

Network of Decentralized Isolated Microgrid for Village Electrification

Dr. Wuthipong Suponthana

www.leonics.com, ws@leonics.com

Thailand

LEONICS and Isolated Microgrid (iMG)

- Design & Implement small scale (150-15kW) Isolated Microgrid system for villages electrification since 2001
- Design & Implement Mega-Watt Scale (1MW-5MW) Isolated Microgrid for villages electrification since 2007
- Becomes HOMER's Partner since 2015



Isolated Microgrid System for Villages

Why the commercial MG projects is not growing fast when PV price is cheaper and Energy Storage price is low enough?

We found other costs in the project

- Cost of Logistic to Site (Man, Machine, Material)
- Cost of building Power House
- Cost of building Transmission & Distribution Network
- Cost of using high skill technician for installing, O&M



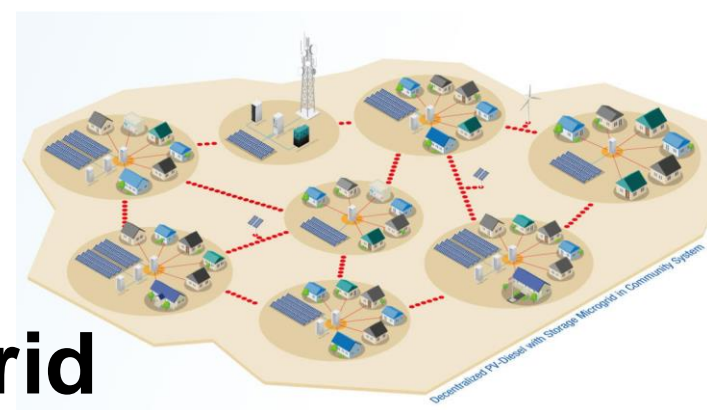
Isolated Microgrid System for Villages

Beside the project costs, the project owner also want the system to be

- ready to increase total system power
- ready to expand service area to get new customers
- high reliability which it will not totally fail when a part of equipment in the system is damaged
- simple and use low skill technical people to do system operating and maintenance (O&M)



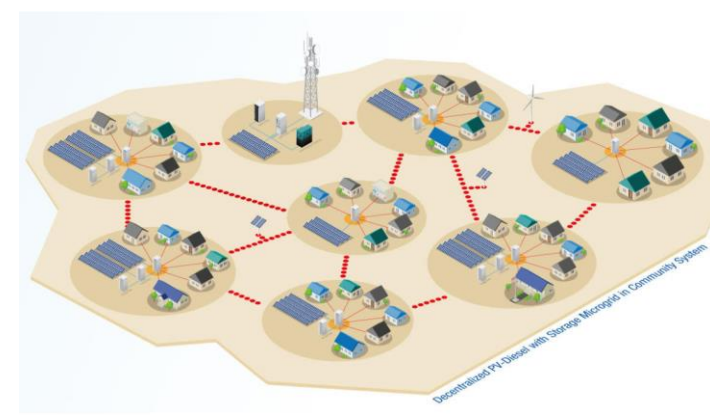
The proposed solution



The Network of Decentralize Isolate Microgrid

- Can begin to implement with a small system (Node and cluster) and can grow the network by adding more Nodes or adding Clusters
 - Easy to increase system power
 - Easy to expand service area
- Capable to operate in redundant PCU in the network
- Reduce Logistic cost to site and time for installation
- Reduce cost of building large Power house
- Reduce cost of Transmission & Distribution line

The proposed solution

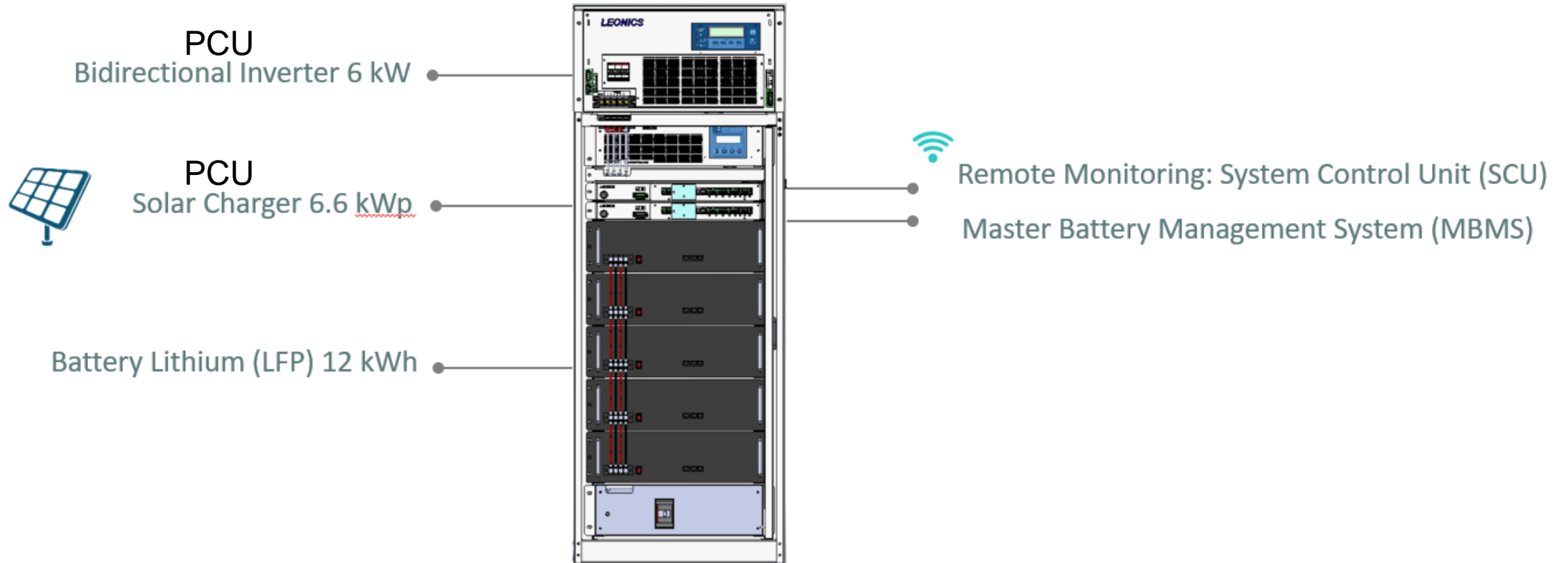


Beginning with a small system with one Node to form a cluster.

After the demand grows we can add more Nodes to the cluster or add more cluster to the system.

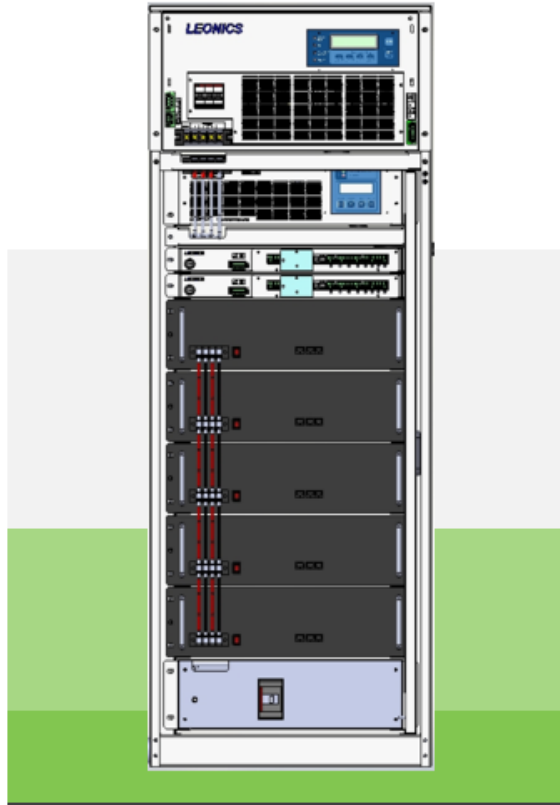
The proposed solution

POWER NODE

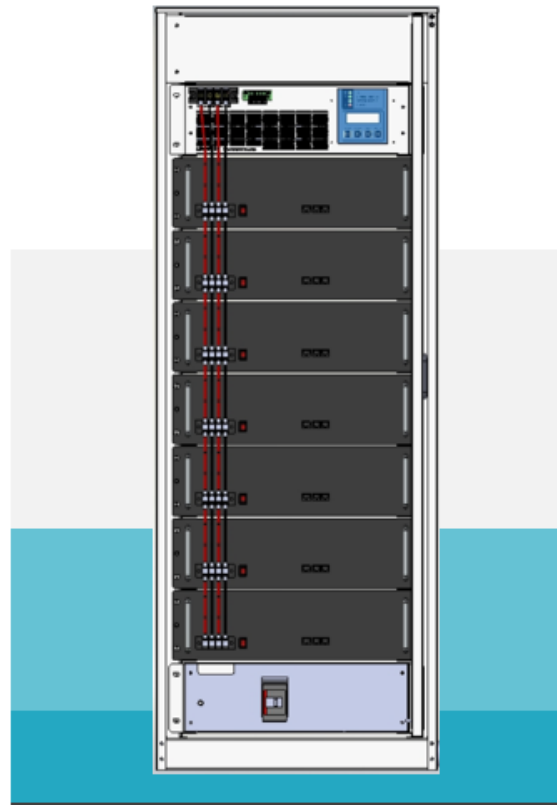


The proposed solution

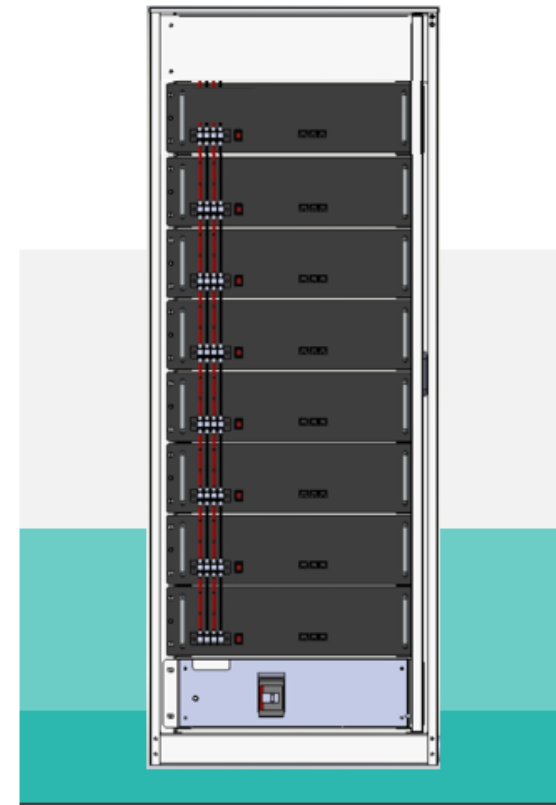
Power Node



Energy Node

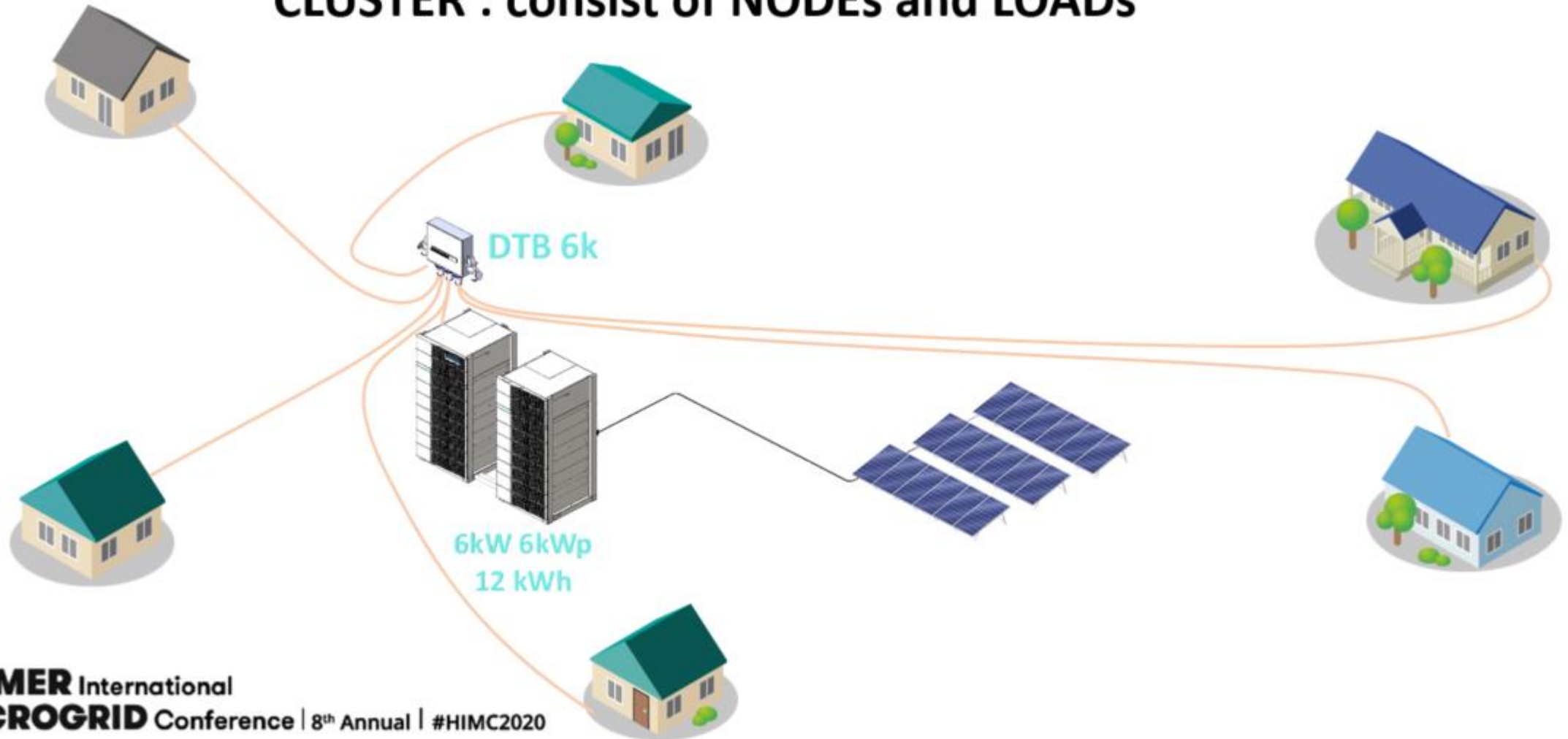


Storage Node

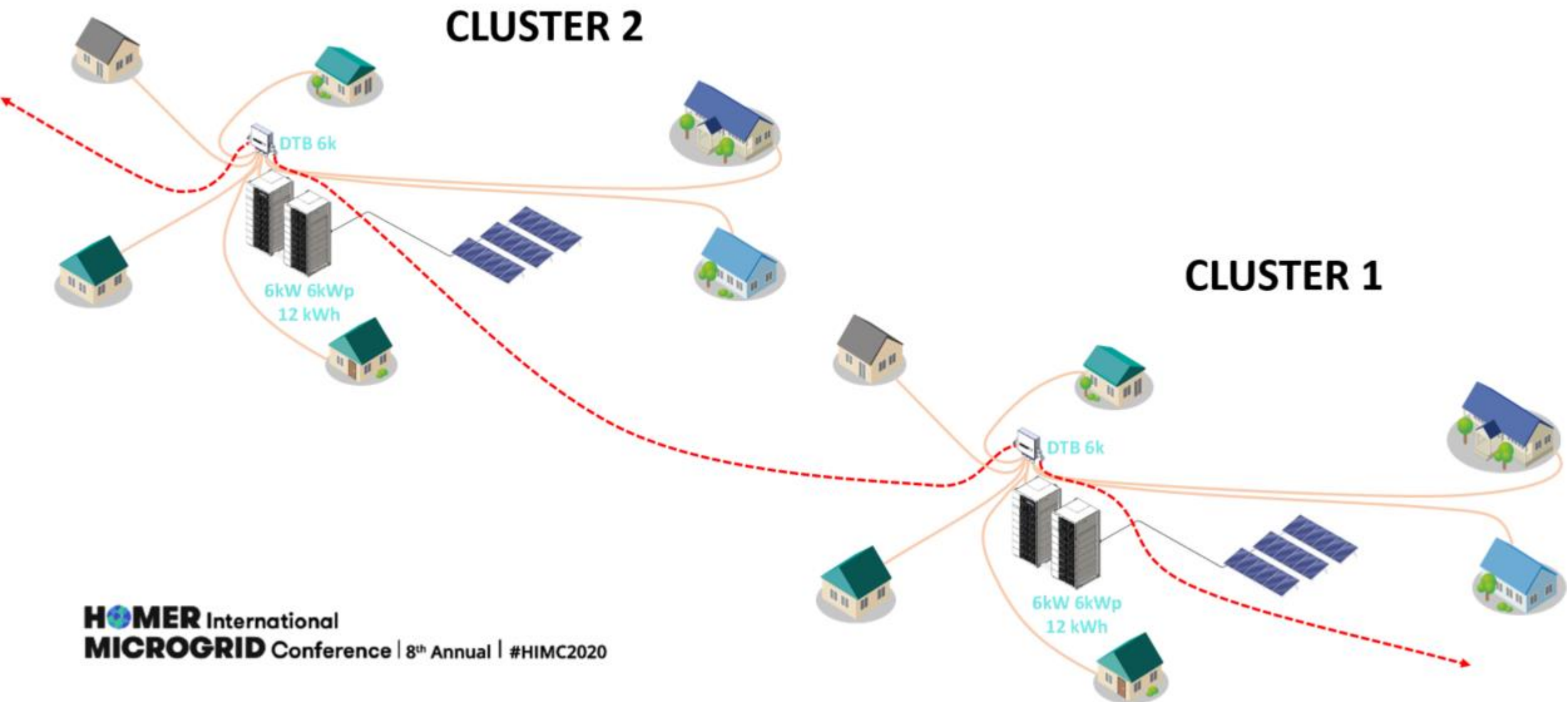


The proposed solution

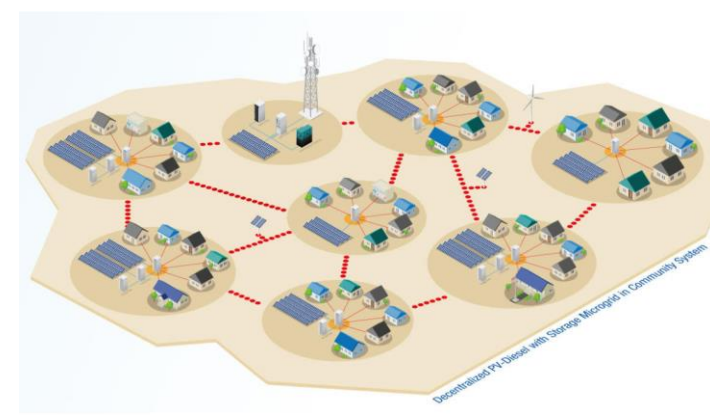
CLUSTER : consist of NODEs and LOADs



The proposed solution



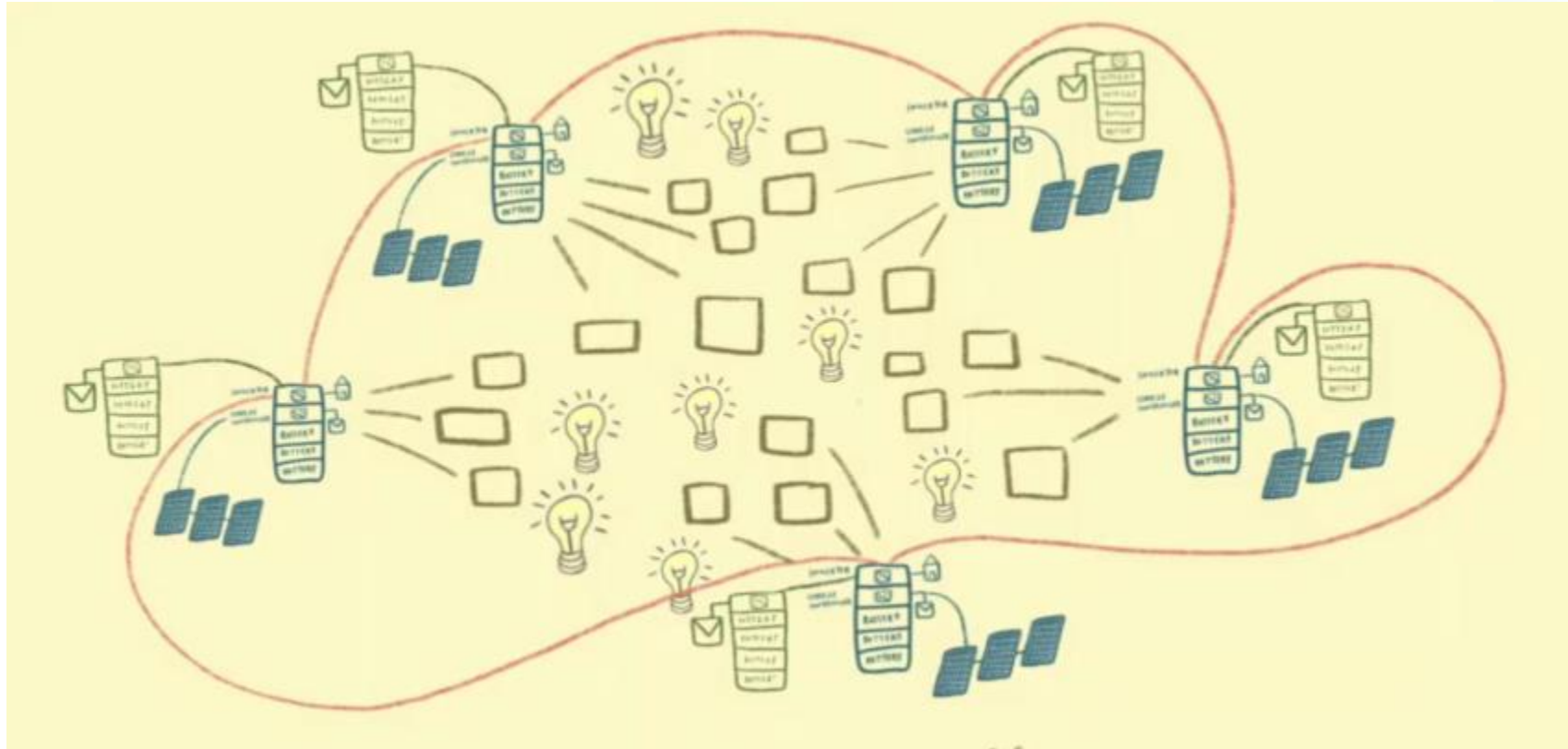
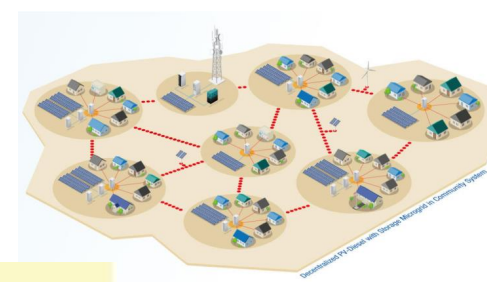
The proposed solution



The system capable to operate in redundant PCUs.

When an inverter in a Node is fail the other inverters in other Nodes or Clusters can help supply power.

The proposed solution



NODEX : Explanation of Village electrification application video → <https://www.youtube.com/watch?v=Zzh8Z4n0MFc>

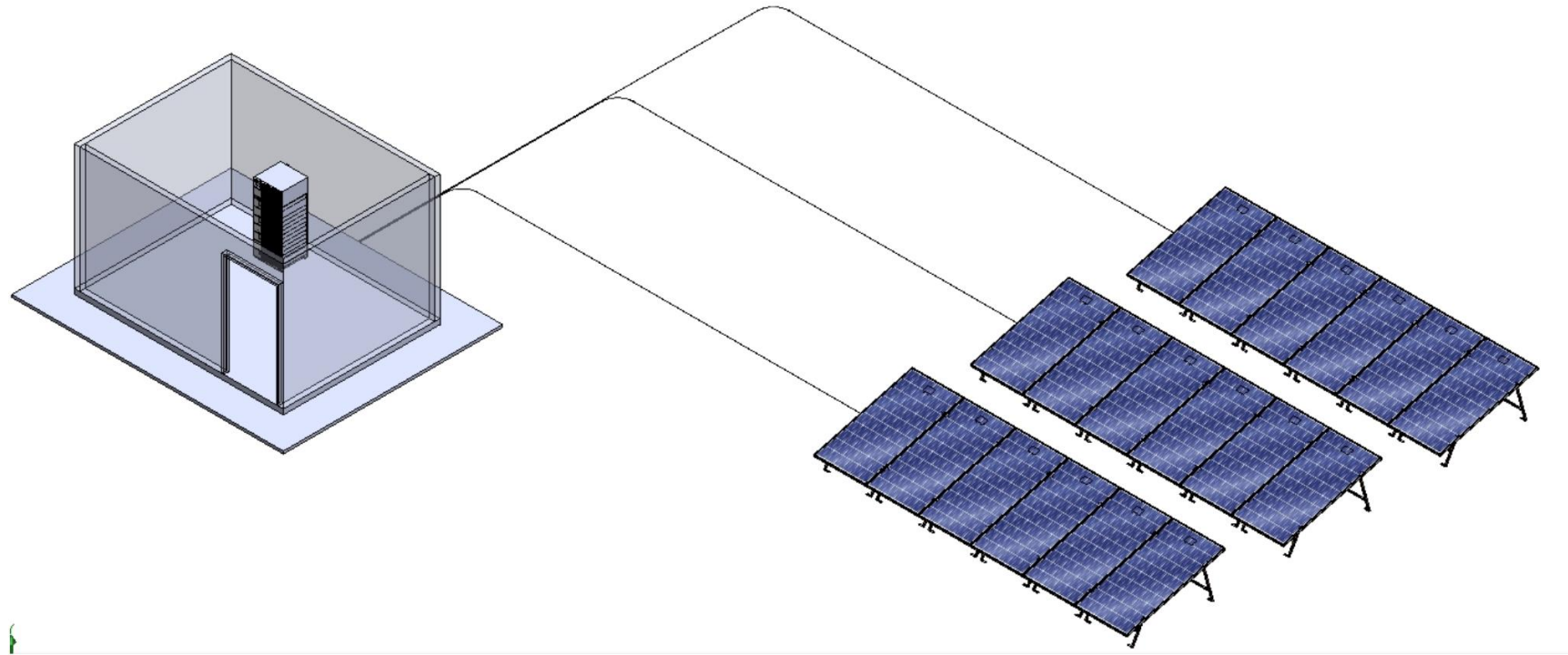
When inverter in a Node fail other inverters can help

The proposed solution



- **Reduce Logistic cost**
- **Reduce installation time by using equipment that easy to transport and to install.**

The proposed solution



All parts are small enough for 2 men can carry them

The proposed solution

- **Reduce cost of building power house by installing Nodes in existing building or villager's houses.**

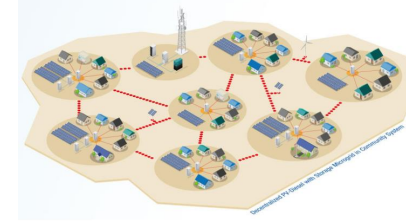
The proposed solution



Centralize iMG (need to build large infrastructure)



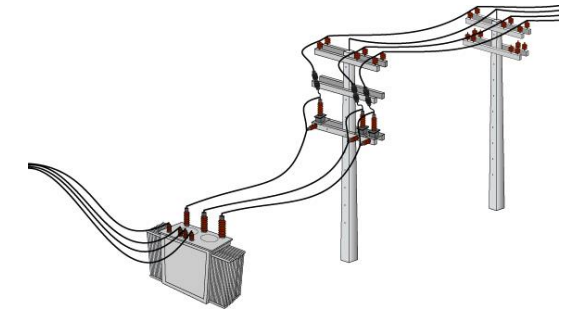
The proposed solution



Network of Decentralize iMG (small clusters of infrastructure)



The proposed solution



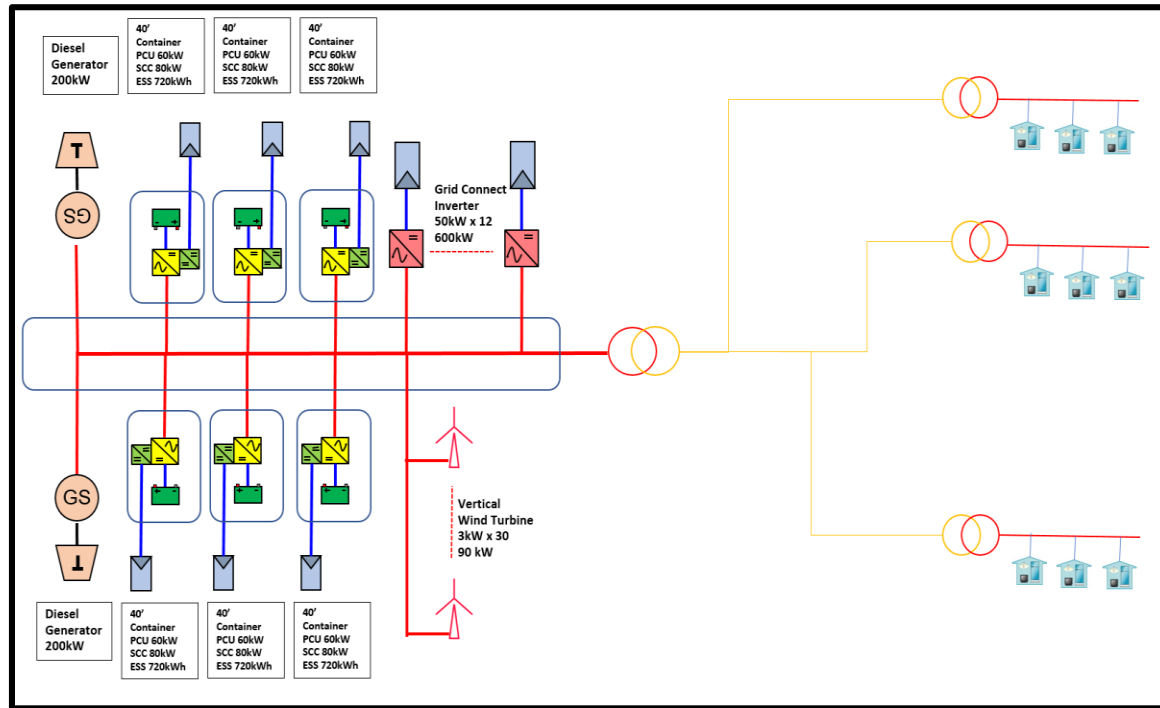
- **Reduce cost of transmission & distribution line by**
 - **Using low voltage transmission & distribution network**
 - **Using smaller cable but still can maintain minimum voltage drop and reduce cable losses**



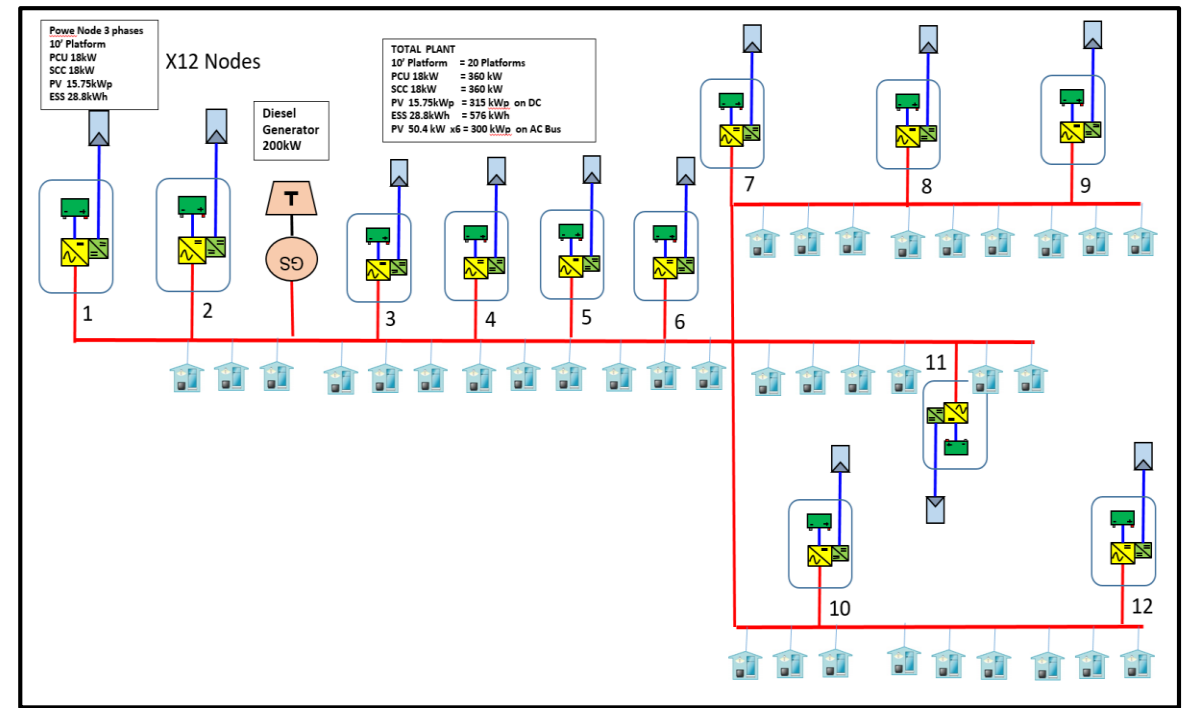
The proposed solution



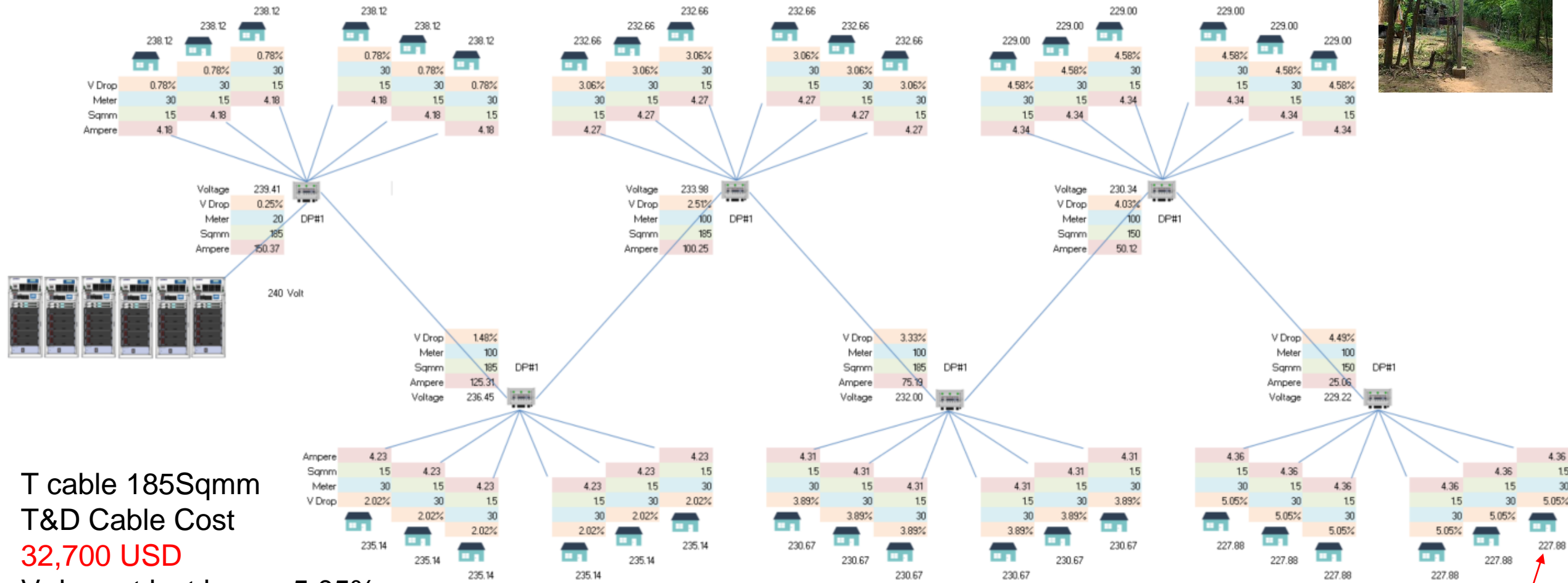
Medium Voltage distribution network



Low Voltage distribution network



The proposed solution



T cable 185Sqmm

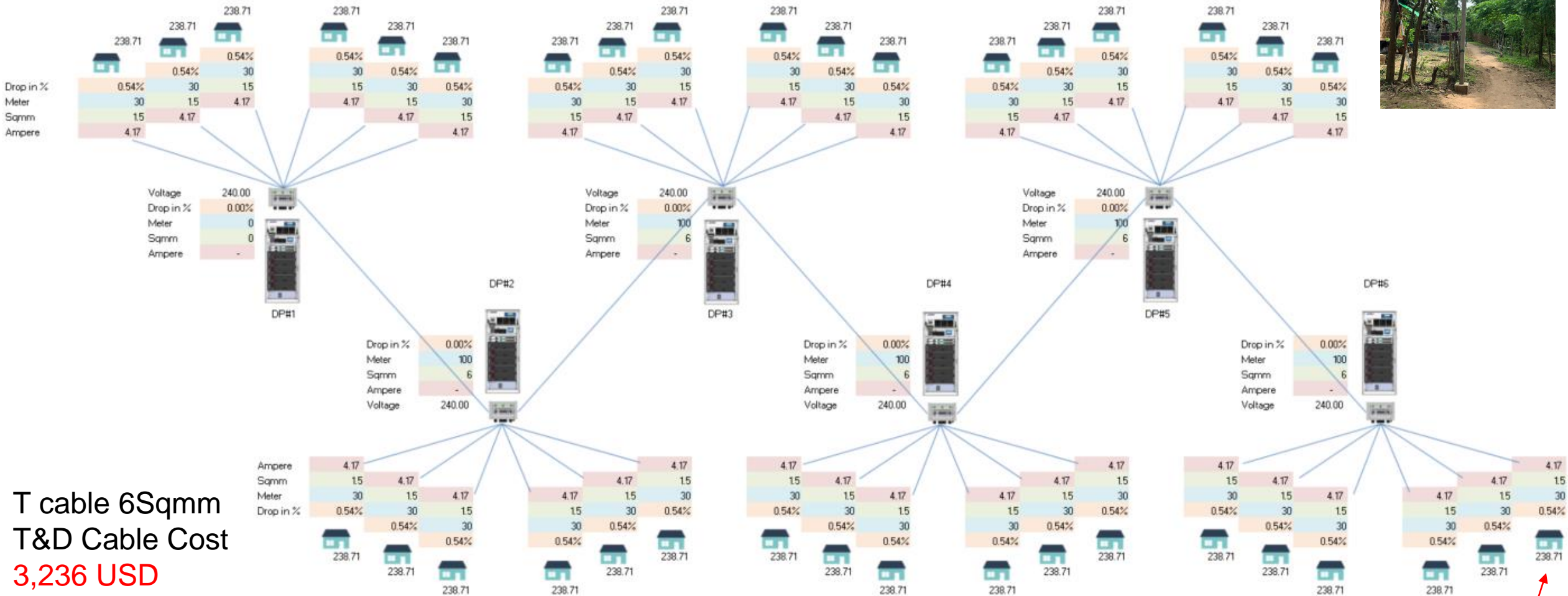
T&D Cable Cost

32,700 USD

V drop at last house 5.05%

V drop 5.05%

The proposed solution



T cable 6Sqmm
T&D Cable Cost
3,236 USD

V drop at last house 0.54%

V drop 0.54%

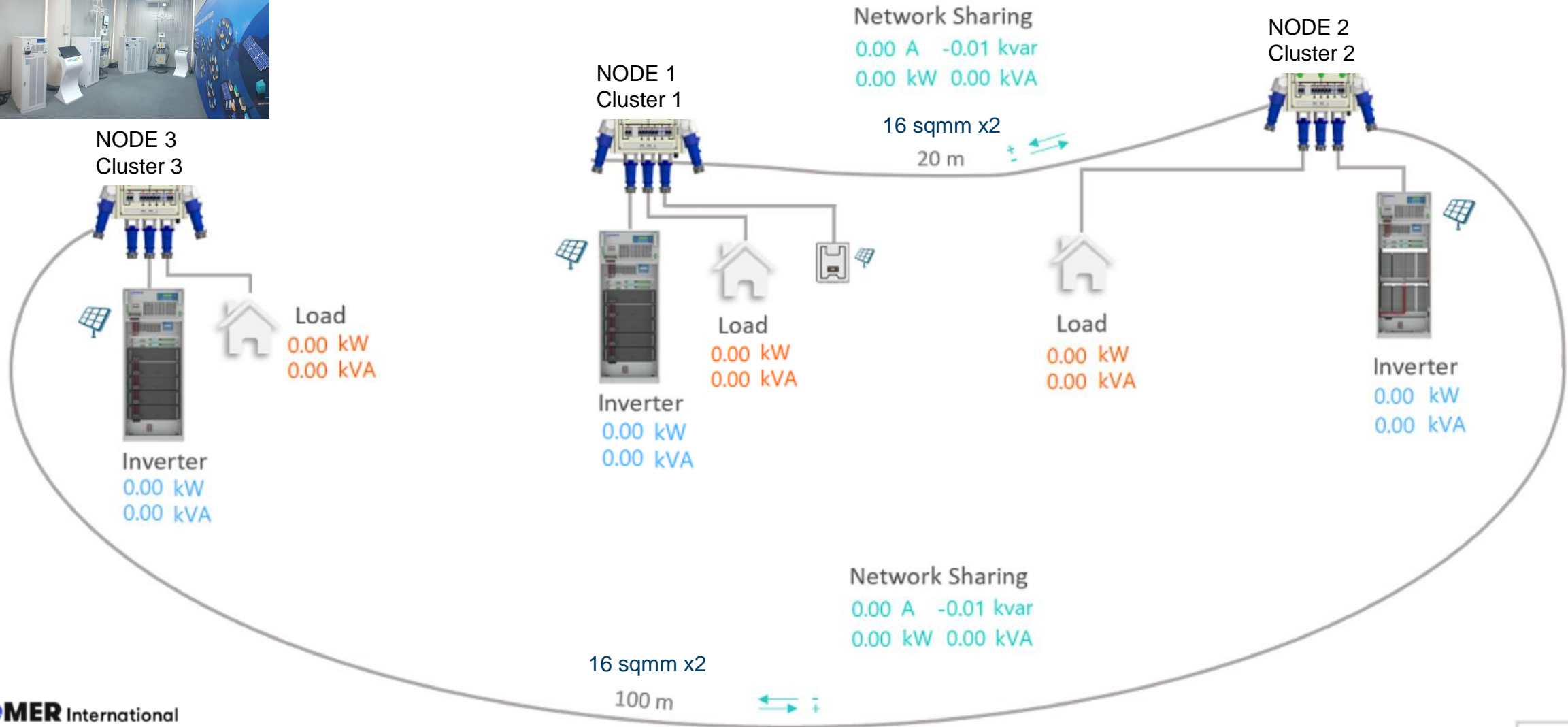
Is the concept of Network of Decentralize iMG can be done?



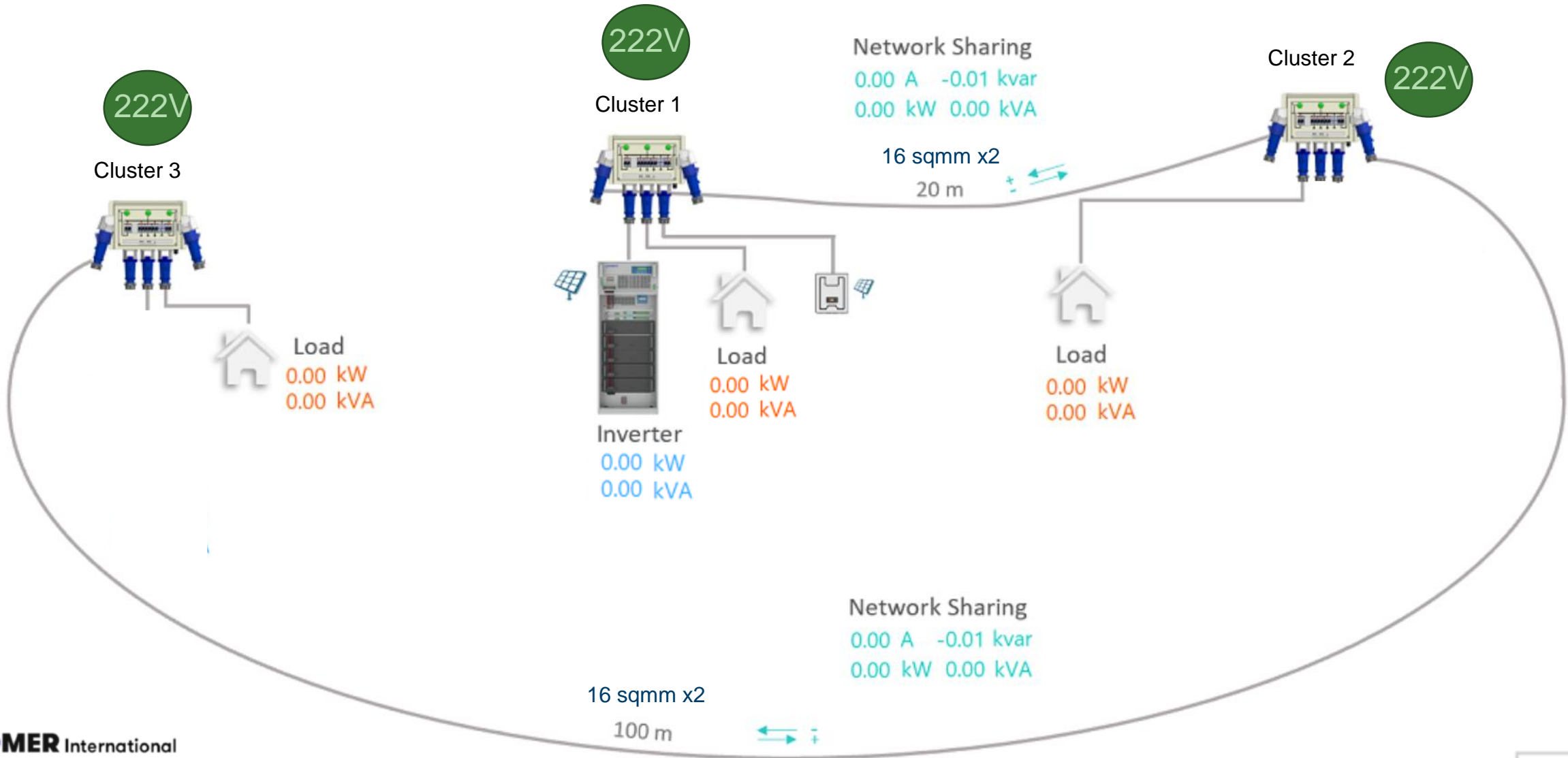
Is the concept of Network of Decentralize iMG can be done?

Easy to Expand System Power and Service Area

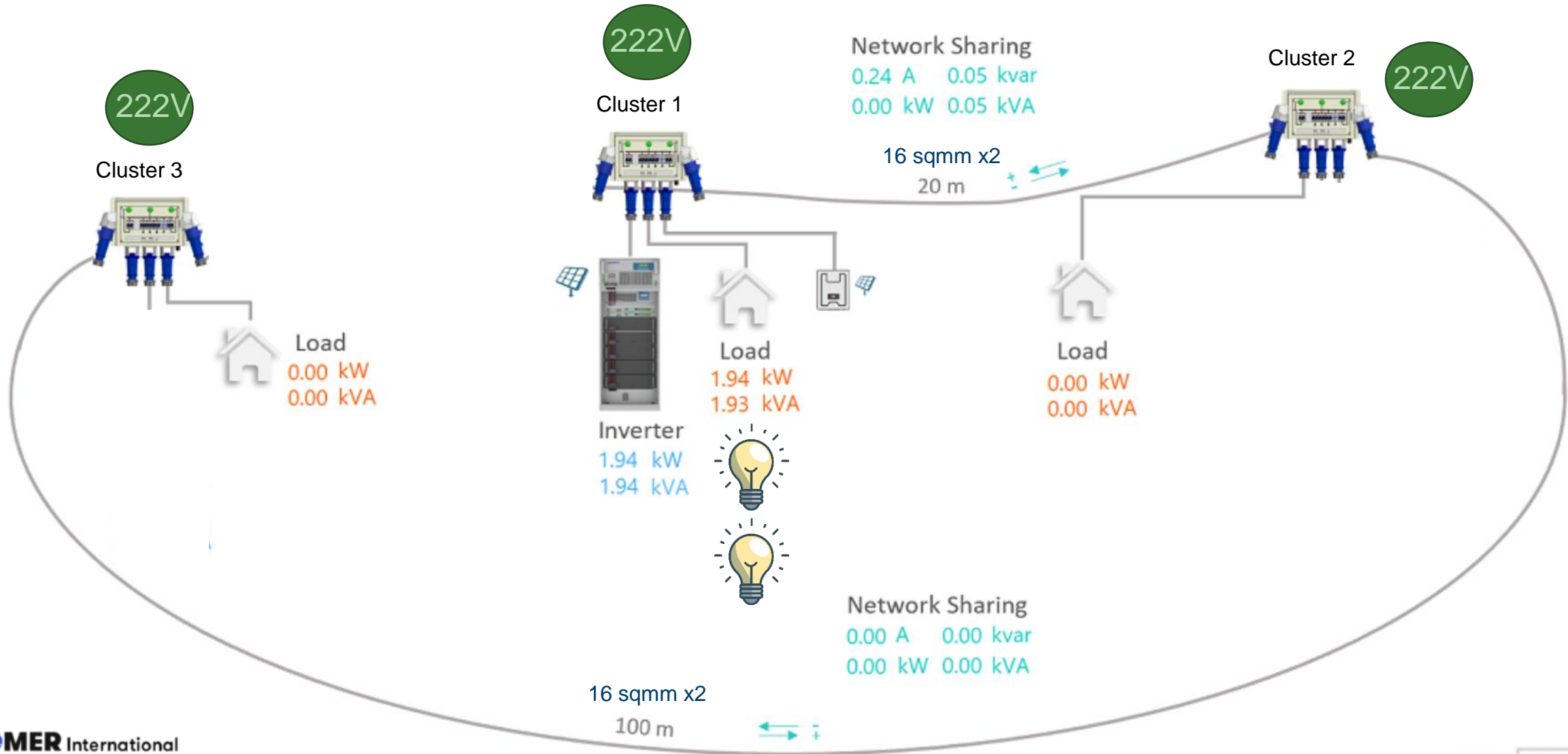
Easy Expand System Power and Service Area



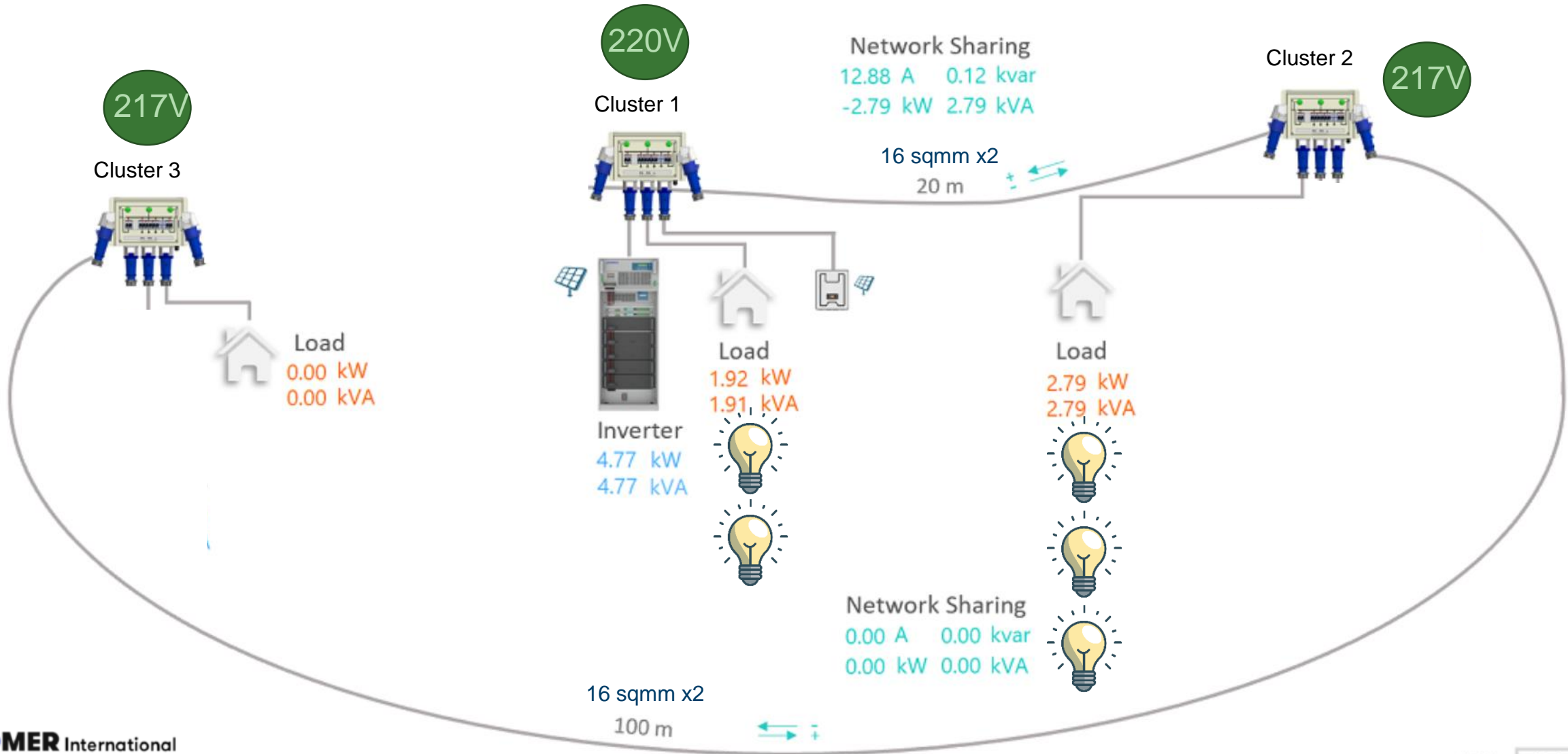
Easy Expand System Power and Service Area



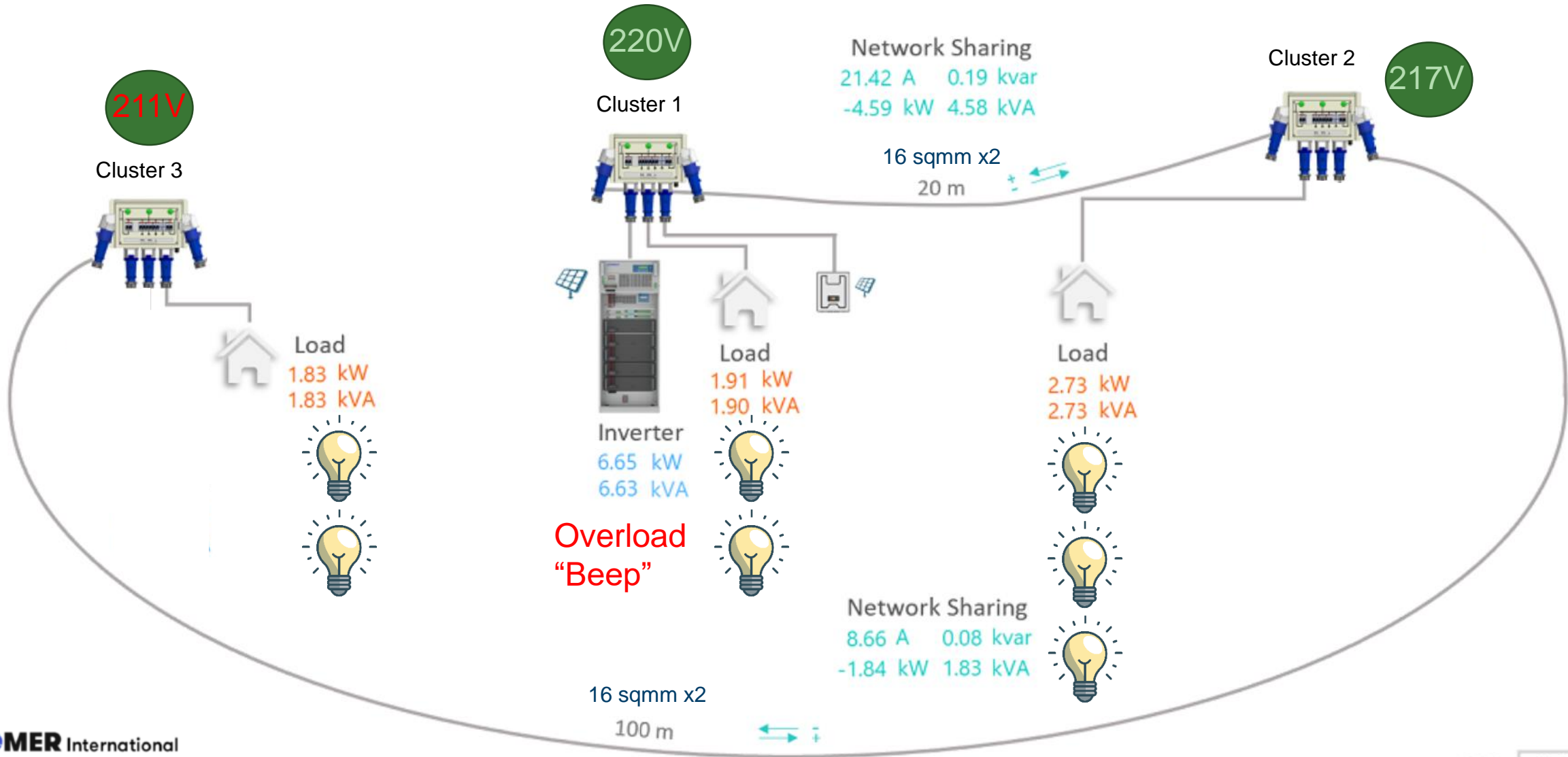
Easy Expand System Power and Service Area



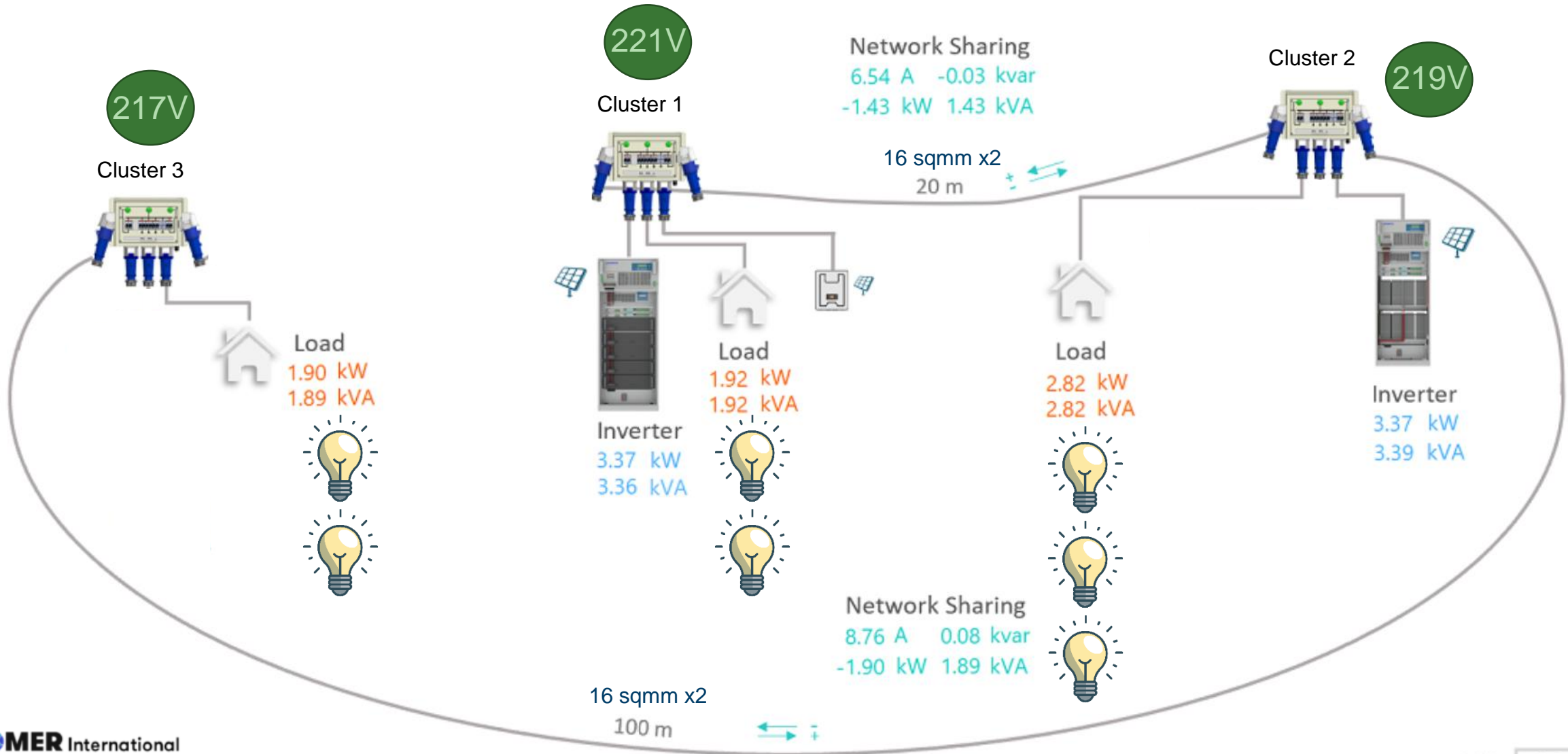
Easy Expand System Power and Service Area



Easy Expand System Power and Service Area



Easy Expand System Power and Service Area



Easy Expanding System Power and Service Area

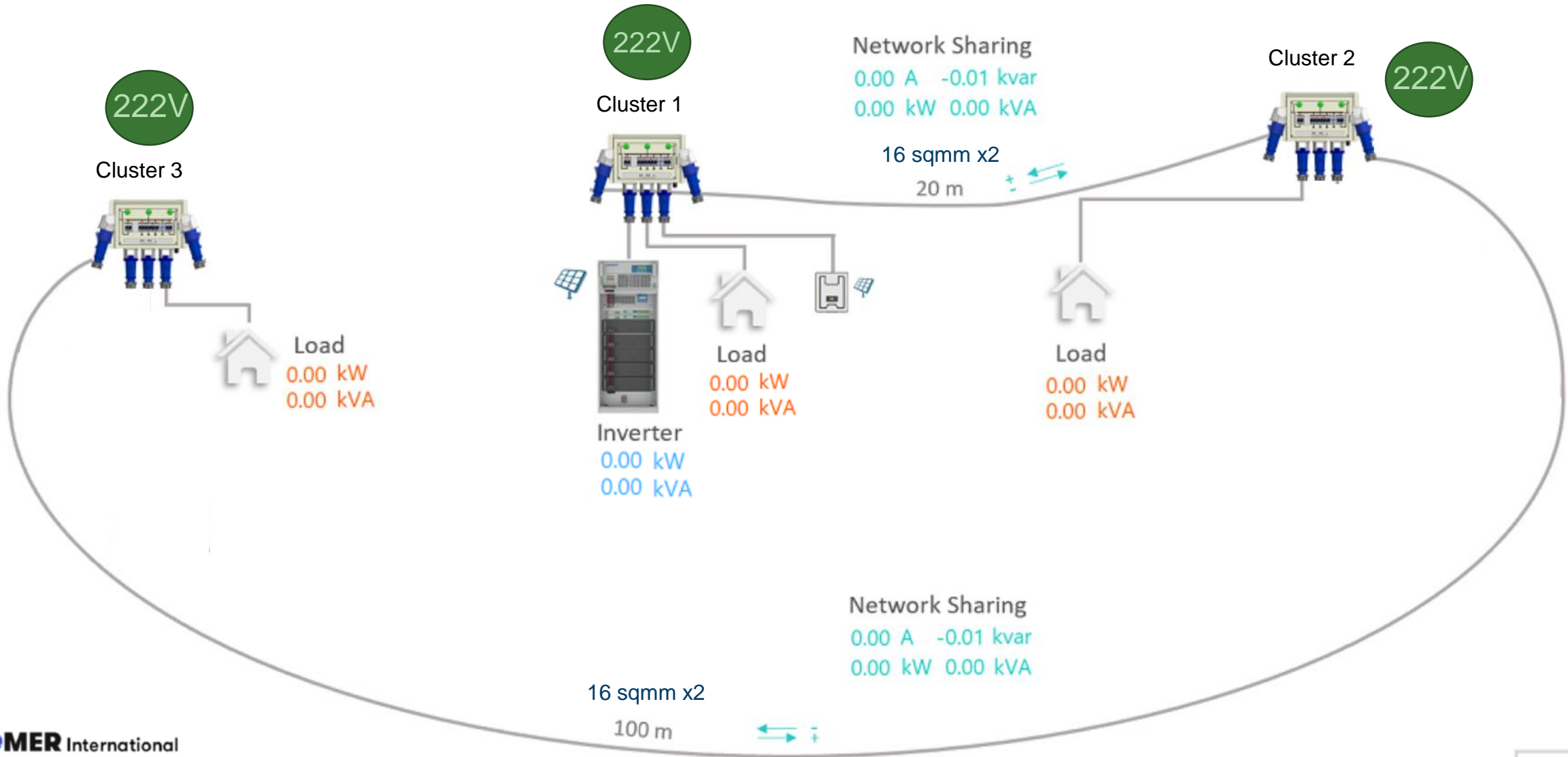


NODEX : Demonstration for Expanding System Power & Service area video → <https://www.youtube.com/watch?v=nFAhJwW9VNY>

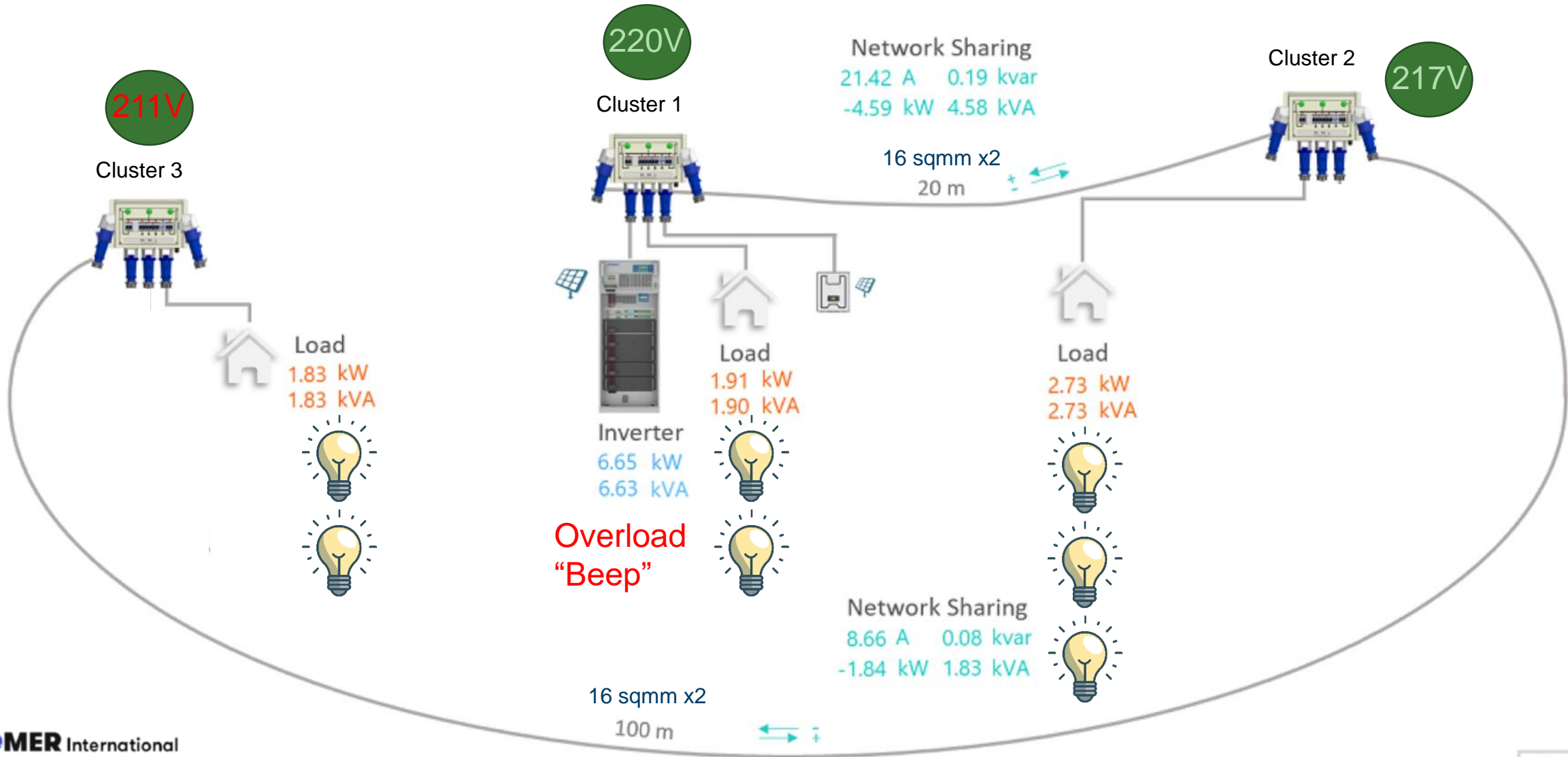
Is the concept of Network of Decentralize iMG can be done?

Reduce Voltage drop & Cable loss

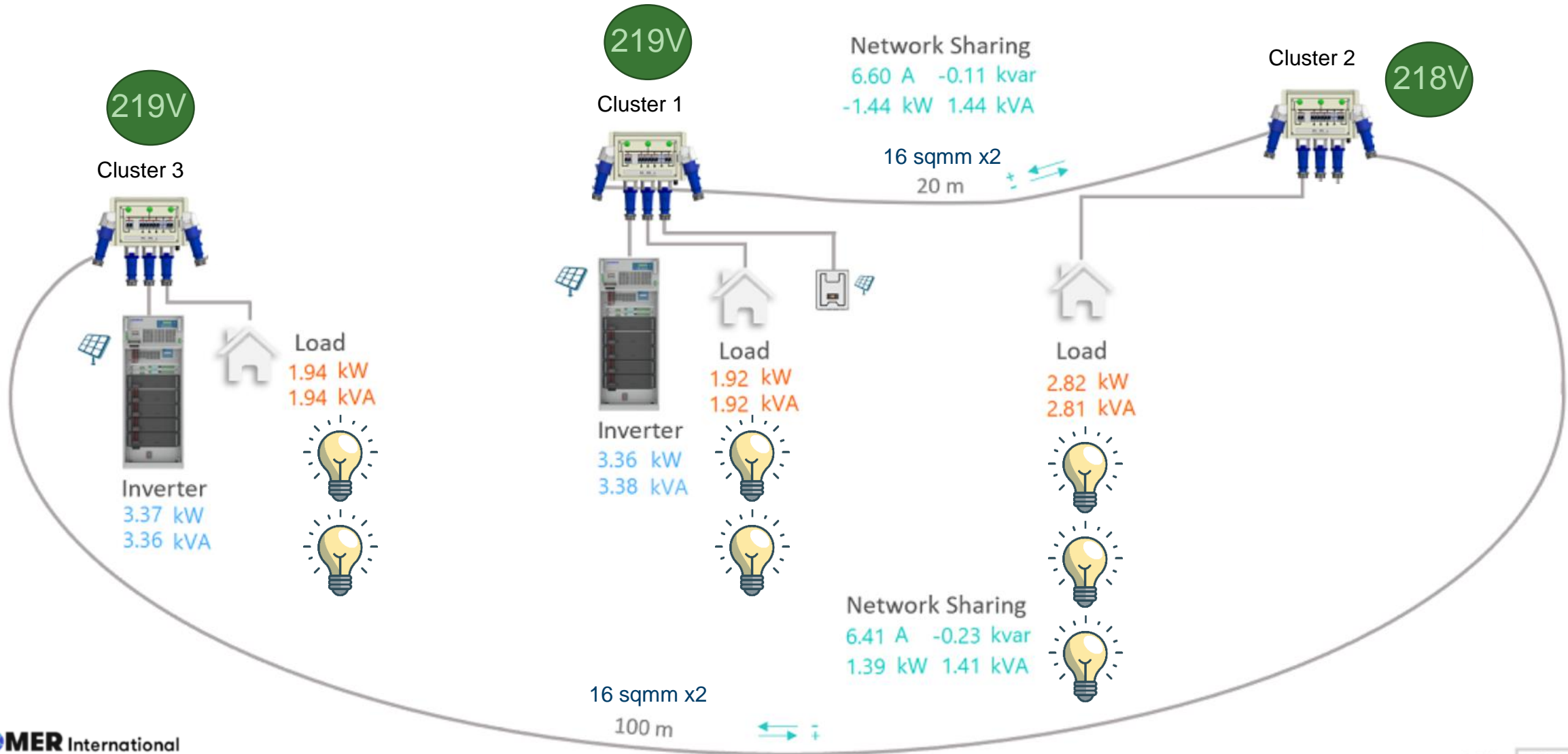
Reduce voltage drop & Cable loss



Reduce voltage drop & Cable loss



Reduce voltage drop & Cable loss



Reduce Voltage drop & Cable loss



NODEX : Demonstration for Voltage drop and Cable loss video → <https://www.youtube.com/watch?v=qKwZyLkRY1o>

With this concept can we do higher PCU power?

01 NODEX Cluster Container

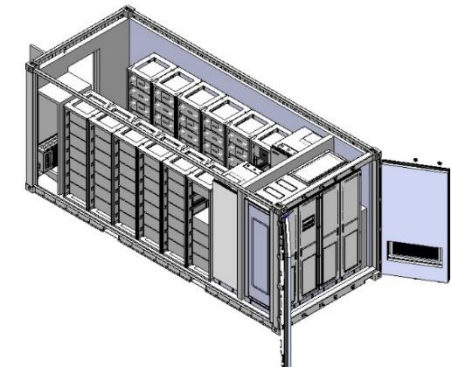
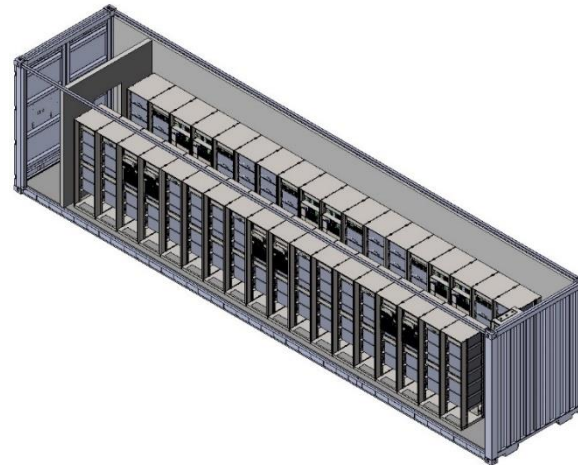
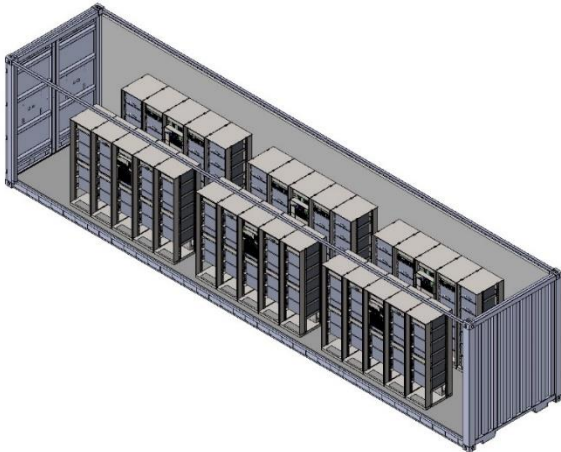
60 kW Load/Charge Capacity
80 kW Solar Capacity
720 kWh Storage Capacity
190 kWh Energy Production/Day

02 NODEX Cluster Container

120 kW Load/Charge Capacity
80 kW Solar Capacity
806 kWh Storage Capacity
190 kWh Energy Production/Day

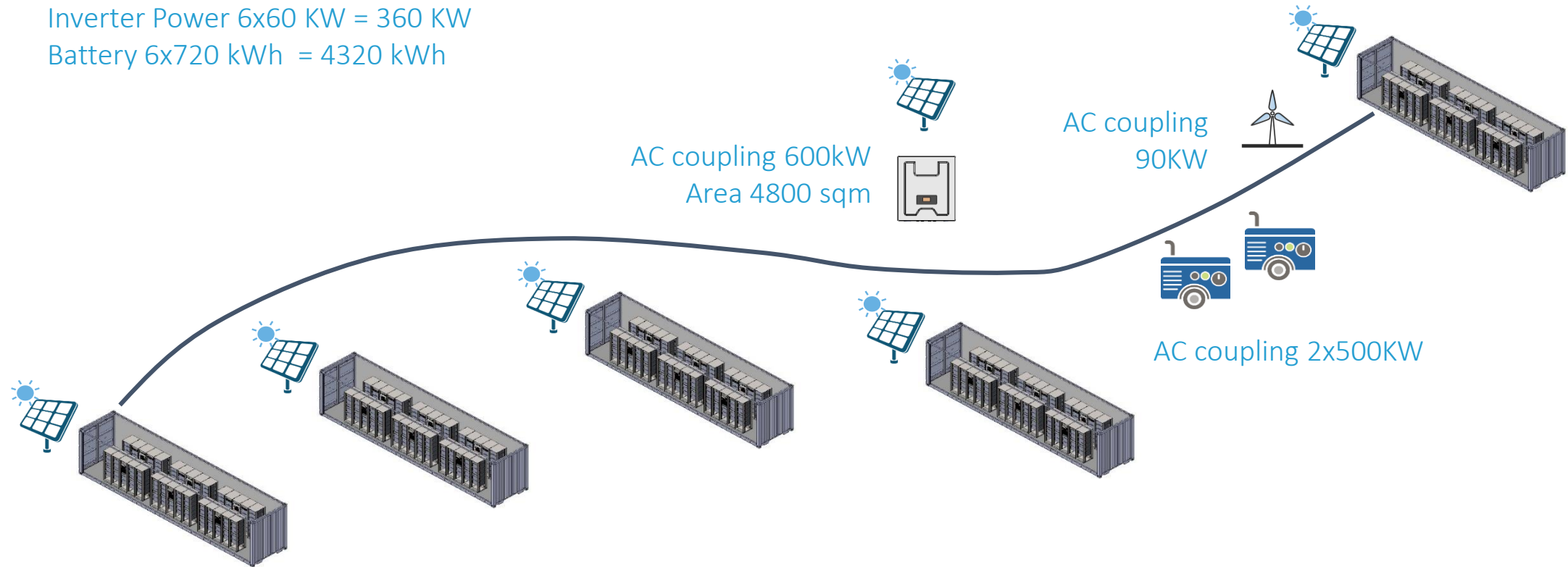
03 NODEX Cluster Container

120 kW Load/Charge Capacity
360 kW Solar Capacity
614 kWh Storage Capacity
1100 kWh Energy Production/Day



With this concept can we do higher PCU power?

PV with solar charger 80kWp x6 = 480kWp
Area 640 sqm x6 = 3,840 sqm.
Inverter Power 6x60 KW = 360 KW
Battery 6x720 kWh = 4320 kWh

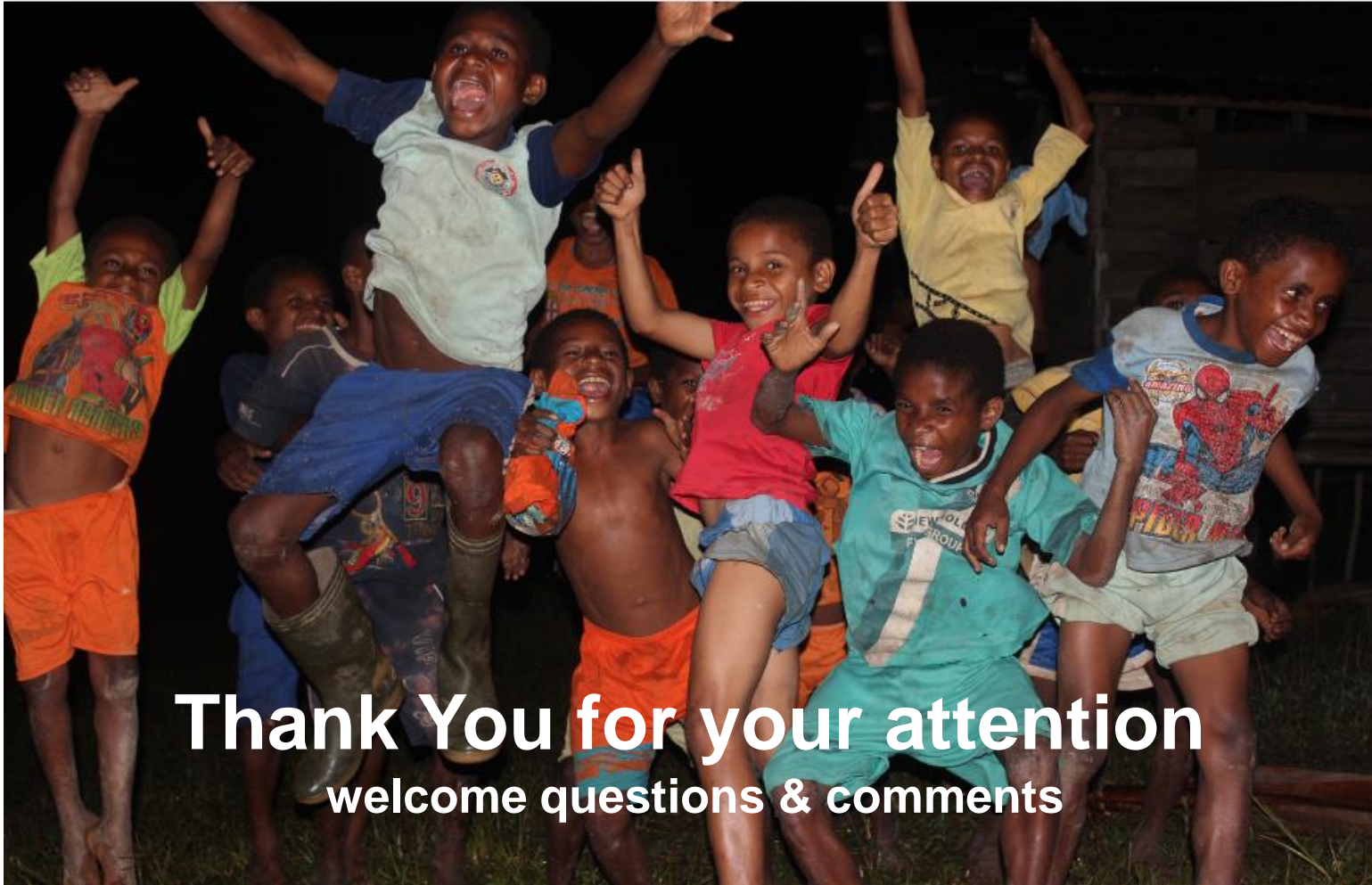


With this concept can we do higher PCU power?



LEONICS

We hope you like to concept



Thank You for your attention
welcome questions & comments