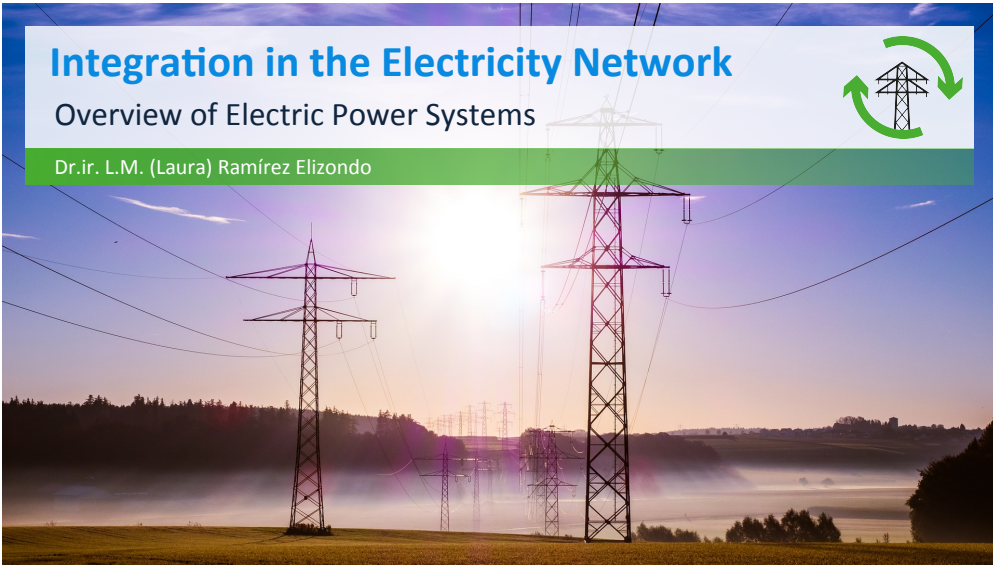


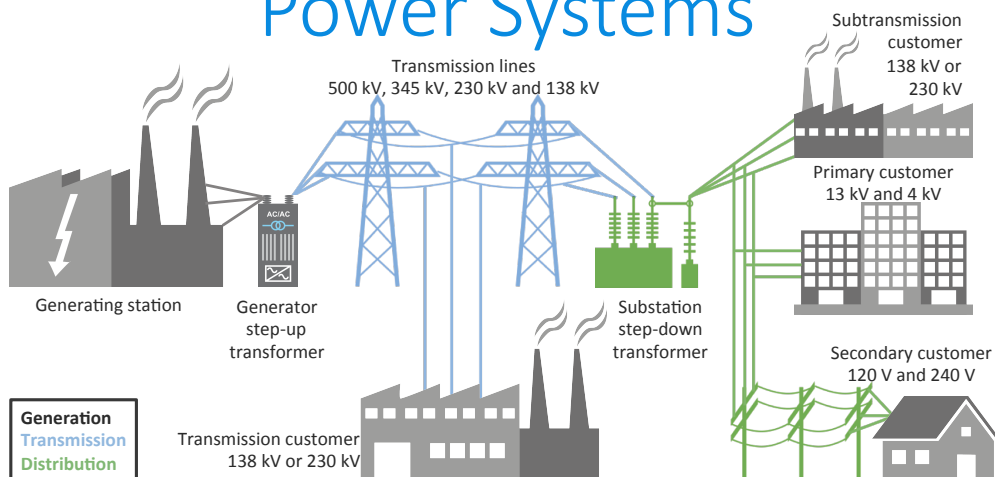
# Integration in the Electricity Network

Overview of Electric Power Systems

Dr.ir. L.M. (Laura) Ramírez Elizondo



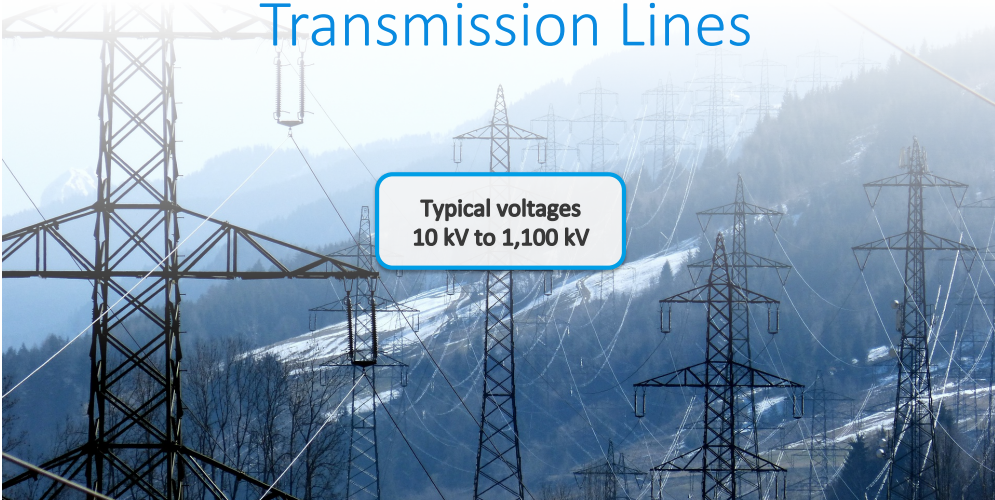
# Power Systems





## Transmission Lines

Typical voltages  
10 kV to 1,100 kV



## Distribution System

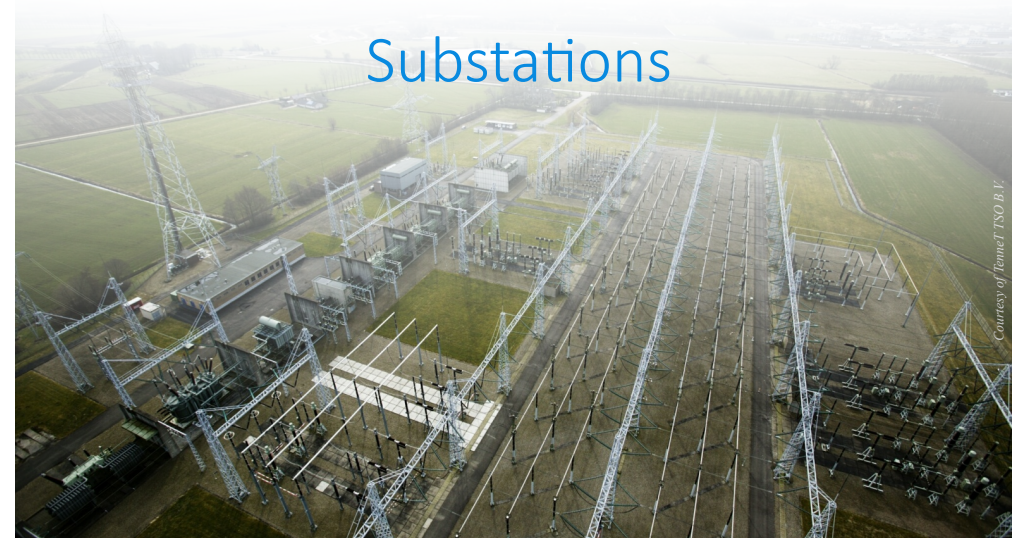
Typical voltages  
120 V up to 10 kV



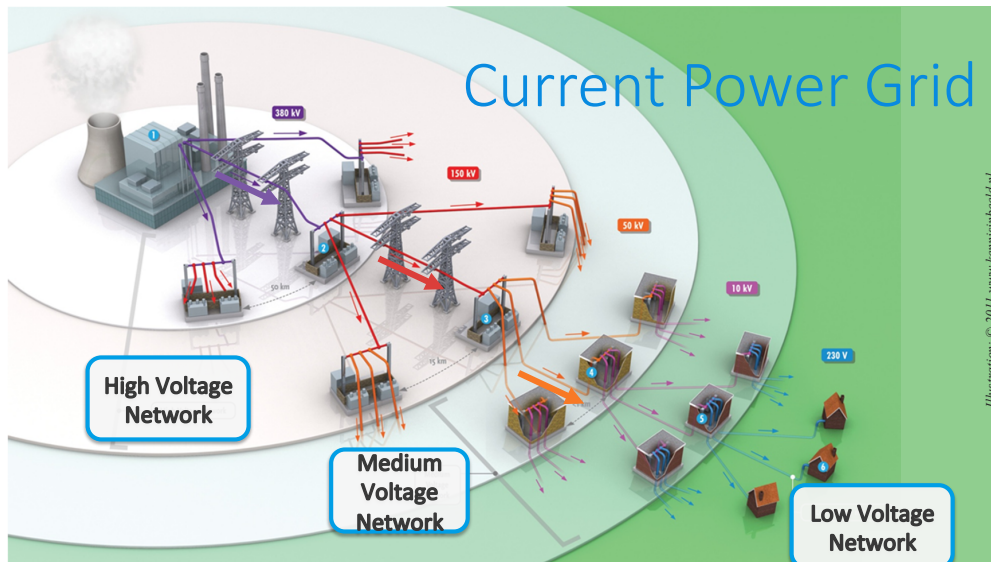
## Transformers



## Substations

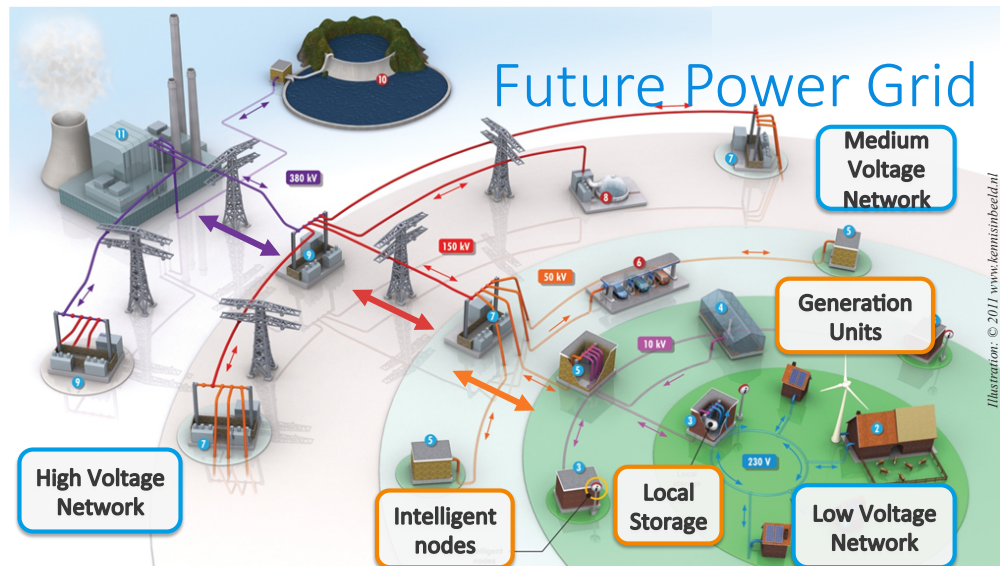


## Current Power Grid



## Traditional Power Systems

- Generation and consumption at different places
- Controllable
- Transformers
- Alternating current



## Smart Grid

A smart grid is an electricity network that can *intelligently* integrate the actions of all users connected to it – generators, consumers and those that assume both roles – in order to efficiently deliver sustainable, economic and secure electricity supplies

## Future Power Systems

- Uncontrollable
- Use of direct current
- Relatively low power generation
- Bidirectional power flow
- Storage is very important
- Smart grids concepts will be introduced

Thanks for your attention!

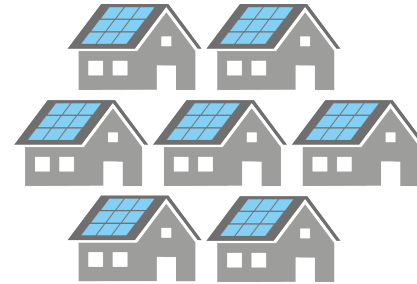
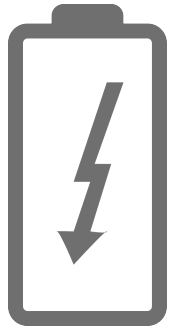


# Integration in the Electricity Network

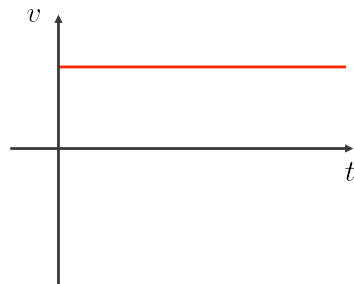
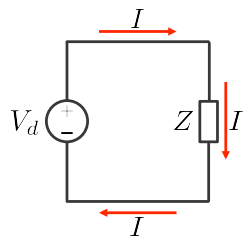
Demand Side Management and Microgrids

Dr.ir. L.M. (Laura) Ramírez Elizondo

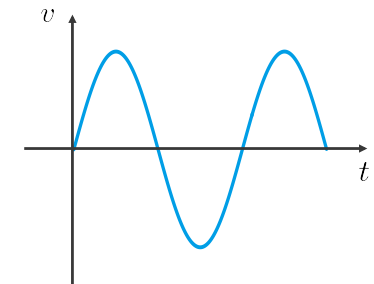
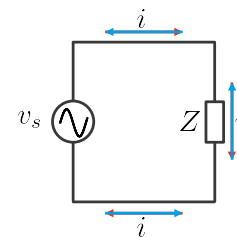




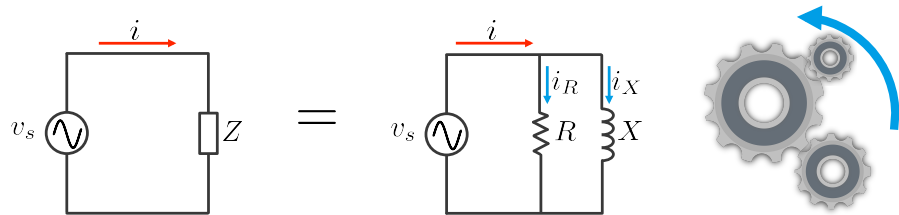
## Direct Current



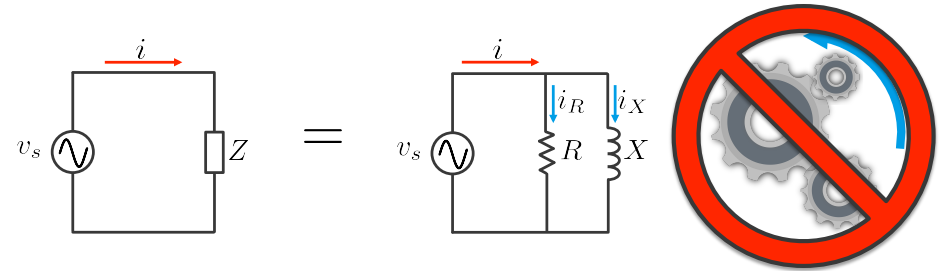
## Alternating Current



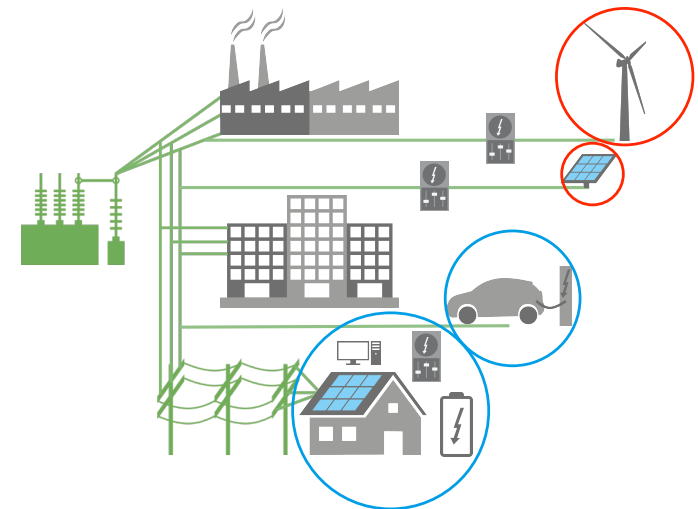
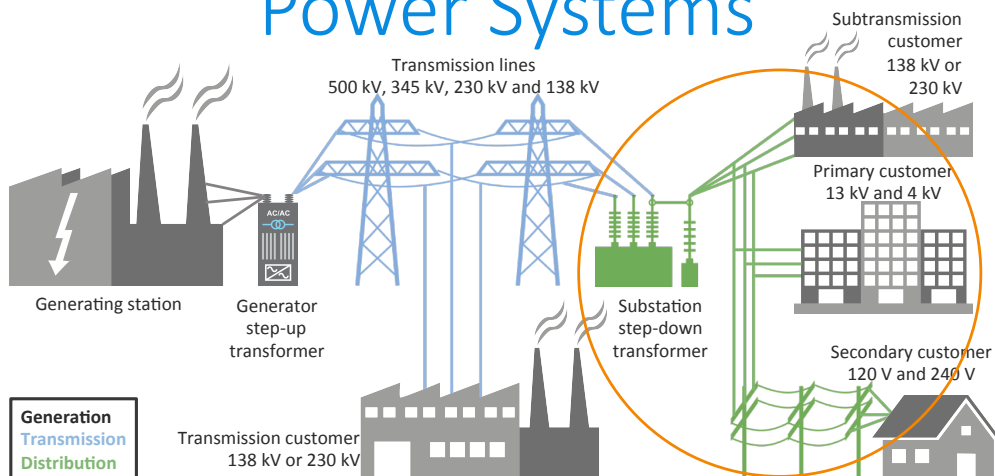
## Active Power



## Reactive Power



## Power Systems



## Demand Side Management

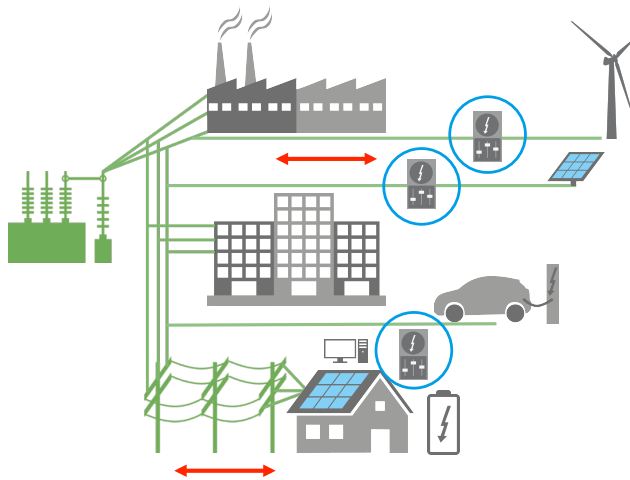
“[Demand Side Management aims ] to reduce energy consumption and improve overall electricity usage efficiency through the implementation of policies and methods that control electricity demand”

Source: Hallberg, P. et al. (2011). Views on Demand-Side Participation: Involving Customers, Improving Markets, Enhancing Network Operation, 23.

## Demand Response

“[Demand Response demand response makes use of ] incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized”

Source: Hallberg, P. et al. (2011). Views on Demand-Side Participation: Involving Customers, Improving Markets, Enhancing Network Operation, 23.



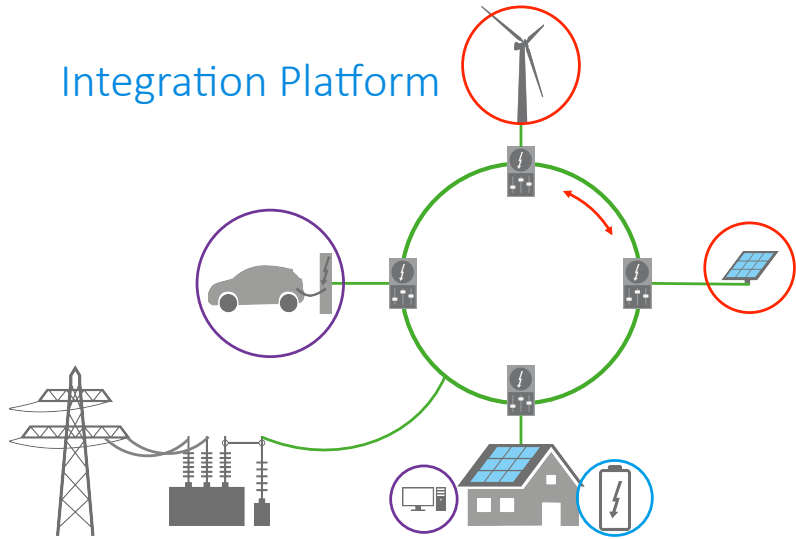
## Microgrid

“Electricity distribution systems containing loads and distributed energy resources that can be operated in a controlled, coordinated way either while connected to the main power network or while islanded”

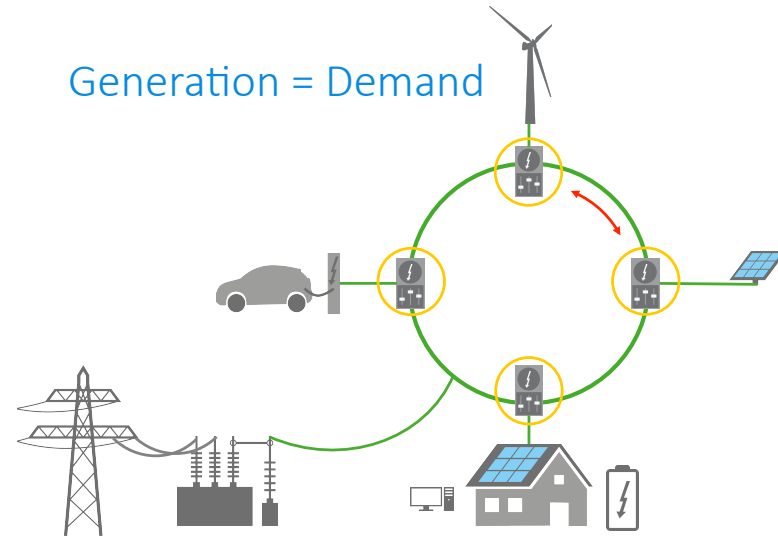
Source: CIGRÉ. Working Group C6.22, Microgrids Evolution Roadmap, Microgrids 1: Engineering, Economics, & Experience



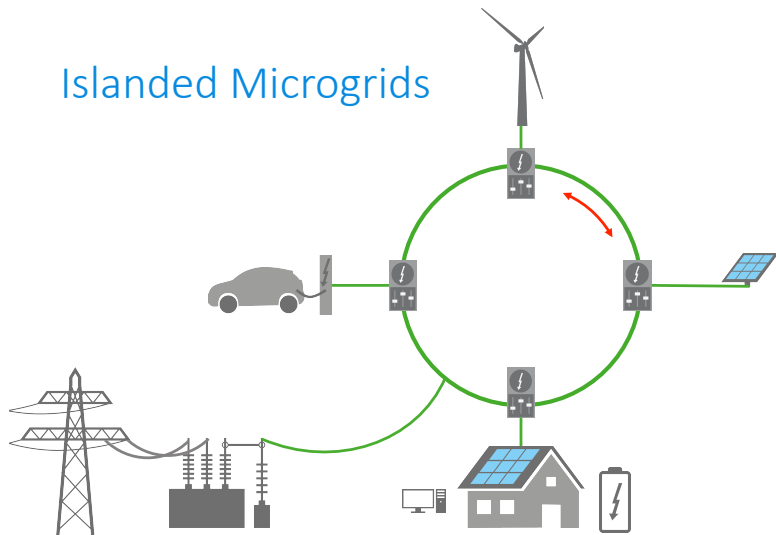
## Integration Platform



## Generation = Demand



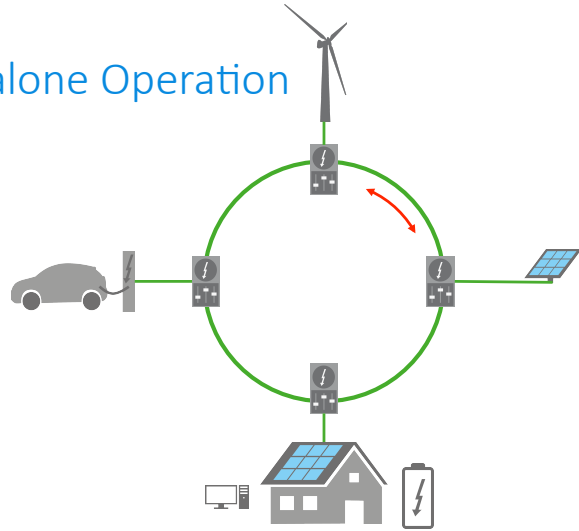
## Islanded Microgrids



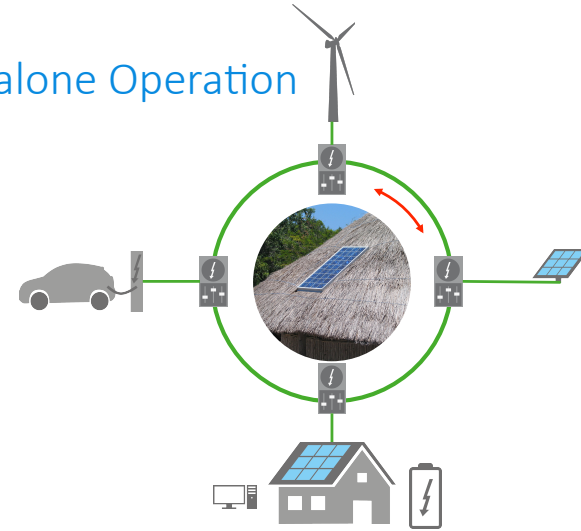
## Business Opportunities



Stand-alone Operation



Stand-alone Operation



Thanks for your attention!

