeria: Solar-Powered Cold Storages



Background

- ☐ Recovery from conflict
- ☐ Food loss & waste for perishable commodities (e.g., vegetables & fruits)
- ☐ Lack of grid electricity infrastructure
- ☐ Women and youth

Interventions

- ☐ 7 solar-powered cold-storages installed in 7 horticulture markets in NE Nigeria
 - ☐ 3-tons capacity
 - ☐ Store electricity during daytime to allow 24-hour operation
 - ☐ User fee: 100 Naira (\$0.25) per 20kg crate / day
 - ☐ Operated by Social Enterprise (ColdHubs.Ltd)
- ☐ 350 traders directly benefited through access to cold-storage



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Panasonic solar panels as advanced Japanese technologies

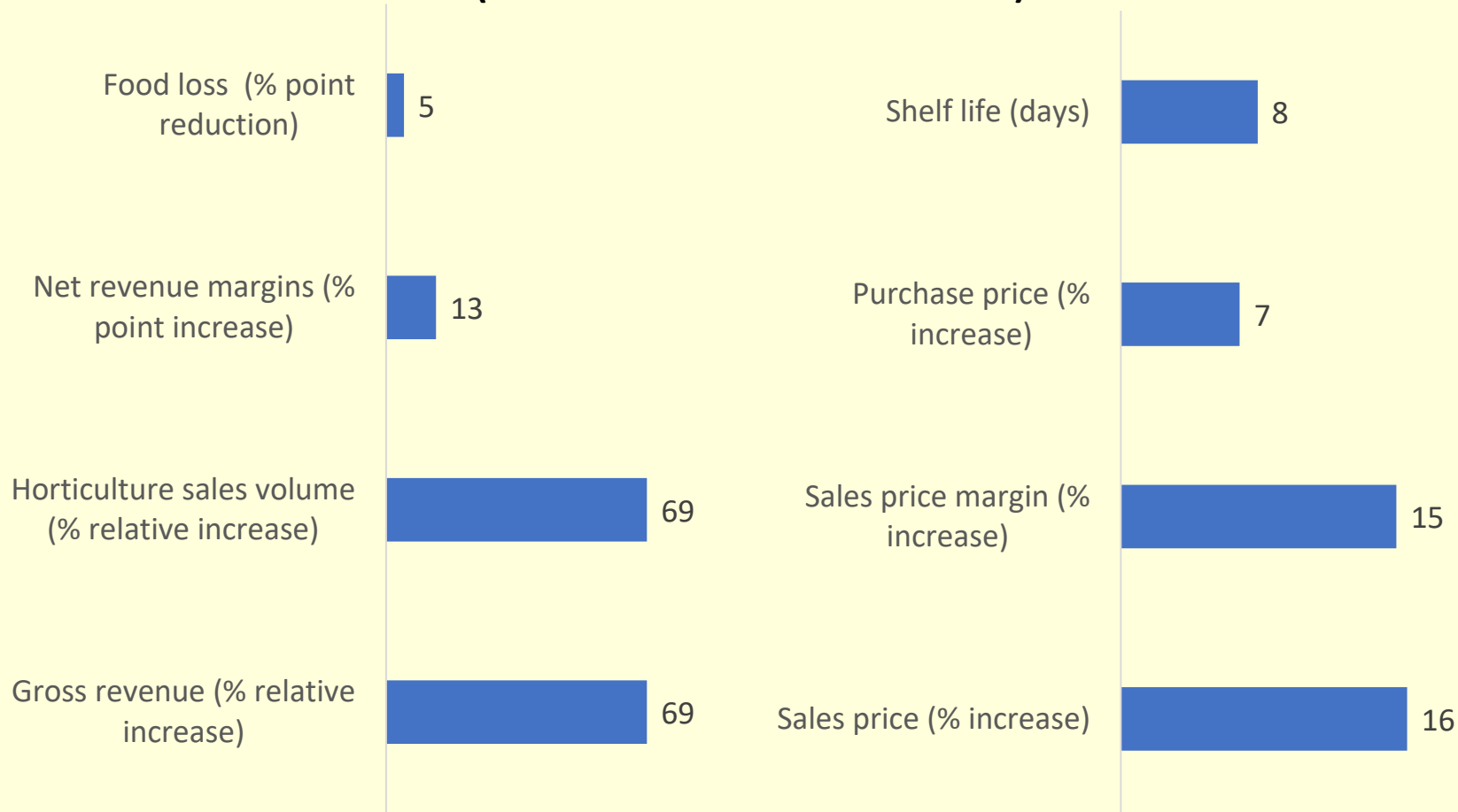
Manufacturer	Model	Maximum power output per panel (Watt)	Price per power output (US\$ / Watt)	Efficiency (%)	Temperature Coefficient (% / °C)
Panasonic	380W Monocrystalline (PERC) Solar PV Module	380	0.58	19.6	- 0.39
Competing manufacturer A	Competing model	330	0.51	16.9	- 0.40
Competing manufacturer B	Competing model	260	0.57	15.5	- 0.41



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Significant economic benefits of cold-storage use at market-agent level, relative to non-users (December 2020 ~ March 2021)



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**Solar power can be a viable alternative to grid electricity
based on the estimated Internal Rate of Return**

	Case 1	Case 2	Case 3
Electricity source	25% loss without cold storage, 5-day cycle (turnaround 6 times a month)	20% loss without cold storage, 5-day cycle	15% loss without cold storage, 5-day cycle
Generator with diesel	11.9%	8.3%	5.8%
Grid	39.5%	12.2%	9.0%
Solar	33.2%	11.4%	8.6%

Figures are based on the transaction quantity from the Dutse market in Jigawa State and commodity prices from all 14 markets, which are updated assuming a 16% inflation rate between 2021 and 2022.

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**Key nutrients are
preserved longer in cold-
storage, compared to air
temperature**

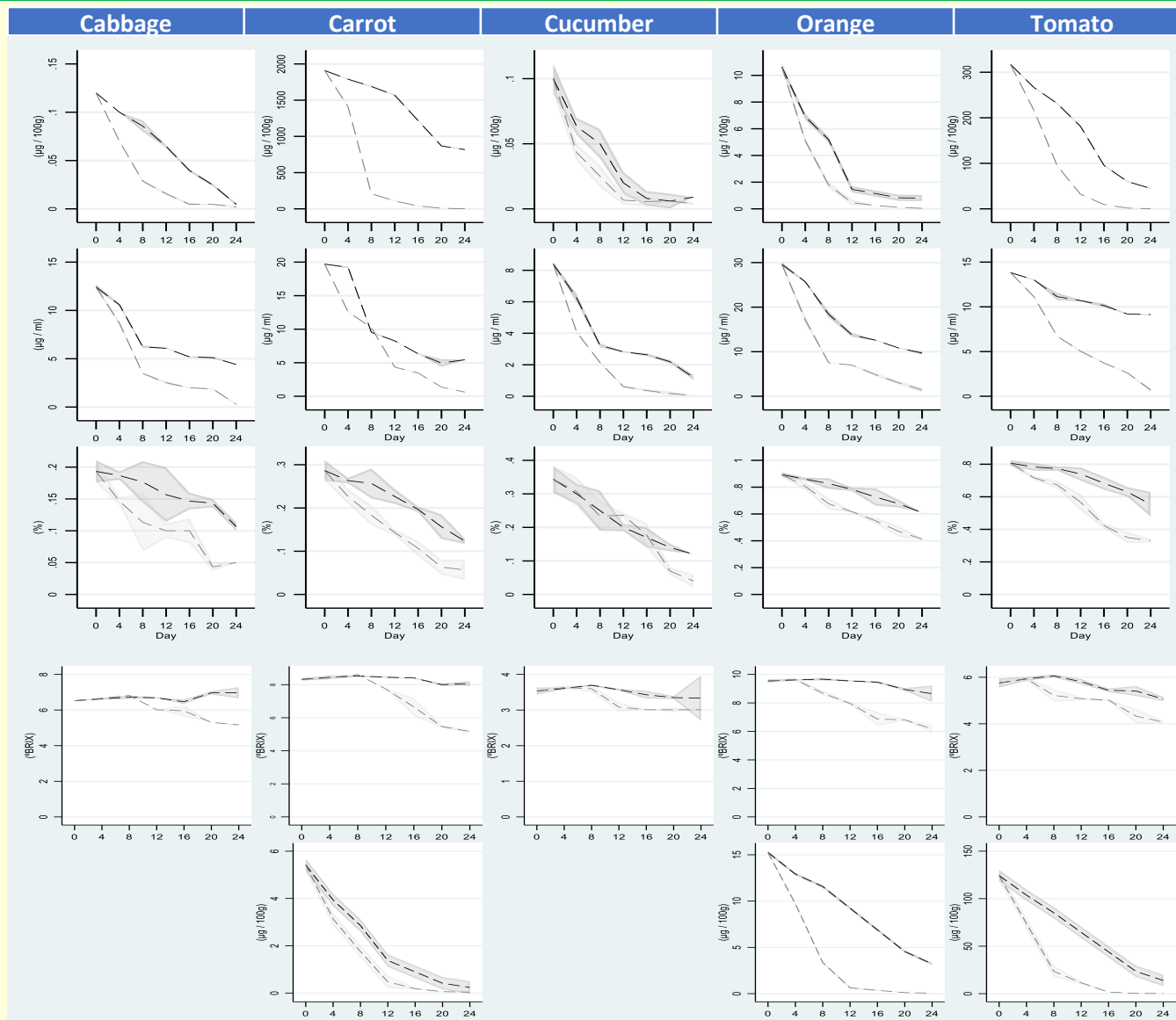
Beta carotene

Vitamin C

Titratable Acidity

Total soluble solid

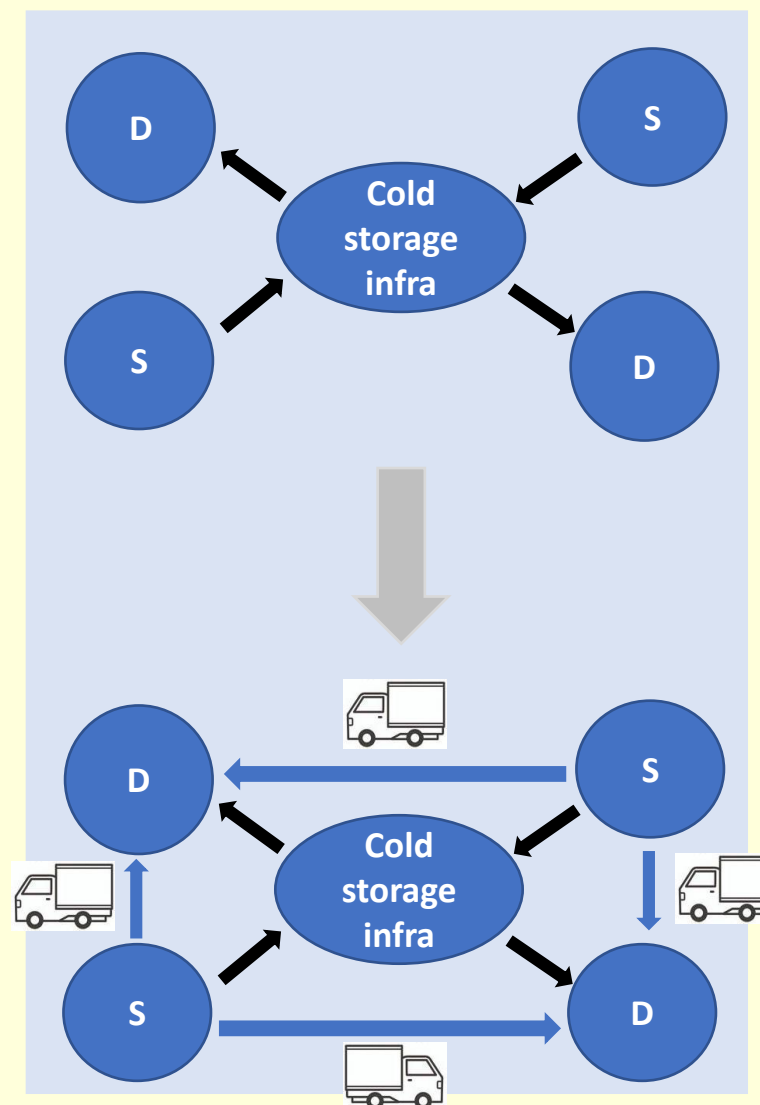
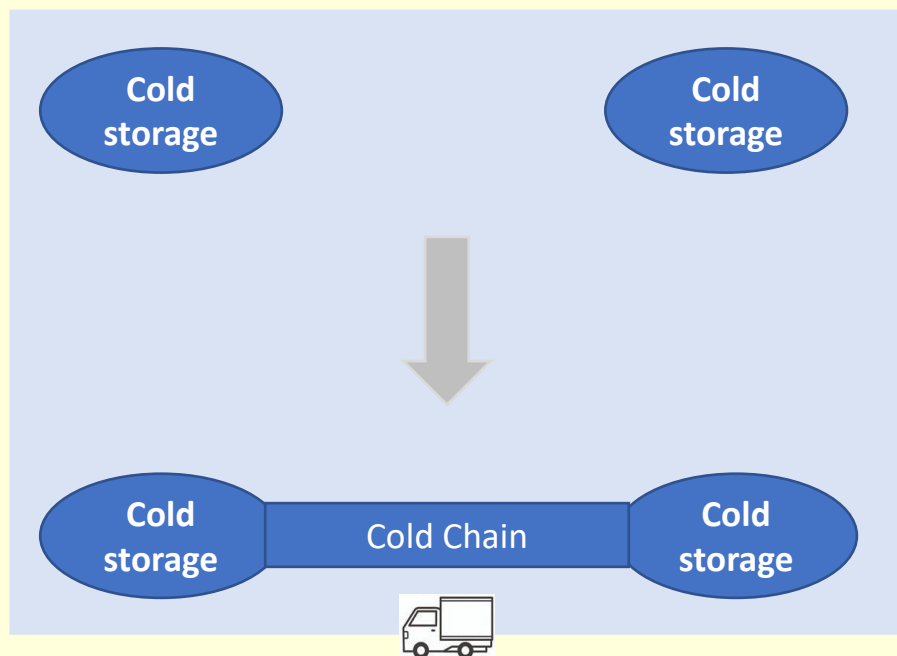
Beta-lycopene



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“Connecting the dots” through cool transportation can further expand the potentials



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Conclusions

- ☐ Significant impacts of solar-powered cold storages in Northeast Nigeria
- ☐ Reduced loss/waste & preserved nutrition
- ☐ Economic benefits to both market agents and producers
- ☐ Solar-panels offering improved business model over conventional electricity source
- ☐ Women and youth involved in storage operation, commodity sales



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References

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- Yamauchi F & H Takeshima. (2022). *Chapter 27: Solar Power to Transform Food Systems and Rural Livelihoods: Evidence from a Solar-Powered Cold Storage Intervention in Nigeria*, in *Agricultural Development in Asia and Africa: Essays in Honor of Keijiro Otsuka*, T Sonobe, JP Estudillo & Y Kijima (eds.), forthcoming.

Thank you !