

# Using embedded renewable generation to stabilize rural distribution networks

**ABO**  
**WIND**



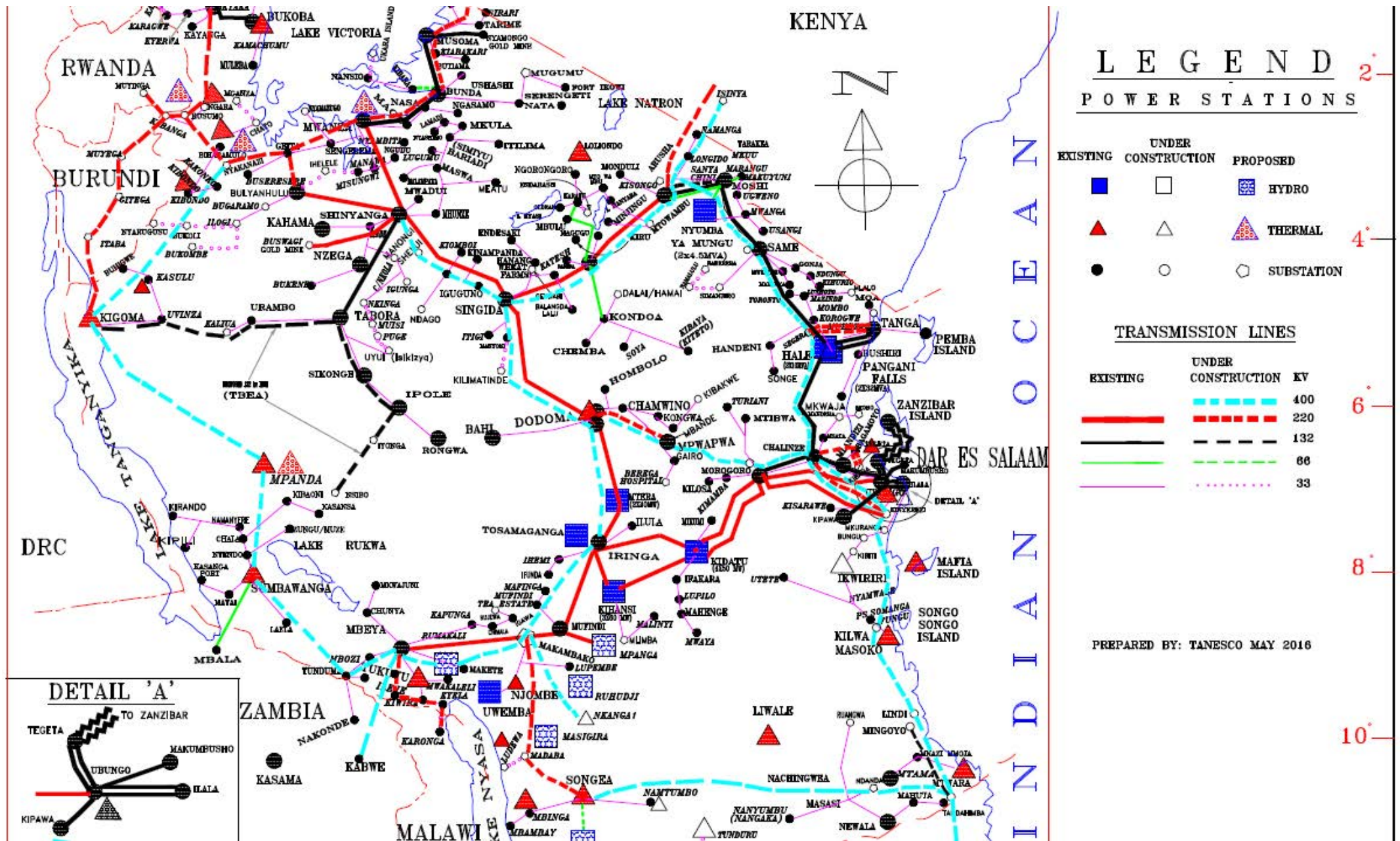


## Rapidly Growing Economy

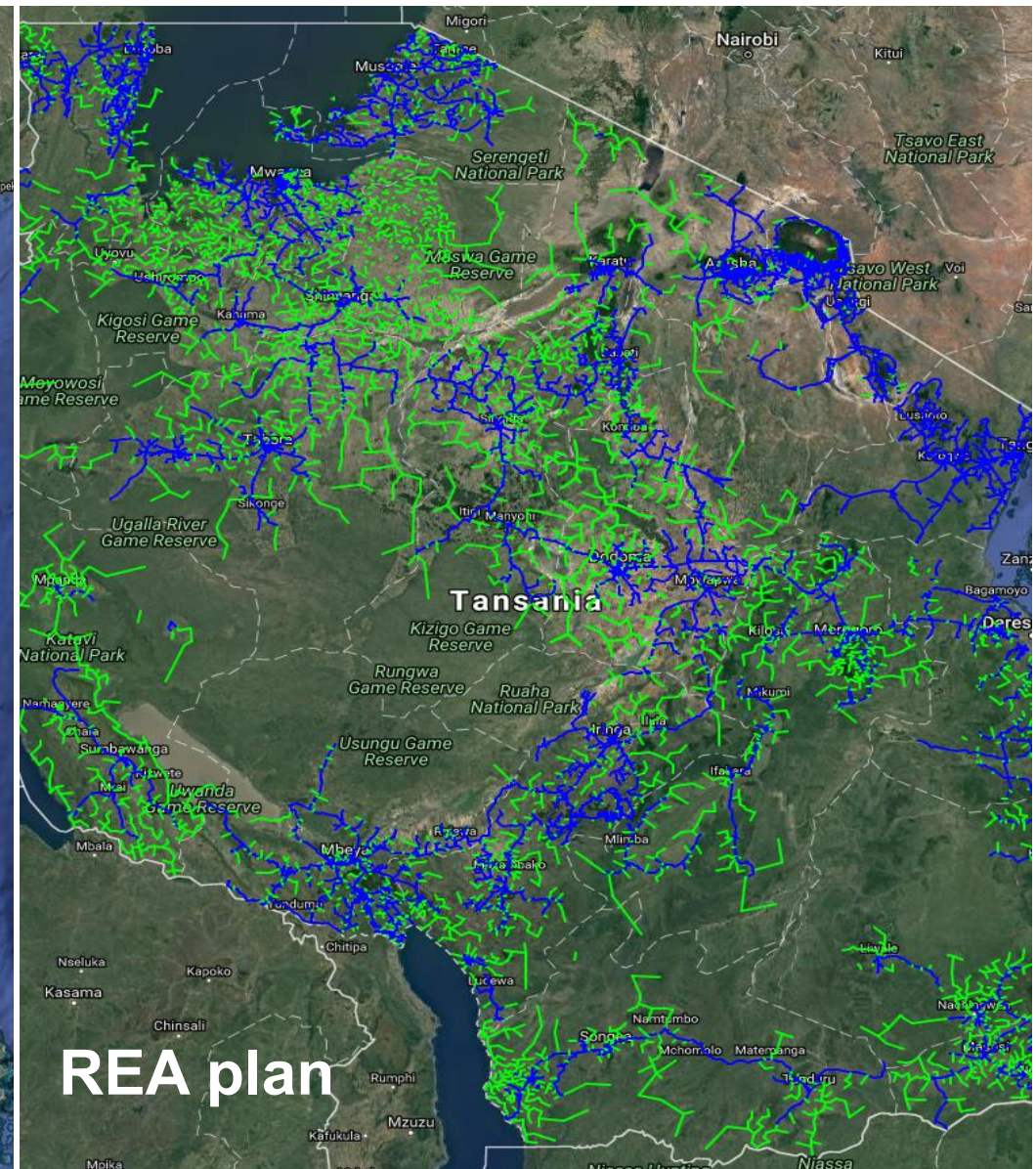
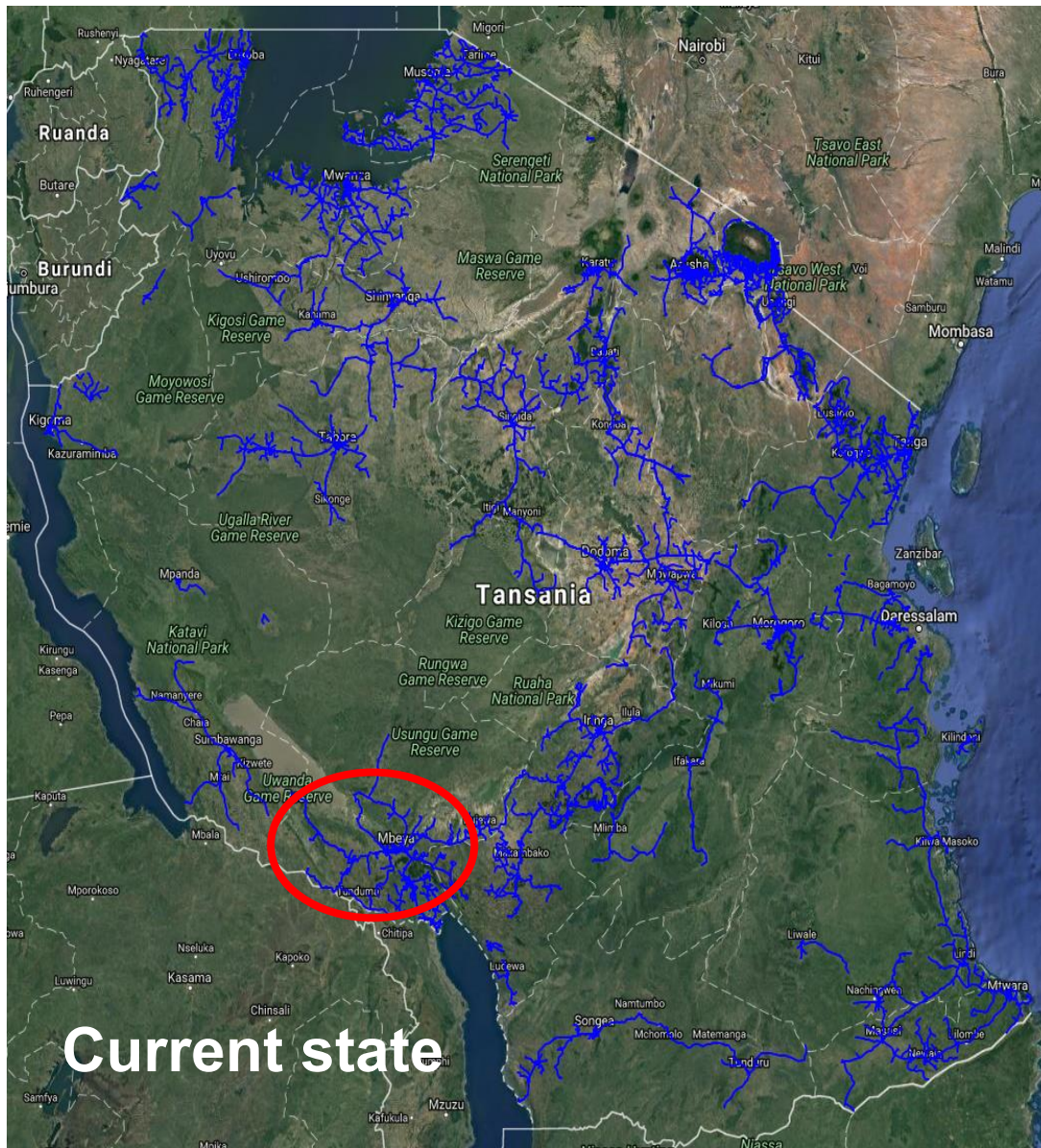
- Surface: 947,300 square kilometres
- Inhabitants: 55 million (58/km<sup>2</sup>)
- Access to electricity<sup>1</sup>
  - 1990 - 5,3million (5,8%)
  - 2014 - 15,5 million (15%)
- Generation mix
  - Hydro 561 MW
  - Gas fuel 544 MW
  - Liquid fuel 210 MW
  - Mini-grids 82 MW



# Grid development plan









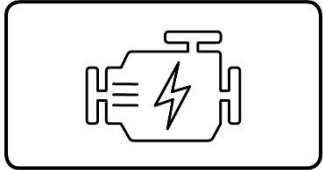


## The distribution grid

- Extremely large distribution networks supplying thousands of small distribution transformers



## Evaluation of generation options



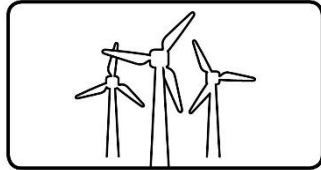
### Diesel

Dependence  
on Imports

High fuel &  
transport costs

Expensive  
Maintenance

CO<sub>2</sub>  
Emissions



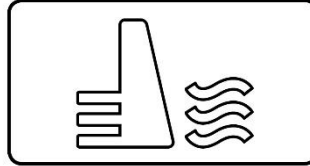
### Wind

Regionally  
restricted

Close proximity  
to GSP stations

Maintenance  
capabilities?

No CO<sub>2</sub>  
Emissions



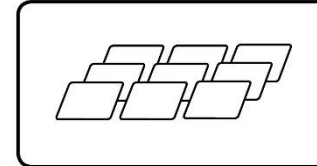
### Hydro

Water is a  
scarce resource

High CAPEX

Maintenance  
costs high

No CO<sub>2</sub>  
Emissions



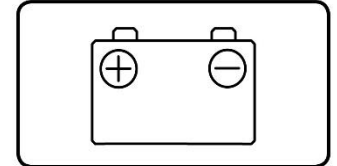
### PV Solar

Great potential  
in all areas

Better adaption  
on Grid capacity

Modular unit  
repairs

No CO<sub>2</sub>  
Emissions



### Storage

Support for  
Wind and Solar

Can be placed  
everywhere

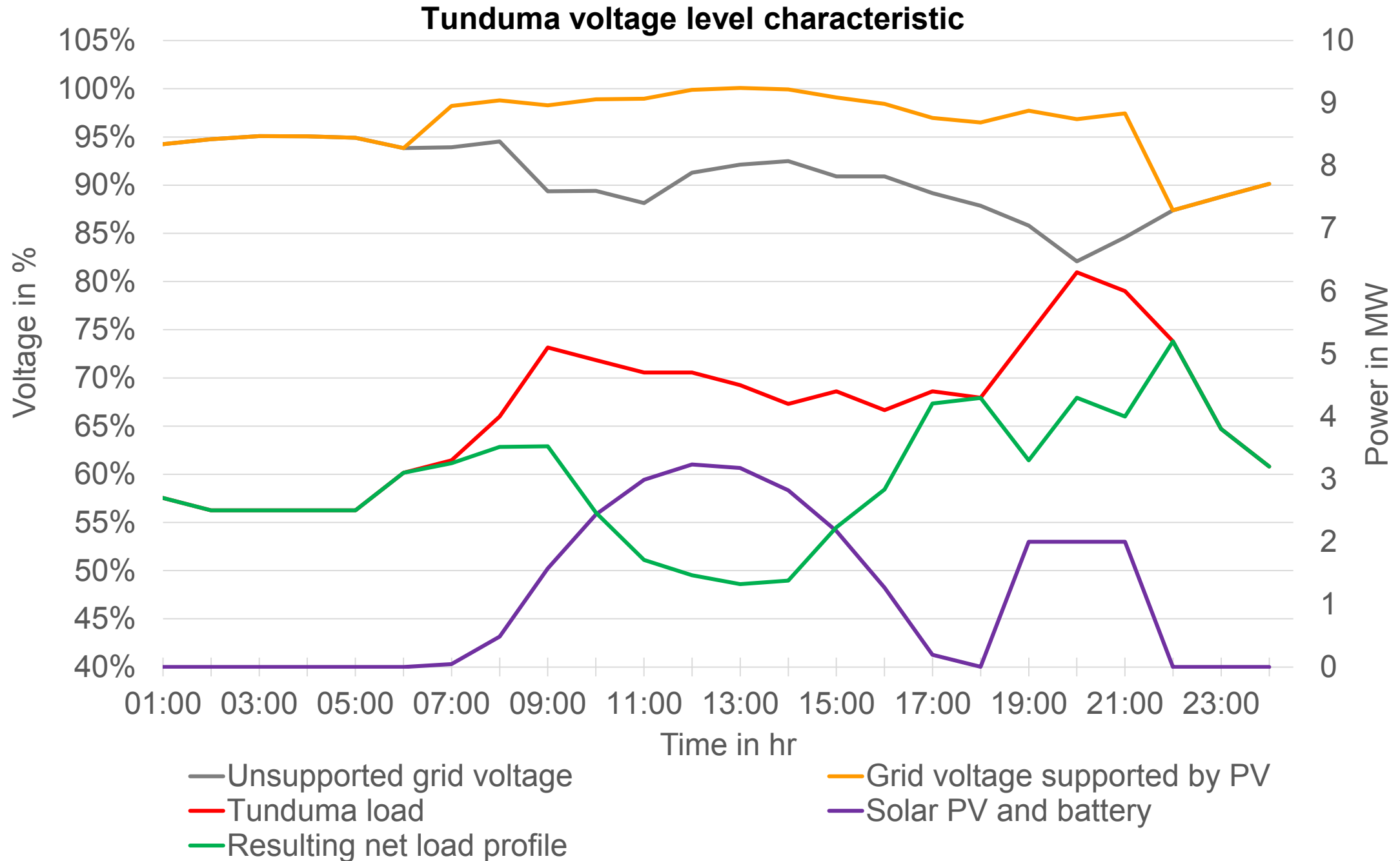
Modularity

No long-term  
experiences



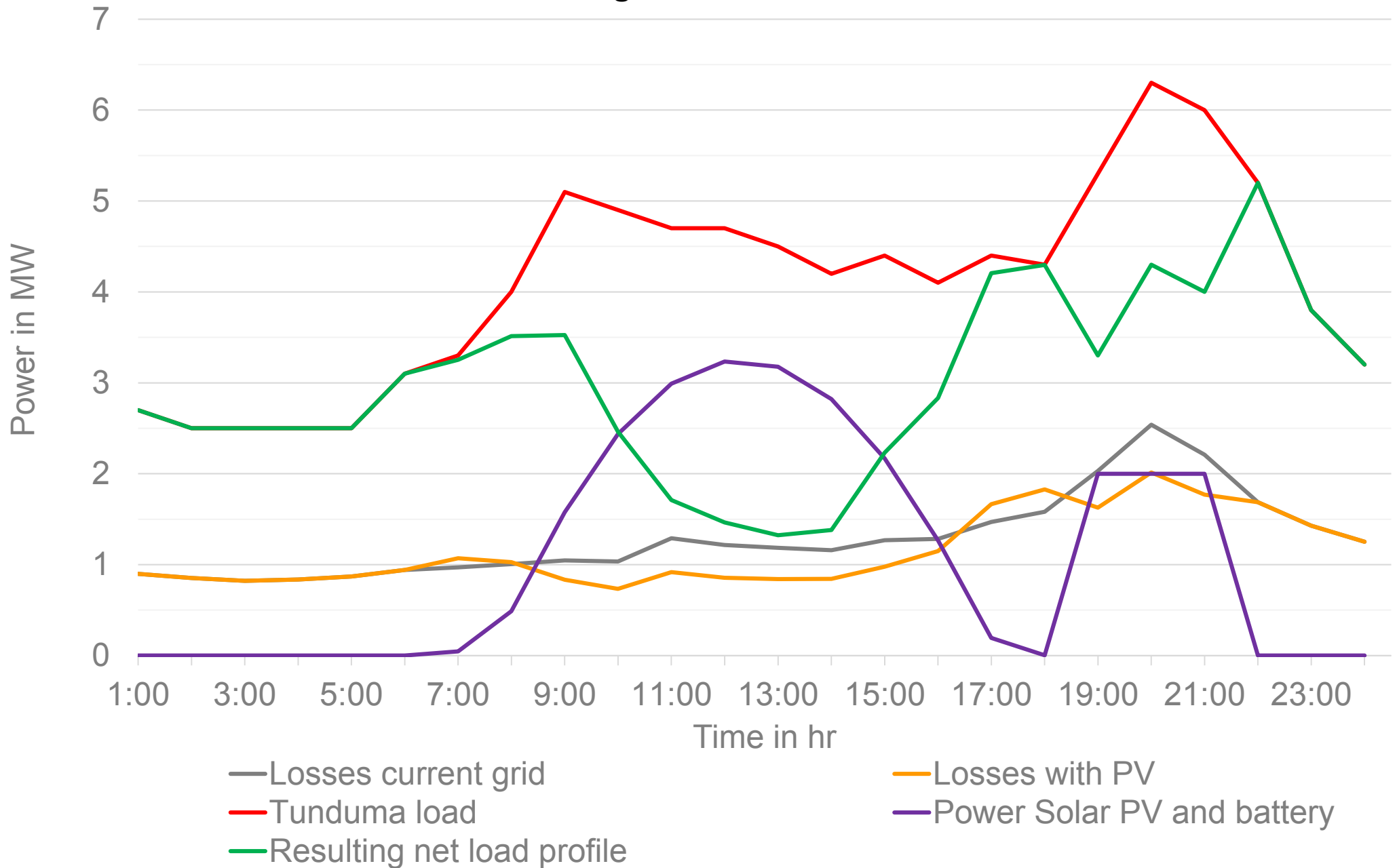
**ABO**  
**WIND**



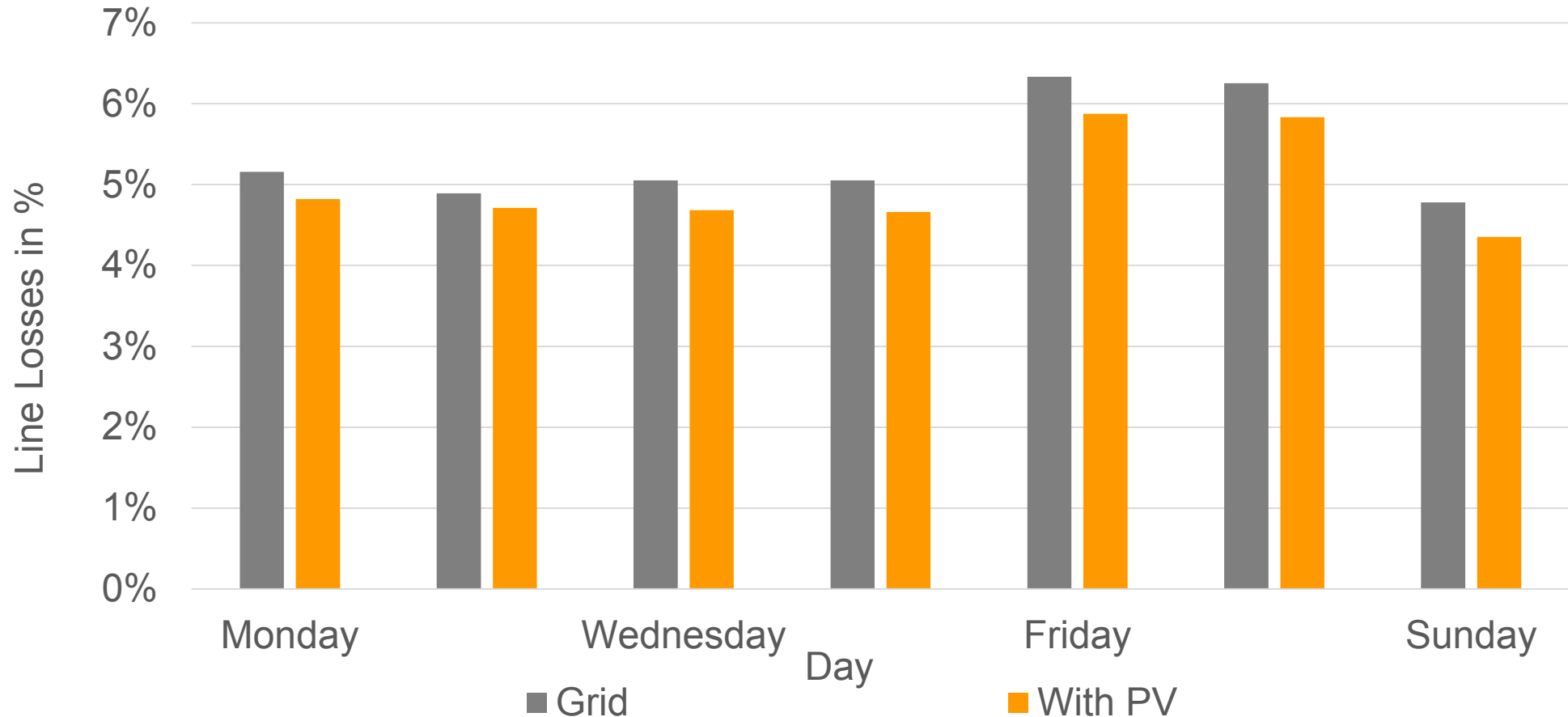




## Tunduma grid losses characteristic

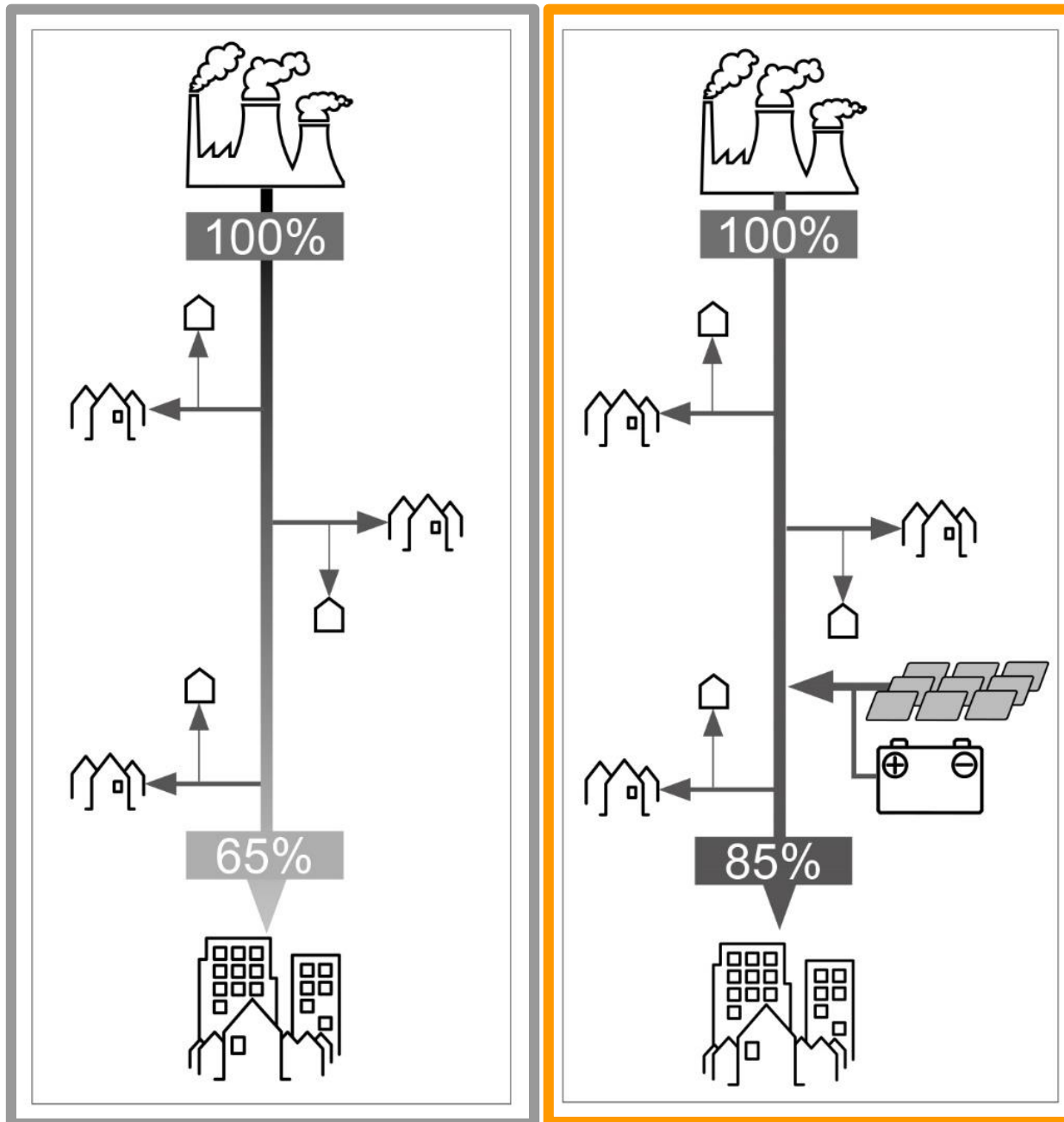


**Tunduma weekly load losses (1<sup>st</sup> week of July 2017)**



- Loss reduction of approx. 1,200 MWh per year
- Annual savings of approx. 130,000 USD
- Estimated 11,000 new connectable customers without the need of grid extension





## Concept

- Photovoltaic system with battery storage
- PV system stabilizes the grid during day and charges the battery storage
- Battery stabilizes grid during night times
- Active and reactive power for grid improvement
- Enables the connection of new customers without grid extension
- Widespread use of the system will increase the effect

# Thank you for your interest – any questions?

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