# Introduction Evert Raaijen

- Biography:
  - Evert Raaijen born 1965, holds an MSc degree electrical engineering from the University of Twente (1983-1988).
  - Working experience:
    - 1988-1990: military duty; science teacher at military school
    - 1990-2011: EXENDIS; R&D engineer, R&D manager, director new business and technology
    - 2011-now: Alfen; business development manager, initiator of the business division TheBattery
    - 2008-now: Royal Netherlands Army: actively serving reserve officier; consultant (renewable) energy systems

Alfen offers its clients smart energy solutions across Europe

Alfen provides B2B solutions across three business lines

Smart Grid Solutions	EV Charging Solutions	Energy Storage Solutions

Alfen Connect

Service & Maintenance

← Integrated solutions →

■ Countries with Alfen sales presence
■ Alfen products installed
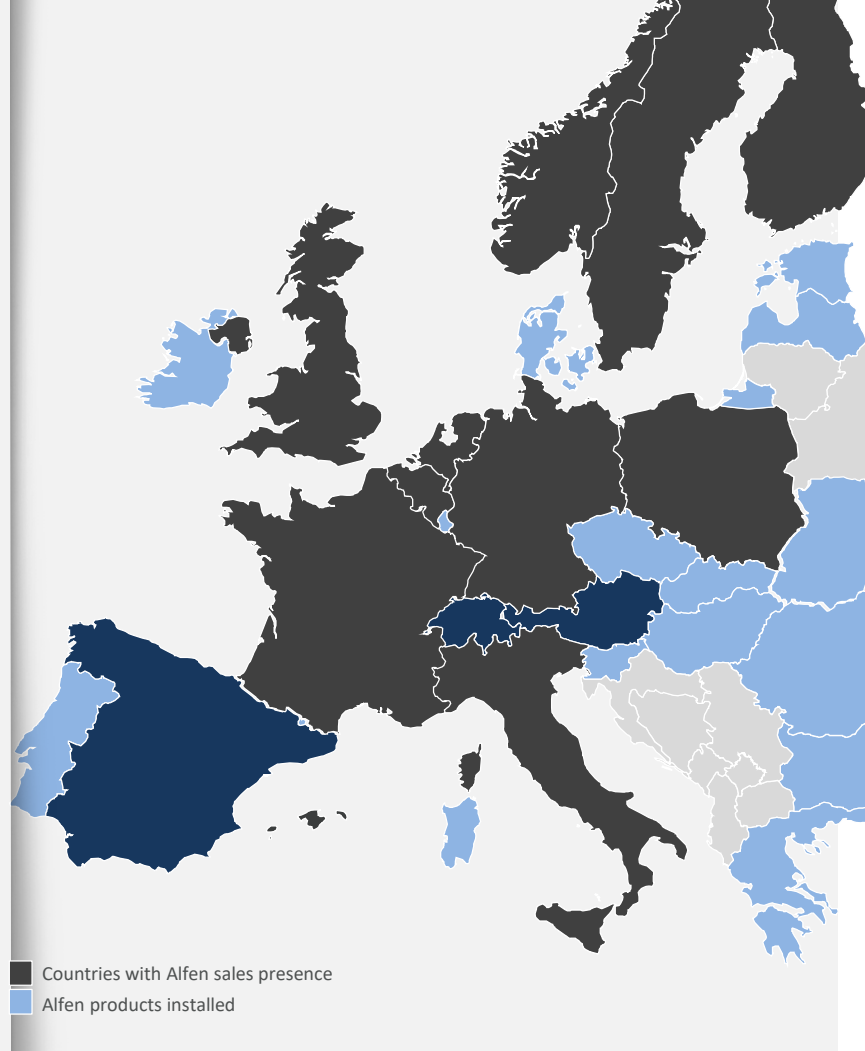
Energy transition

More uncontrolable generation

Energy transition
Grid balancing is needed

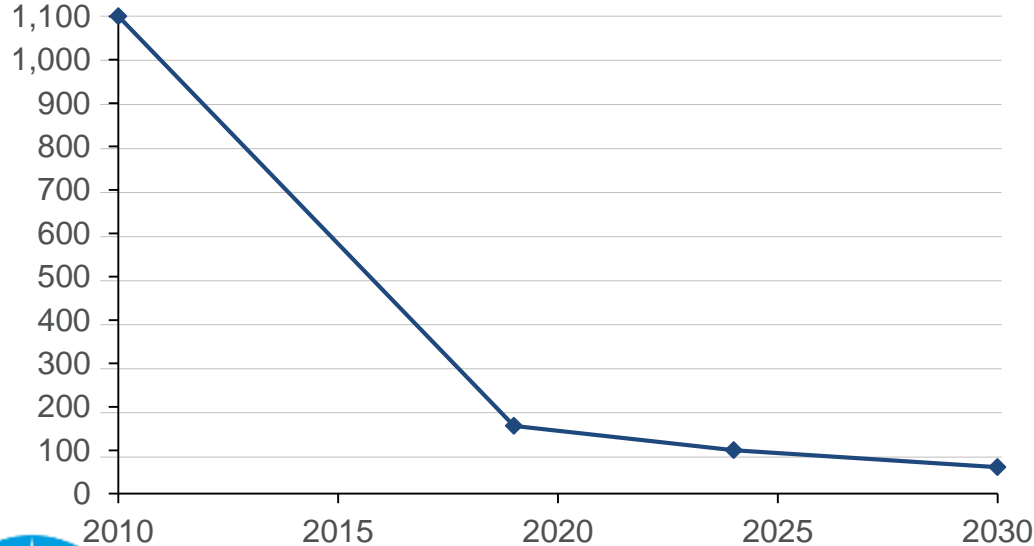Future situation

Decentralized
power generation

Energy Storage

Energy Storage

- Energy storage
- Controlable loads (e.g. EV charging)

Lithium Ion battery prices per kWh are expected to drop by -8% to -9% per annum towards 2030

Battery costs keep on declining

Battery costs in real terms ($/kWh)

Source: BloombergNEF Dec 2019

Reduced cycle costs → more potential business cases:

- BESS prices are reducing
- Battery guaranteed cycle life is improving
- Battery deprecition can be down to few 0.01 Euro/kWh
- Facilitating new business cases and opportunities !
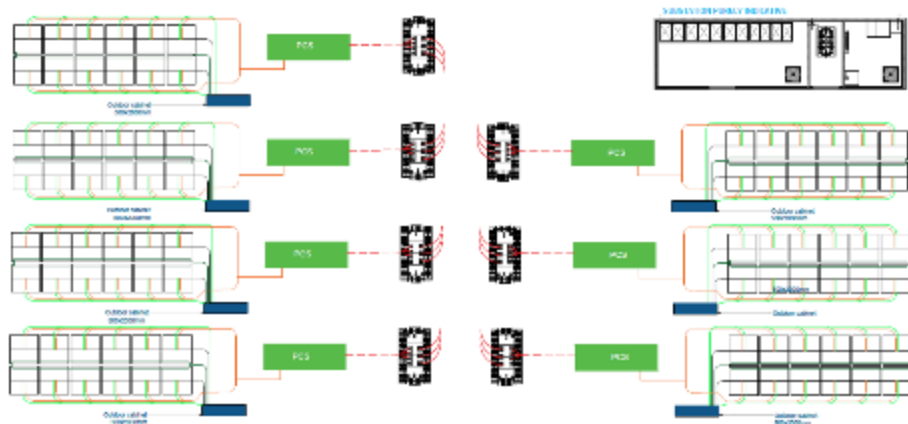
Evolution of solutions

Single container → multi container   → outdoor cabinets (batteries/inverters)

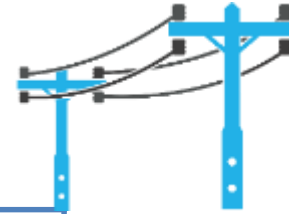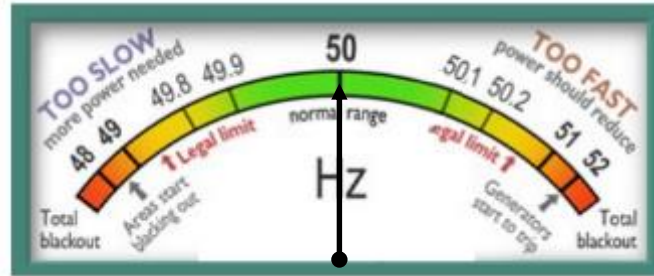n x 100 kW   → n x 1 MW   → 1 – 200 MW++

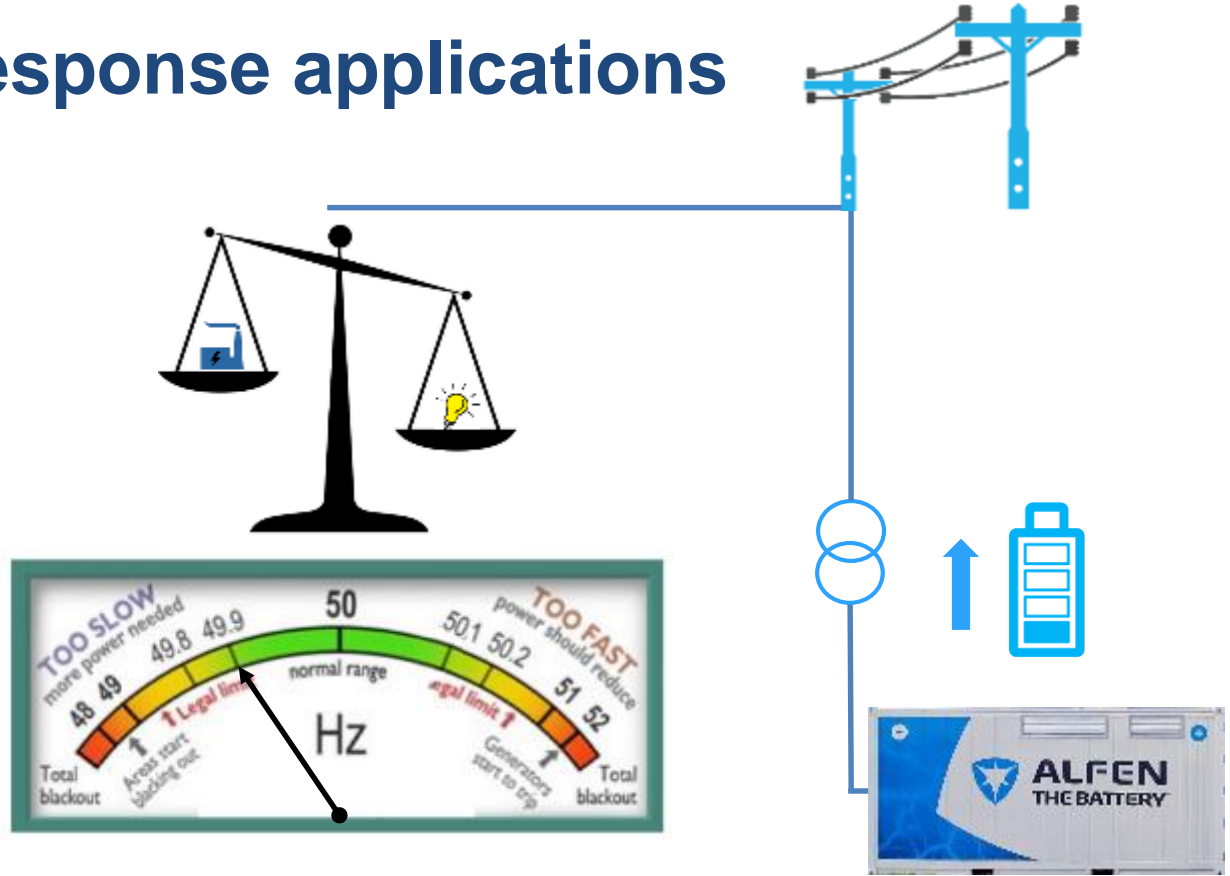# BESS applications and trends

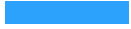- Frequency response applications
- Synthetic Inertia
- Lower c-rates (more stored energy)
- BESS solutions to reduce congestion
- Backup power
- Mobile applications reducing diesel
- Increasing market interest to replace DG with BESS & PV
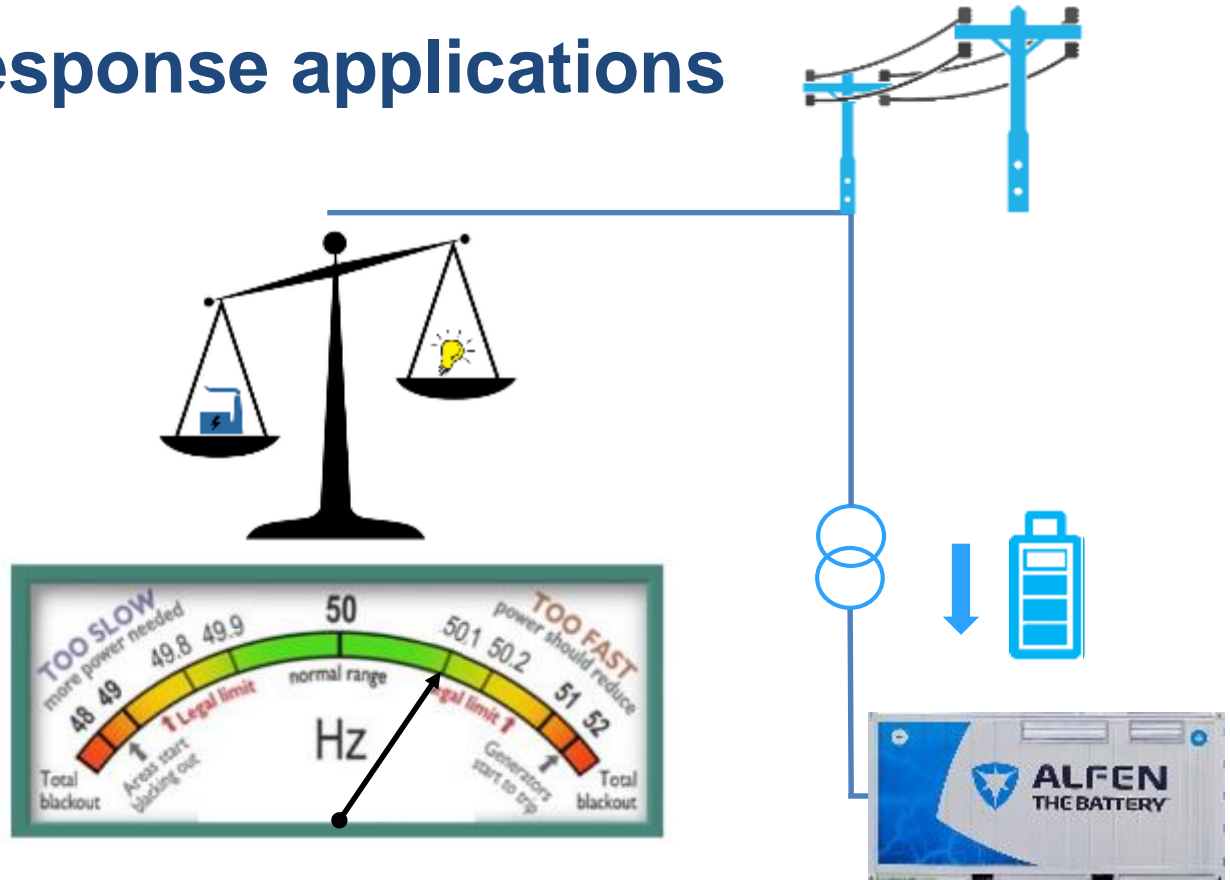- Solutions for datacenters

Frequency response applications

Frequency response applications

Frequency response applications

Typical reaction times 1-30 seconds

HARTEL WIND FARM PROJECT

10 MW Battery Energy Storage System in the Port of Rotterdam

Customer: Green Choice

Location: Port of Rotterdam

Project: Hartel wind farm (24 MW)

Power output: 10 MW

Battery capacity: 10 MWh

Scope: End-to-End BESS project with integrated transformer solution and connection on MV-level.

Applications: Frequency response / Renewables

Operational since: April 2019

Press release: https://alfen.com/en/news/alfen-selected-supply-10mw-energy-storage-system-greenchoice-hartel-windfarm

Synthetic inertia

Examples congestion management:

1 MW Battery Energy Storage System for distribution centre LIDL

Customer: LIDL

Location: Nijmegen, the Netherlands

Project: Distribution centre

Power output: 1 MW

Battery capacity: 1.23 MWh

Scope: End-to-End BESS project with connection to the local grid on MV-level.

Applications: Frequency response / Peak shaving

Operational since: August 2018

Alfen selected by Vattenfall to supply a 20 MWh energy storage system in Sweden
07-04-2020

Alfen selected by Vattenfall to supply a 20 MWh energy storage system in Sweden

Mega energy storage system in Swedish university town Uppsala, will contribute to Vattenfall's mission of 'fossil free living within one generation'

Vattenfall has selected Alfen to deliver a battery energy storage system of 20 MWh in the university town Uppsala in Sweden, also the fourth largest city in Sweden. This is the third large-scale energy storage system that Alfen will deliver to Vattenfall. The energy storage system will be connected to the power grid of distribution grid operator Vattenfall Eldistribution. The system will be deployed to address grid congestion challenges and to benefit from trading opportunities on the flexibility market.

Alfen's scope consists of the delivery of an energy storage system of 20 MWh (5 MW) based on BMW car batteries, Alfen's 'TheBattery Connect' energy management system and the local grid connection.

https://alfen.com/en/news/alfen
-selected-vattenfall-supply-
20mwh-energy-storage-
system-sweden

Shell ultrafast EV charging service to incorporate Alfen energy storage

Alfen's energy storage solution has been selected by Shell for its ultrafast electric vehicle charging service at its forecourt in Zaltbommel, the Netherlands. The 350kWh battery-based system will be used for 'peak shaving', providing additional power for car charging to reduce load on the grid in periods of peak electricity demand. When car charging activities are minimal, the energy storage system will also be used to offer grid stability services.

In addition to optimising vehicle charging while limiting grid impact, the project also aims to develop further understanding about the role for energy storage in a ultrafast charging environment, offering potential for future rollout of the solution.

Luitzen Kaspersma, Future Fuels Project Manager Benelux and France Shell Retail said: *"Electric mobility is important for helping to meet the growing need for transport in a more sustainable world. Accelerating the*

https://alfen.com/en/news/shell-ultrafast-ev-charging-service-incorporate-alfen-energy-storage

ADO Project

Solar PV

Alfen TheBattery system

Smart Charging Network

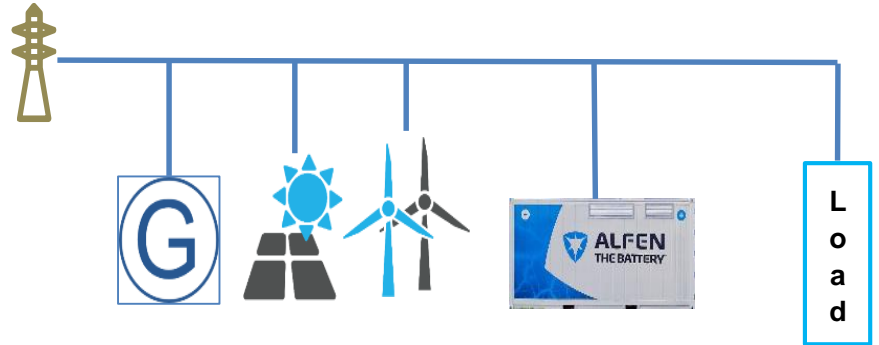Alfen Connect™

Case study: distribution center in area with grid congestion

- Limited grid connection: 330 kW Import/export   (breathing through a straw)
- Load: 1000-3000 kW

50-100 MEuro project on hold caused by grid congestion

Solution:
- PV: 3000 kWp
- Wind: 3000 kW
- Backup Gas Generator: 1500 kW
- BESS: 10 MWh

Self consumption business case

- Difference between import and export tariff can be 0.10 Euro/kWh

- For some applications with combined generation and load self consumption with a BESS can be attractive:
  - Generally PV/Wind/Load > 1 MW
  - Wind has generally better business case than PV
    - wind has more + shorter cycles year and high utilisation of the BESS, relative short pay back time
    - PV has limited cycles per year , low utilisation of BESS, longer pay back time, additional business cases are needed
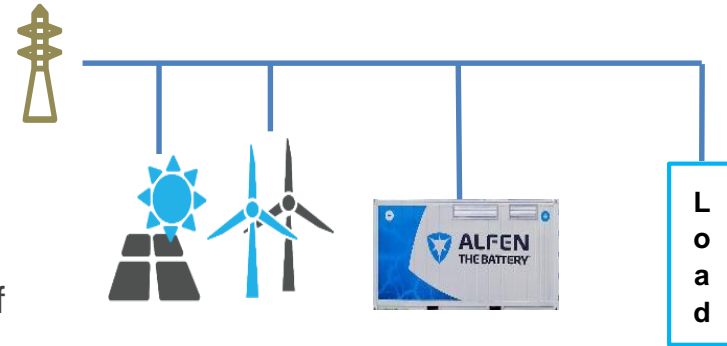
Back up power applications

Amsterdam (17 January 2017)

• Outage from 4:19 to 6:15
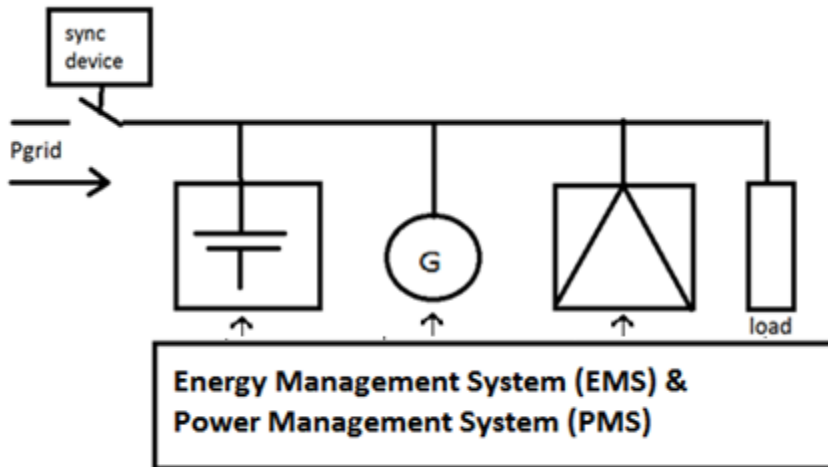
Self healing cellular microgrids

14 November 2017

• Apache causes blackout for about 50,000 households for 6 hrs

U R HACKED

UKRAINIAN POWER GRID TAKEN DOWN BY HACKERS...

THE POWER GRID CYBER WARS HAVE BEGUN

HealthRangerReport.com

Normally connected to the main grid

- Storage to reduce imbalance in the main grid (energy trading, frequency response)
- Demand side management (EV, heatpumps, etc)
- Virtual Neighbourhood storage

Self healing and self controlling in case of grid outage

- Battery Storage to generate microgrid
- Local power generation (renewable / conventional)
- Using grid frequency as reliable Demand Side Management control method
- Working together with other cells
- Building main grid back from bottom up

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Alfen to deliver 1MW energy storage system to Fortum and Caruna as part of new framework agreement
24-10-2019

Alfen to deliver 1MW energy storage system to Fortum and Caruna as part of new framework agreement

Alfen has been selected by Finnish utility Fortum and distribution grid operator Caruna to supply a 1 MW (1MWh) energy storage system in the Helsinki capital area. This storage system is the first order under a new framework agreement between Fortum and Alfen, covering both energy storage systems as well as transformer substations.

The energy storage system will be used to provide back-up power for a mid-voltage section of Caruna's power grid. The section consists of 20 mid-voltage transformers and provides energy to 334 households and few

https://alfen.com/en/news/
alfen-deliver-1mw-energy-
storage-system-fortum-
and-caruna-part-new-
framework-agreement
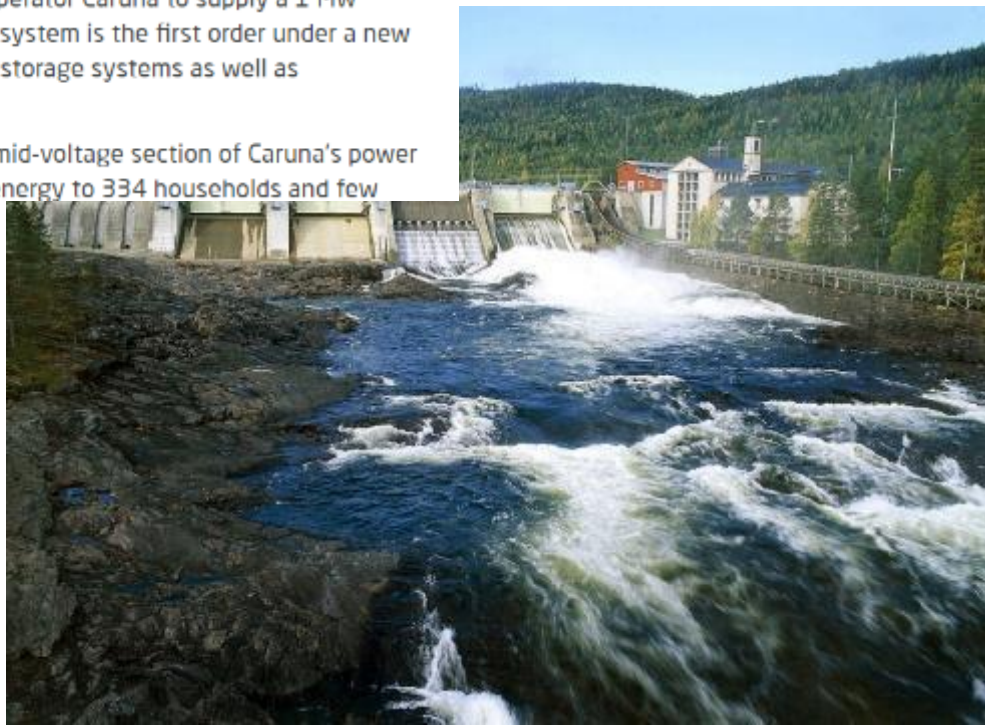
Off grid: example project Nigeria

- Cocoa factory near Lagos Nigeria
- Electricity off for 80% of time
- 15 year ago grid was disconnected => using diesel generators
- disadvantages: high costs of diesel & maintenance, often supply problems diesel, negative CSR
- New solution: Solar PV + battery storage
  - 2,35 MWp PV
  - 2 MWh/2MW (= daily electricity consumption of 200 houses !)

Questions?