

# Benefit of Offgrid Hybrid Power Plants with maximum renewable penetration

Cost and emission reduction by integrating renewables into diesel plants

# Offgrid Hybrid Power Plants

1. What are the major challenges?
2. How can high renewable penetration be beneficial?
3. How does Siemens support this?

# Opposing trends, new opportunities

## Challenges of fuel based generation



Fuel costs



Weak / no grids



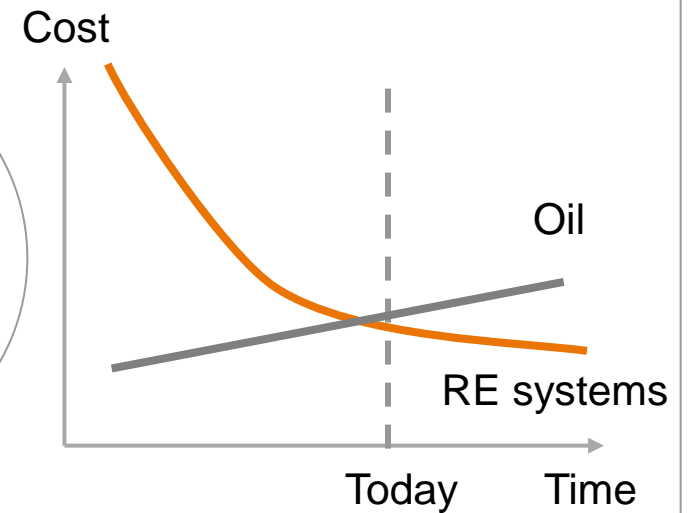
Emissions



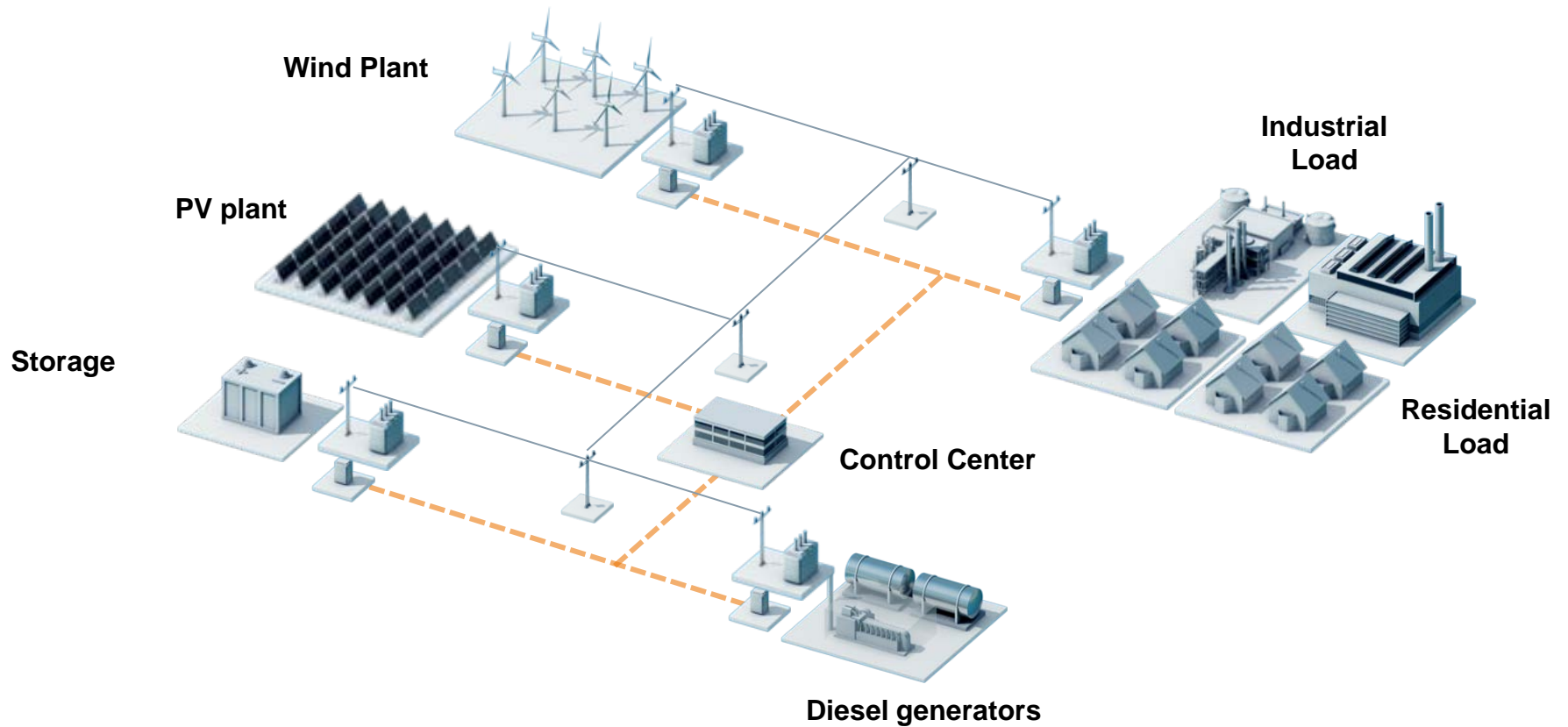
Logistic

Hybrid  
Power  
Plants

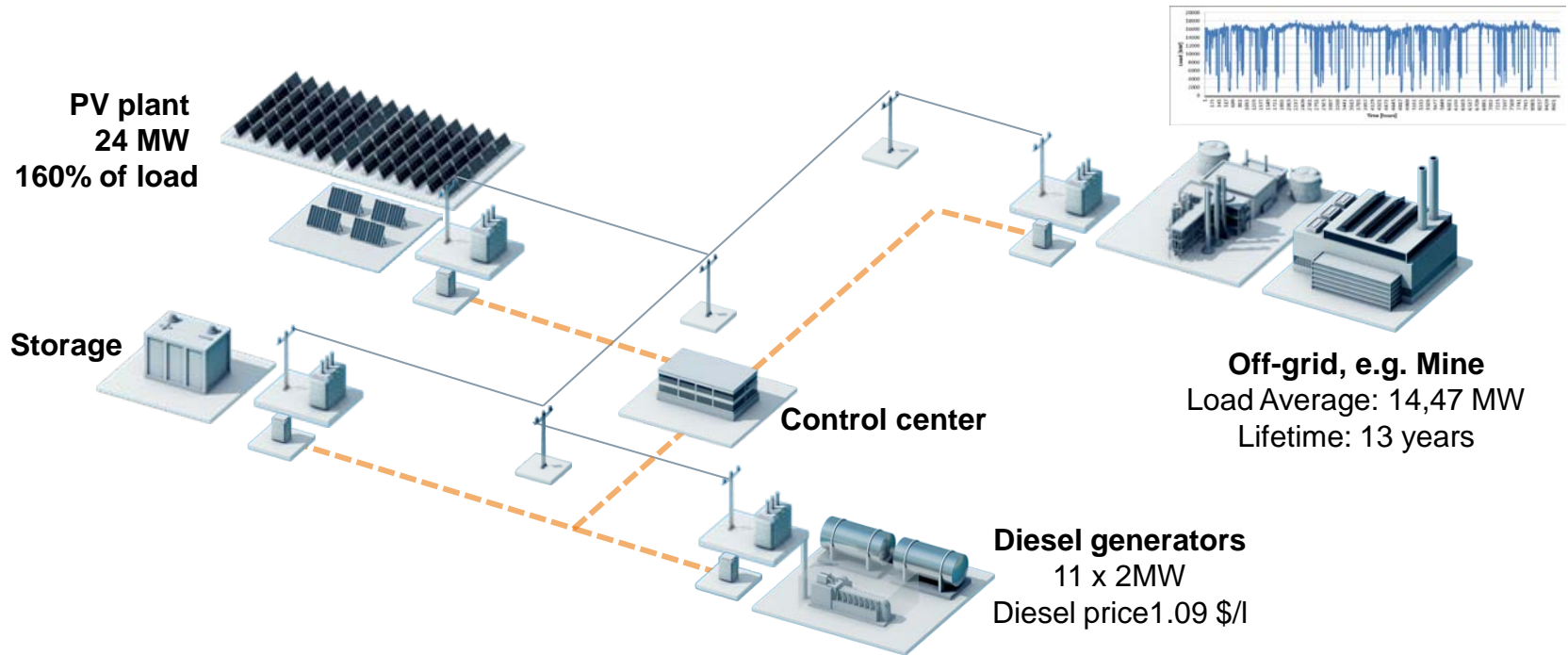
## Shift in technology



# What is a hybrid diesel plant?



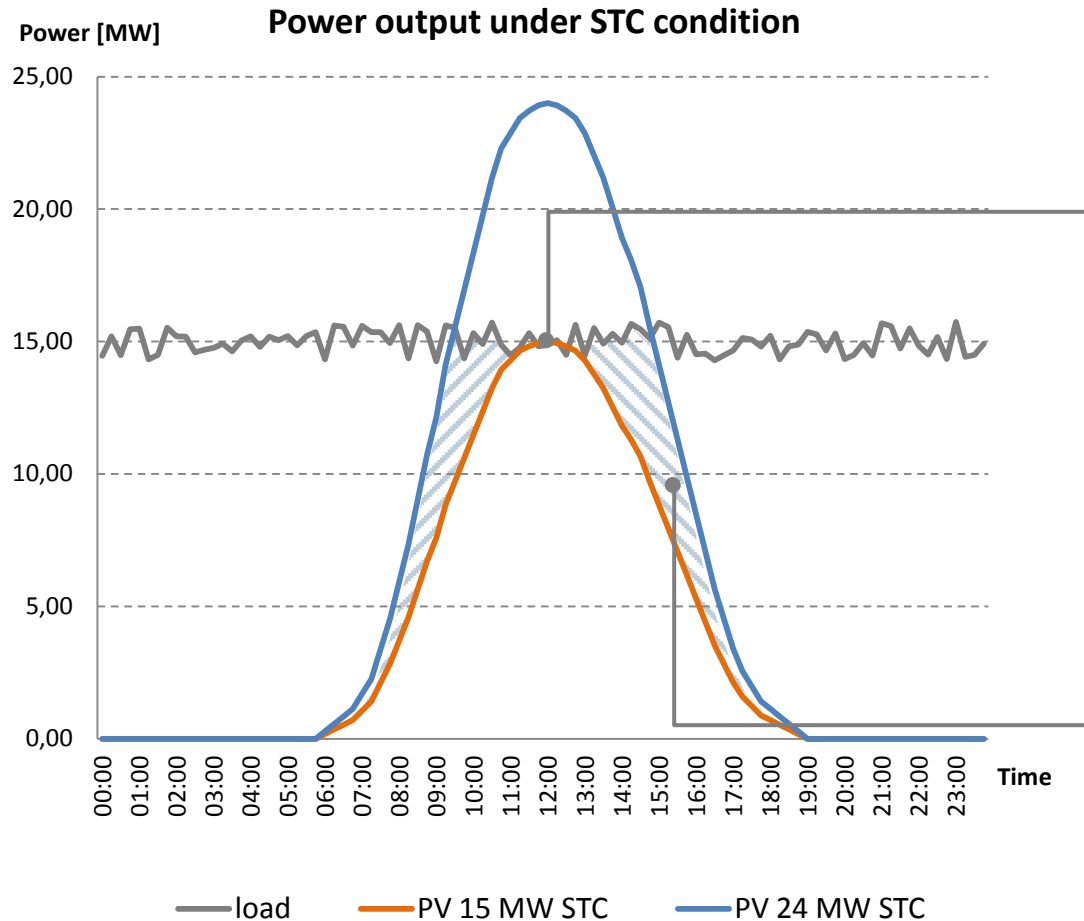
# How can high renewable penetration be beneficial?



Capex

■ Diesel only

# Why to go for highest renewable penetration Standard Test Condition



Even if PV plant installed capacity is designed equal to average load it's only possible to achieve 100% renewable penetration if:

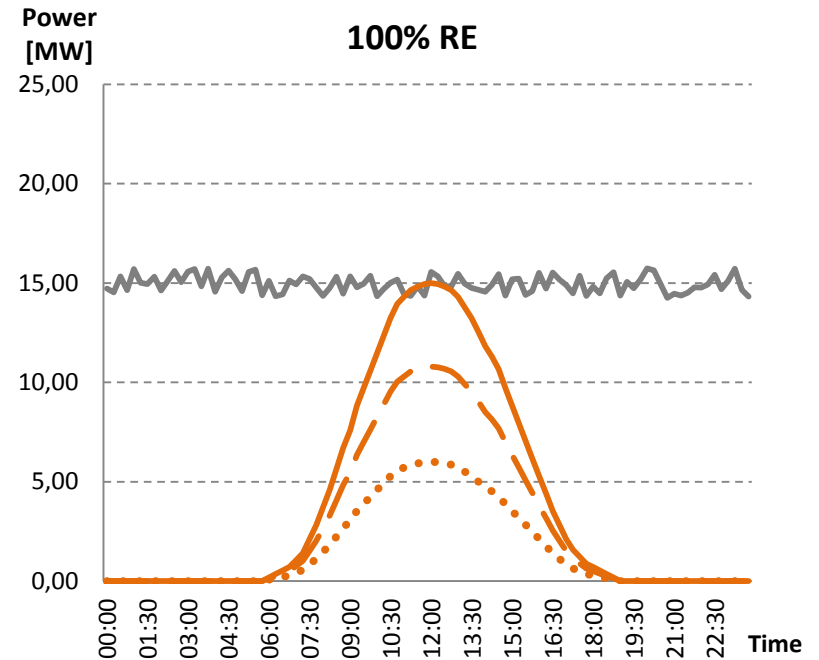
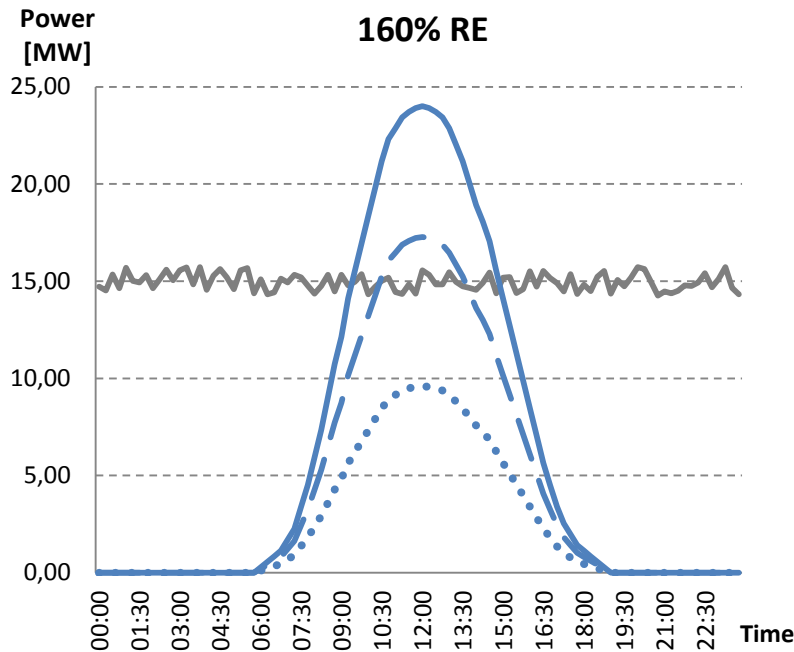
- Laboratory conditions (STC)
- AND
- At noon time

Additional production on early and late hours of the day.

Balance to find between additional investment and increase of production.

# Why to go for highest renewable penetration real weather conditions

## Power output under real weather conditions



— Standard Test Condition

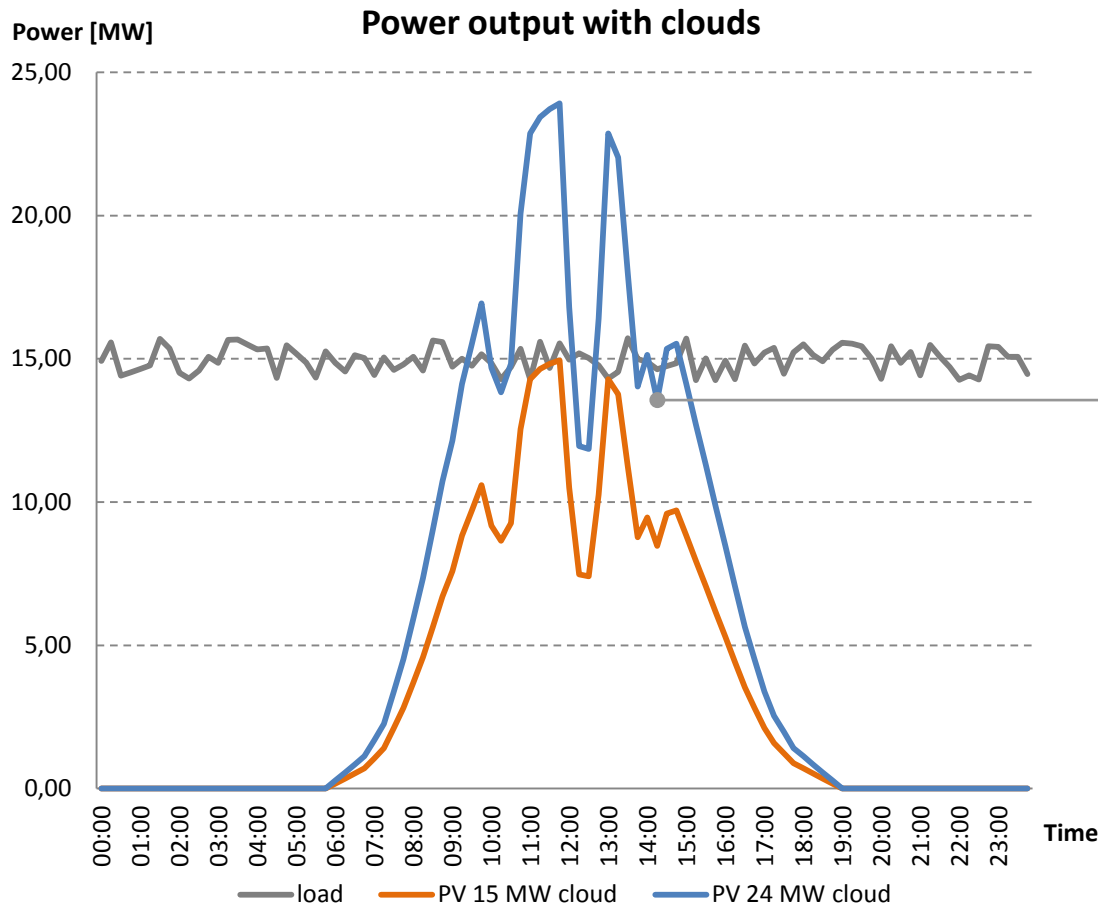


- - - Medium irradiation



..... Low irradiation

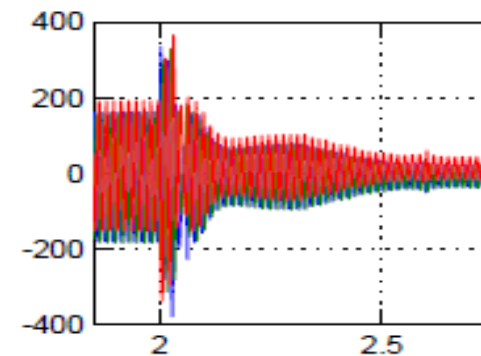
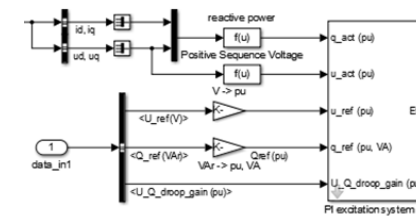
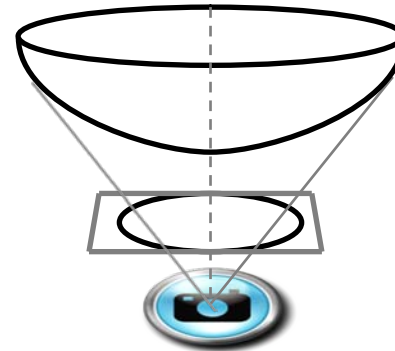
# Why to go for highest renewable penetration impact of clouds



With a PV plant sized at 160% of average load mostly sufficient RE power can be provided even if clouds covering the plant partially.

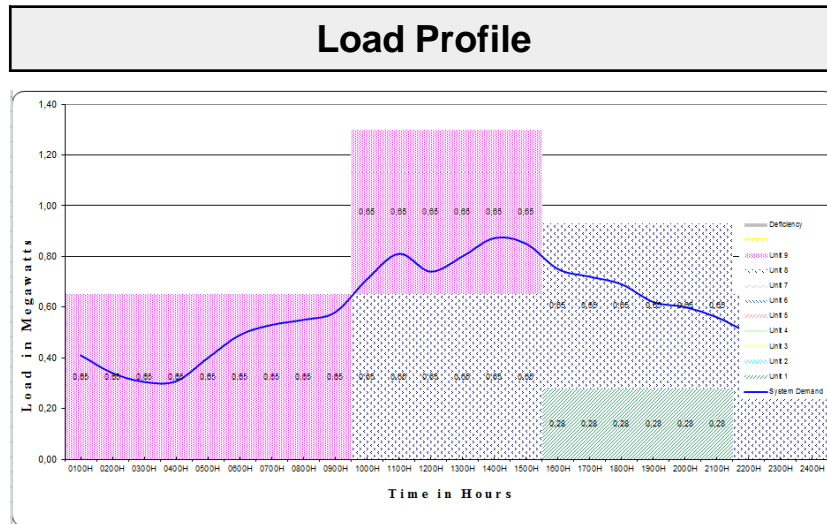
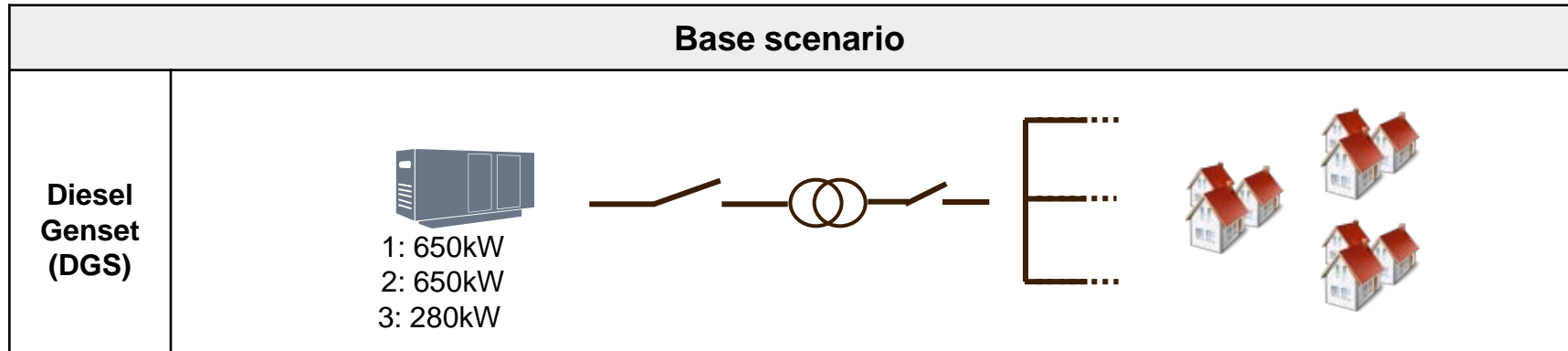


# Siemens Hybrid Power Plants – 24/7 reliable Power



# Sample case study – Philippines

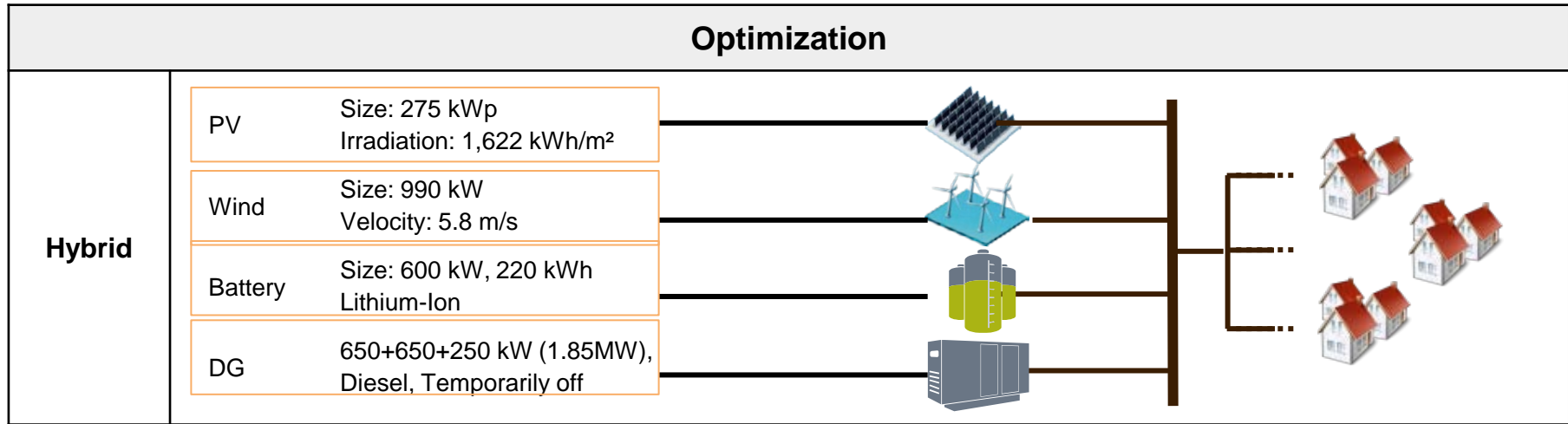
## Base scenario: Diesel Gensets Only



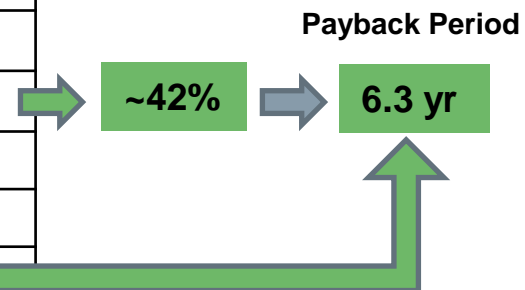
Description	DGS
Diesel Plant Size:	650+650+280kW
Fuel type:	Diesel
Diesel cost (delivered) (USD/ l)	1.00
Diesel consumption (l/ yr)	1,752,336
Diesel costs (USD/ yr)	1,752,336
Maintenance costs (USD/ yr)	112,419
Total operating costs (USD/ yr)	1,864,755
CO2 emissions (kg/yr)	4,614,477

# Sample case study – Philippines

## Optimization: Wind, PV, Storage & Diesel Gensets



Description	DGS	Hybrid	Saving
Diesel cost (delivered) (USD/ l)	1.00	1.00	-
Diesel consumption (l/ yr)	1,752,336	1,018,981	733,355
Diesel costs (USD/ yr)	1,752,336	1,018,981	733,355
Maintenance costs (USD/ yr)	112,419	231,241	(118,822)
Total operating costs (USD/ yr)	1,864,755	1,250,222	614,533
<b>Investment costs (USD)</b>	-	<b>4,598,415</b>	
LCoE (USD/ kWh)	<b>0.383</b>	<b>0.335</b>	<b>0.048</b>
CO2 emissions (kg/yr)	4,614,477	2,683,313	1,931,164



# Siemens support

## Benefits from a world class turnkey supplier

**1** Focus on customer requirements

**2** Solutions covering the complete scope

**3** One-stop turnkey solution

**4** Worldwide experience in turnkey implementation

**5** Financial strength

**6** Credibility to attract financial partners

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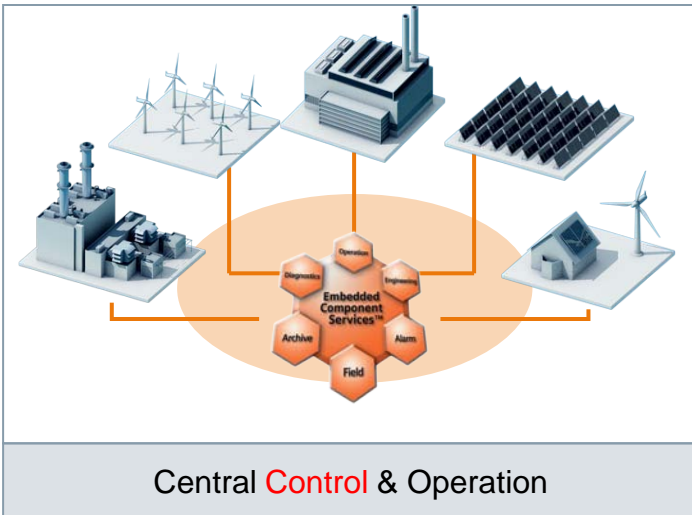
Smart Generation Solutions

E P IE

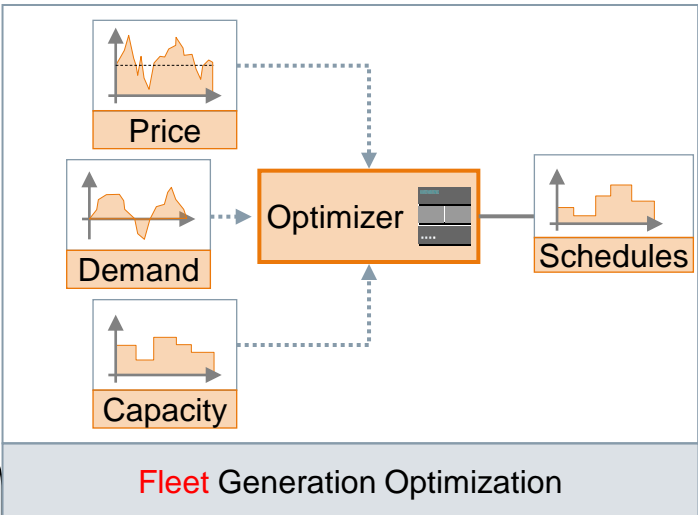
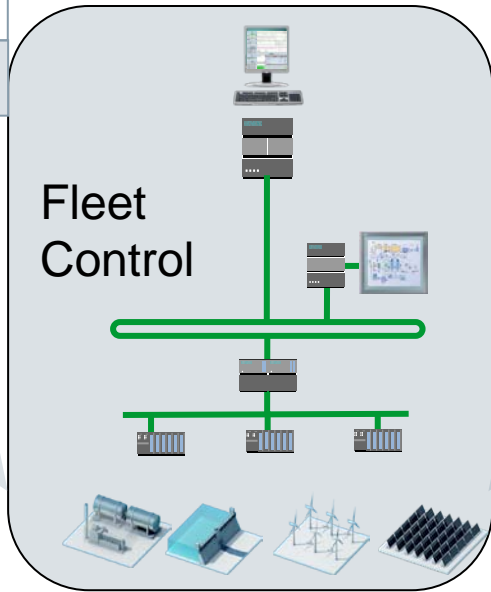
AL:N ECCN:N

# backup

# Our solution: Fleet Control is the "brain" of distributed power plant control



Reliable and secure control



Generation optimization

➔ **Combined solution** provides highest availability, lowest OPEX and maximum earnings

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