

# Nazeer Syed, **personal profile**



Director Business Development

Strategic Segments -Asia Pacific and India Region.

25 years drives experience with Danfoss.

More than 33 years Sales Development & Management exp in Power systems , Electrical, process field instruments.

B.E., (Electronics). MBA (Strategic Management) .

**Main interests are :**

**Smart grids and energy storage,**

**Power-to-X,**

DC-Grid, Marine Solutions,

High Power LV/MV Drives, and product management.

Welcome to  
**Danfoss**



*Danfoss*

ENGINEERING  
TOMORROW

# Danfoss **at a glance**

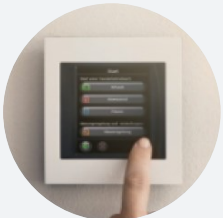
## Businesses



**Power Solutions**



**Drives**



**Climate Solutions**

## Global organization

**42,000**

employees

**97**

factories

**100**

countries

**10.3bn €**

2022 revenue

## Serving industries

**Automotive**

**Marine & offshore**

**Mobile hydraulics**

**Refrigeration & A/C**

**Commercial buildings**

**Residential buildings**

**District energy**

**Food & beverage**

**Heavy industry**

**Water & wastewater**

# Our world

## Danfoss Power Solutions



Construction

Industry

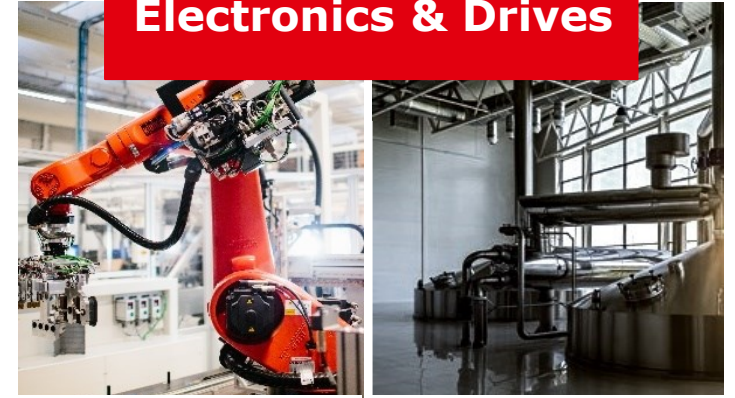
## Danfoss Climate Solutions



Residential Heating

Cooling

## Danfoss Power Electronics & Drives



Industry

Brewery



On-Highway

Agriculture



District Heating

Air Conditioning



Automotive

HVAC

We're starting at home

# Danfoss Nordborg campus became CO<sub>2</sub> neutral in 2022

Danfoss targets are approved by the "Science-based Targets" initiative:

- Scope 1 & 2 goal: CO<sub>2</sub> neutrality in all facilities globally, by 2030
- Scope 3 goal: 15 % emission reduction in 2030



# Danfoss Power Electronics and Drives introduction

The Danfoss logo is a white, stylized script font with a horizontal line underneath, set against a red background.

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# Danfoss Drives Breadth and Depth

## Drive Modules

A complete set of drive modules including for mounting into customer enclosures



VACON® NXP Air Cooled Drives



VACON® NXC Air Cooled Enclosed Drives



iC7 Drives



iC7 Enclosed Drives

## System Drive

Pre-designed system drives configured for each project

## Enclosed

Enclosed products with a wide range of options



VLT® FC302 Automation Drive



VLT® FC202 AQUA Drive



VACON® NXP Liquid Cooled Drives



VACON® NXP Liquid Cooled Enclosed Drive

## Air/Liquid

Cooling flexibility for highest possible power density and lowest cost

## Low Harmonic

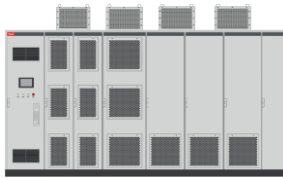
12/18/24 Pulse  
Active front End  
Active Filters  
Passive Filters



System Modules



VACON® NXP System Drive



VACON® 3000 / 1000 Enclosed Drive



VACON and VLT Tools

## MV Drives

For high powers and demanding applications

# DrivePro® Lifecycle Services



DrivePro® Site Assessment



DrivePro® Start-up



DrivePro® Extended Warranty



DrivePro® Spare Parts



DrivePro® Exchange



DrivePro® Preventive Maintenance



DrivePro® Remote Monitoring



DrivePro® Remote Expert Support



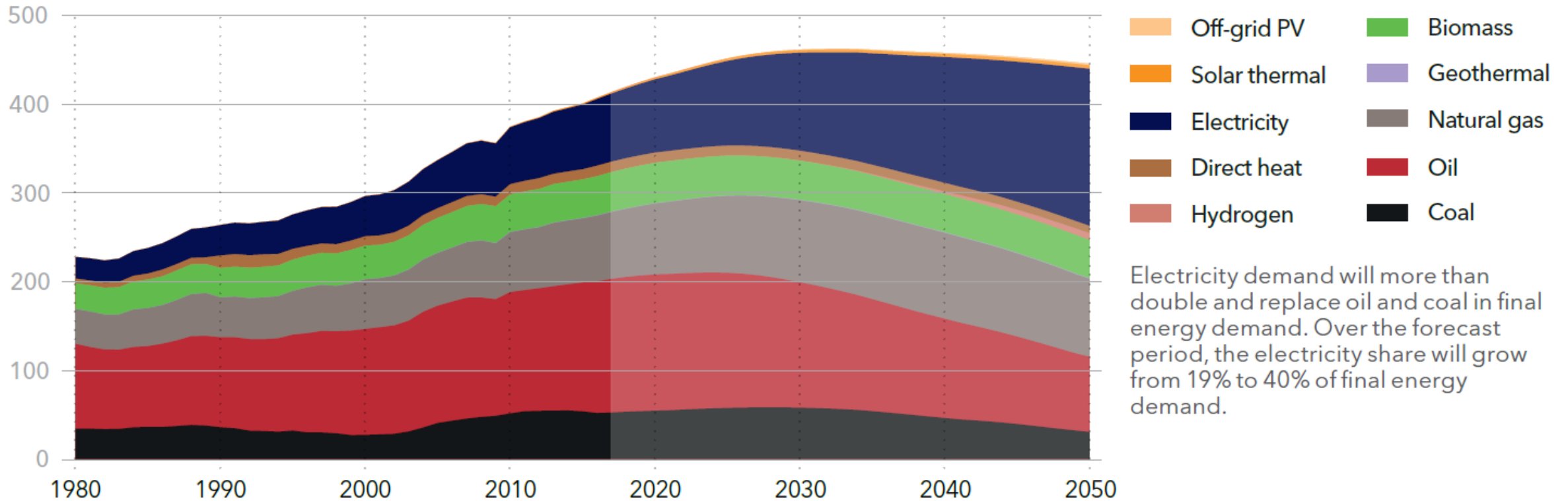
DrivePro® Retrofit



# Power conversion will be needed even more

## World final energy demand by carrier

Units: EJ/yr



Electricity demand will more than double and replace oil and coal in final energy demand. Over the forecast period, the electricity share will grow from 19% to 40% of final energy demand.

Source : DNV-GL Energy Transition Outlook

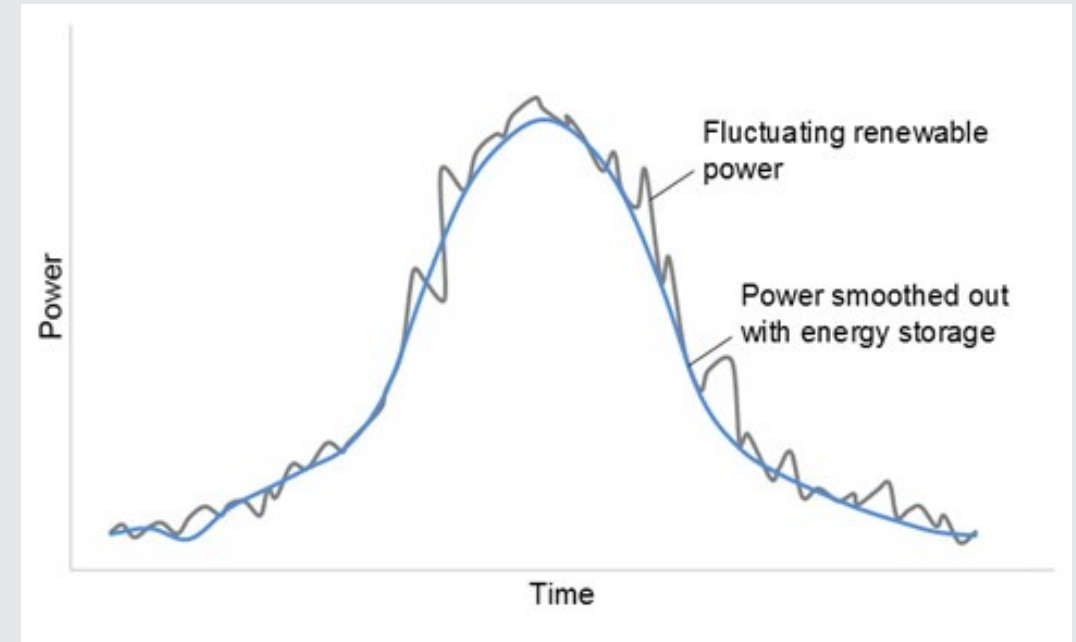
Sustainable  
**future**

**Grid**  
performance



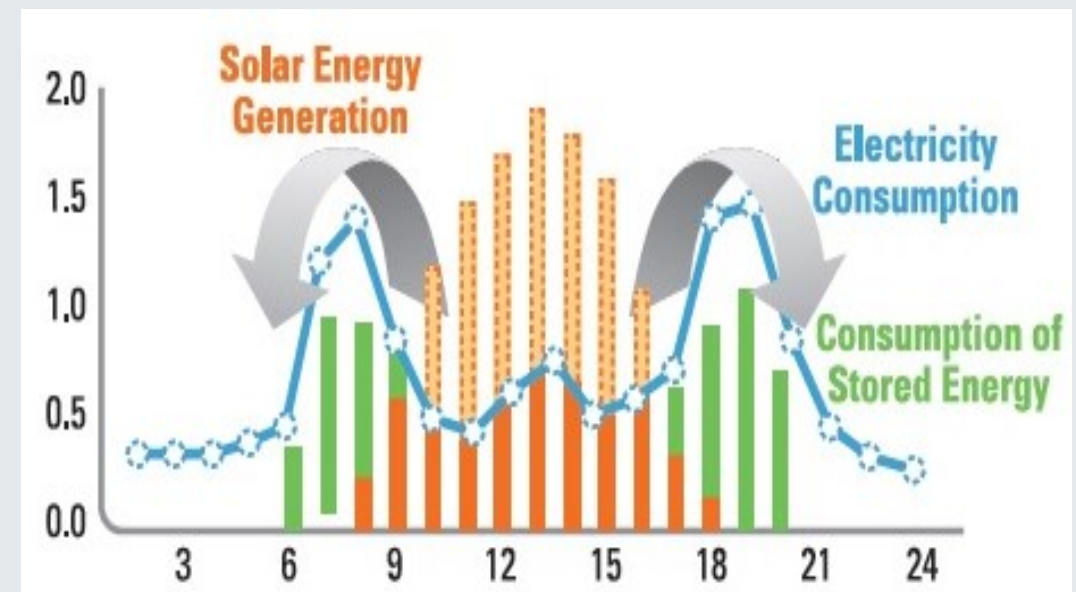
## Renewable Smoothing

- BESS is required to mitigate the intermittent fluctuations of Solar power generation due to cloud intermittency by smoothen Solar PV output power to grid.
- The BESS shall absorb short term power variations in Solar PV plant output by fast charging or discharging the battery and generate a smoother generation curve that can be absorbed in the grid in an easier way.



## Energy time shifting/Peak Shifting

- For energy time shift application the BESS shall time-shift the excess Solar PV plant output power and make it available to grid when needed.
- BESS shall automatically charge the battery with power from solar PV plant during solar generation hours and discharge the battery by supplying power to grid during peak load periods or as per grid operator requirement.



# Energy Storage

Typical use cases



**1. Time shift** of production



**2. Peak load shaving** for incoming power



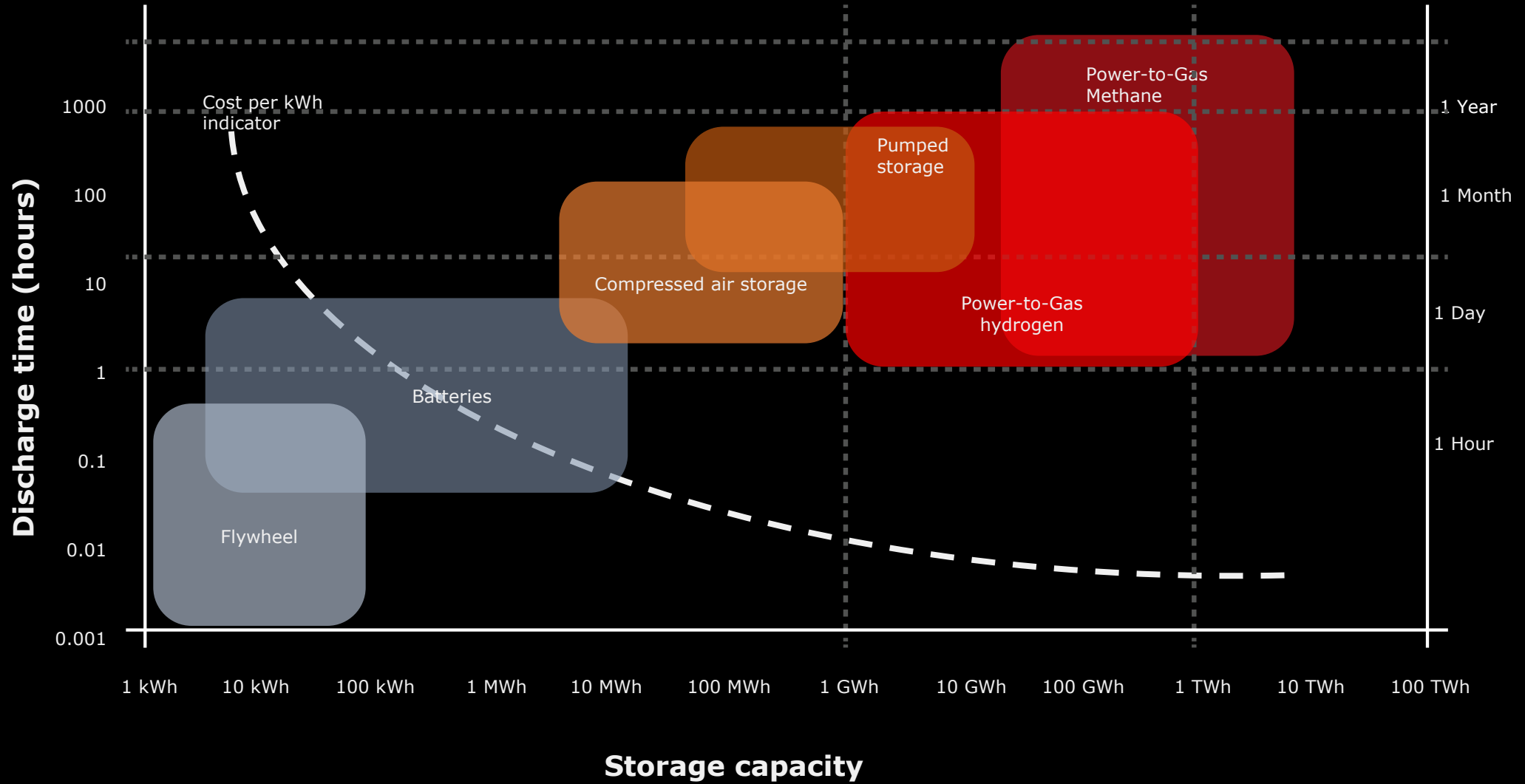
**3. Back-up** power or black-out start



## Application:

- Frequency response
- Backup Power
- Synthetic Inertia
- Lower c-rates (more stored energy)
- BESS for Mobile applications targeting low/zero emissions
- & to replace DG with BESS & PV
- Solutions for datacenters, DC Power Distribution

# Time-shifting **renewables**



# BESS

	Consolidated Energy Storage Roadmap					
	Applications		Energy Storage (GWh)			
	2019-2022		2019-2022	2022-2027	2027-2032	Total by 2032
Stationary Storage	Grid Support	MV/LV	10	24	33	67
		EHV	7	38	97	142
	Telecom Towers		25	51	78	154
	Data Centres, UPS and inverters		80	160	234	474
	Miscellaneous Applications (Railways, rural electrification, HVAC application)		16	45	90	151
	DG Usage Minimization		-	4	11	14
Total Stationary (GWh)		138	322	543	1,002	
Electric Vehicles	E2W		4	51	441	496
	E3W		26	43	67	136
	E4W		8	102	615	725
	Electric Bus		2	11	44	57
	Total Electric Vehicles (GWh)		40	207	1,167	1,414
Total Energy Storage Demand (GWh)		178	529	1710	2416	

According to Niti Aayog, India's renewable energy (RE) capacity is expected to reach 174 GW by 2023, accounting for 37% of the total power generation. To ensure reliable integration of renewables, the country needs 38 GW of battery energy storage systems (BESS) with a capacity of 150 GWh.

FTM BESS market size in India is expected to reach **41.65 GW** by 2030, with a storage capacity of **208.25 GWh**

BTM BESS market size in India is expected to reach 13.35 GW by 2030, with a storage capacity of 66.75 GWh  
Dominated by

Indian cities where the pollution levels are dangerously high are also likely to ban the usage of DG sets soon.

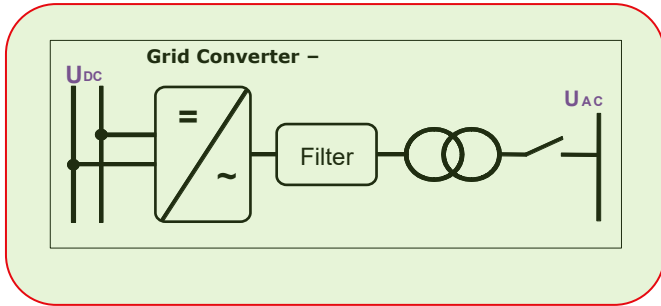
A report in 2018 by public policy consultancy Chase-India estimated the installed capacity of DG sets at 2042 MW in NCR cities – Gurugram (1623 MW), Faridabad (74 MW), Noida (294 MW), Ghaziabad (51 MW). Which is 2GW,  
By some estimates there are over 70GW (100kw to 1000kW) of large DG sets in India.

# Electrification introduction

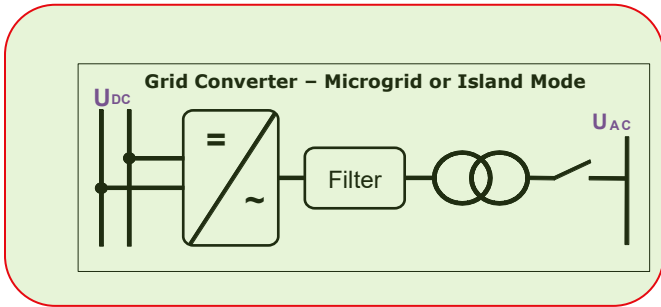
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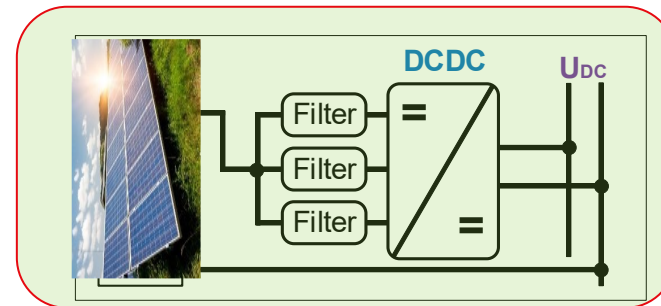
# Power Conversion Building Blocks with ready application adaptation & onshore & offshore , Air & Liquid cooled, Wide voltage & Power range coverage



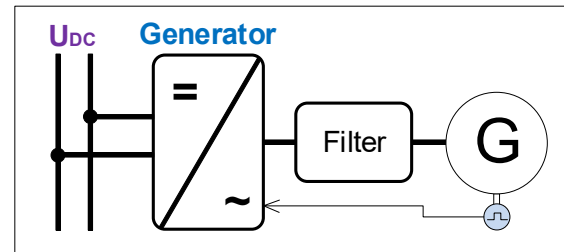
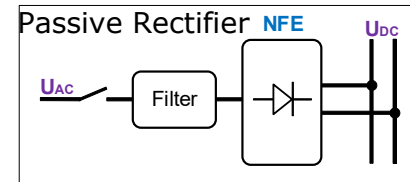
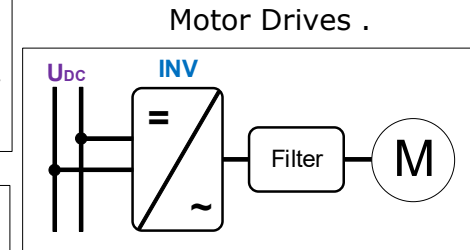
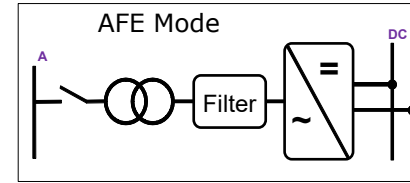
- Energy Storage on Grid , Offgrid , Peak shaving, Time Shifting, Grid stabilisation
- Power Generation
- Shore Supply
- EV Fast Charging of Onroad, Offroad electric vehicles e.g. Busses, Trucks Construction machines, port cranes, mining vehicles, Electric vessels, TugBoats,



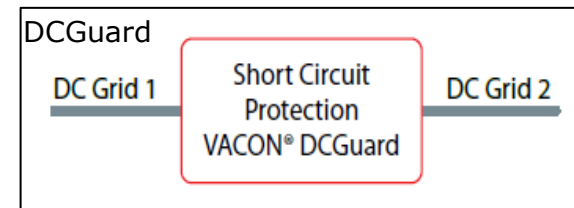
- Grid Forming / Island operation
- Grid Synchronisation
- Frequency Reserve
- Black Start
- Green Hydrogen @P2X.



- Direct to DC , Integrated Energy Storage in industrial applications.
- Fast Charging
- MPPT (Maximum Power Tracking)
- Green Hydrogen @P2X.



- Power Generation (Hydro, Tidal, turbines)
- Hybrid applications with dual mode Motor or generator



- DC Distribution in Marine Vessels
- DC Industry /Datacenters
- DC Grids /DC Power Distribution



- Grid Converter
  - AFE
  - MicroGrid
  - Island
- DC-DC Converter



NXP Power Converters



IC7 Power Converters



IC7 Enclosed Solutions



Reference Concepts  
2024

# What **Danfoss** offers



Full scale products



Dedicated application software



Wide range of certified grid code compliance



Safety certifications



Converter simulation model,  
Dimensioning & selectivity



Comprehensive supporting  
documentation



DrivePro® Site Assessment



DrivePro® Start-up



DrivePro® Extended Warranty



DrivePro® Spare Parts



DrivePro® Exchange



DrivePro® Preventive Maintenance



DrivePro® Remote Monitoring



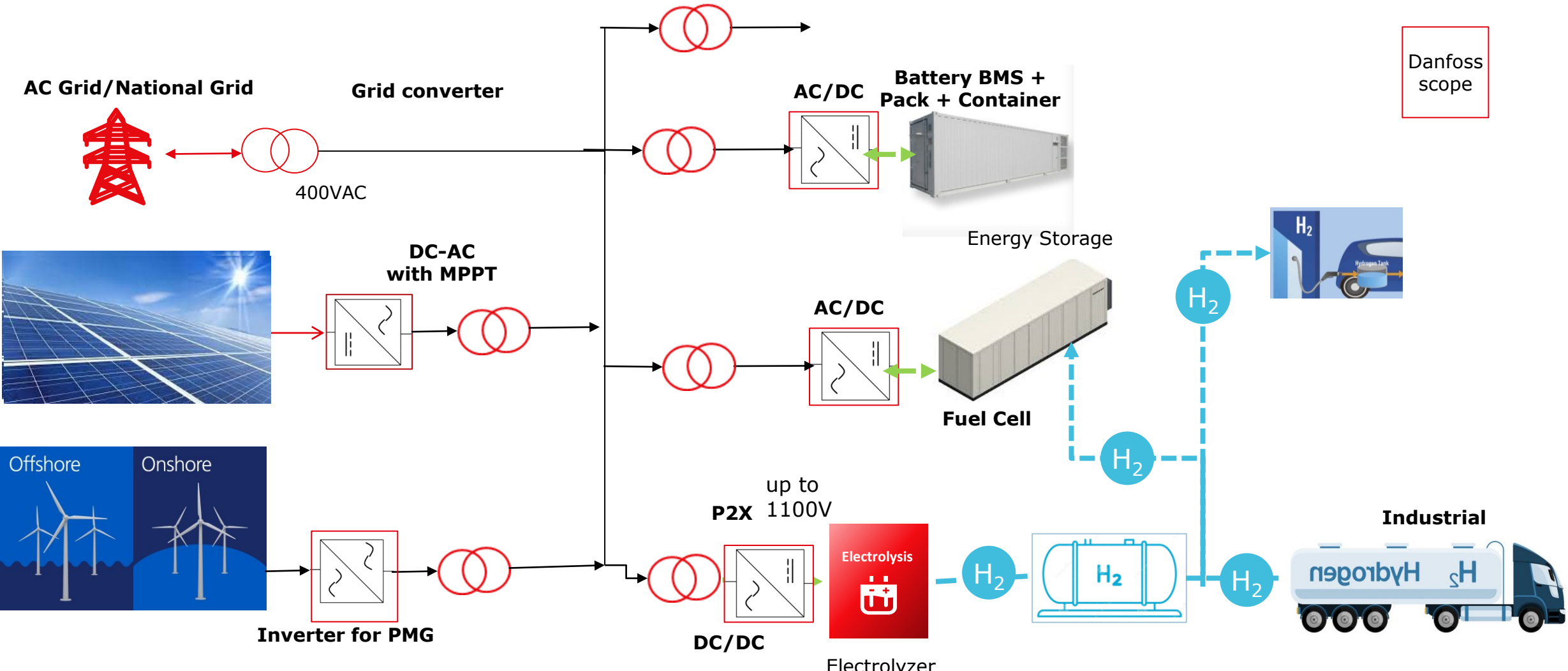
DrivePro® Remote Expert Support



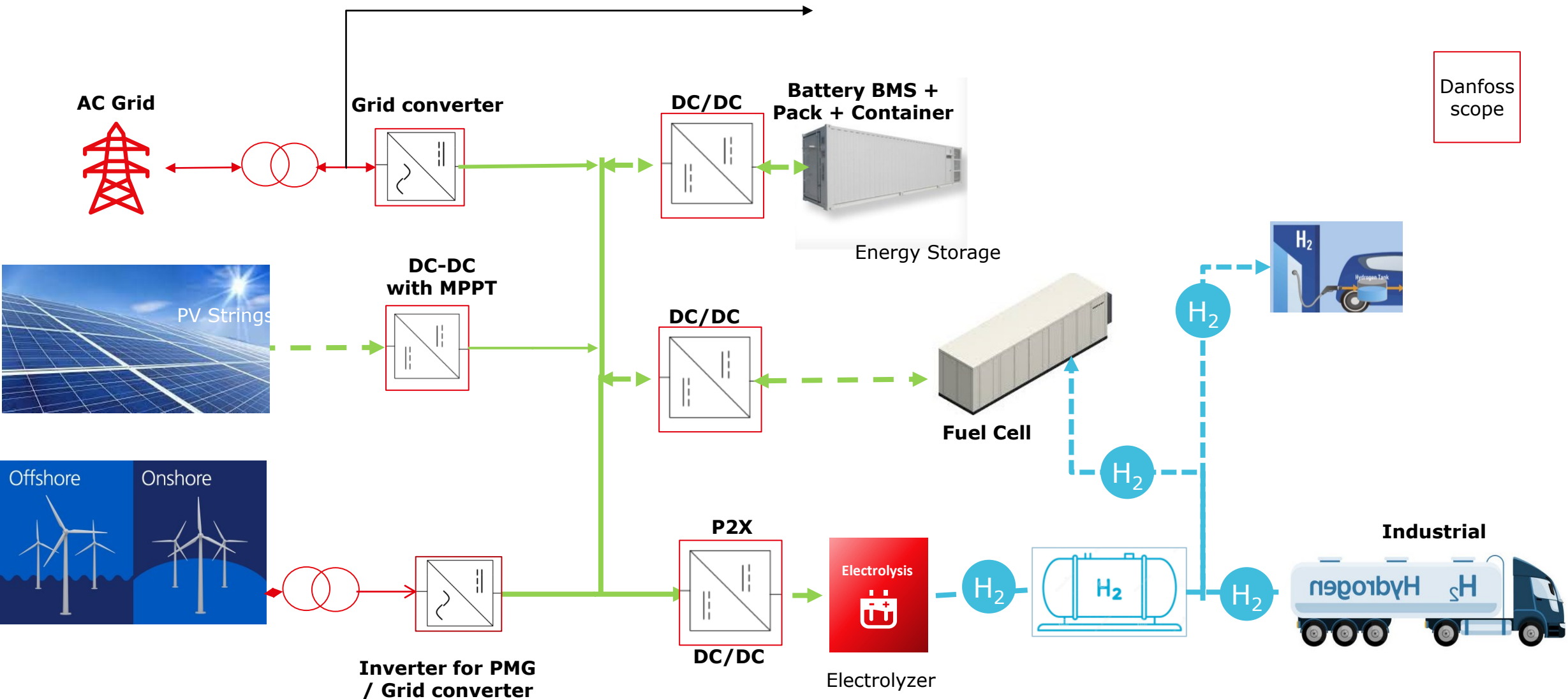
DrivePro® Retrofit

DrivePro® LifeCycle Services

# Power conversion is common for all AC Grid



# Power conversion is common for all DC Grid





## Electrification Focus Areas in Danfoss Drives



### POWER 2X

Enabling production of hydrogen to be utilized as 'green fuel'



Shore Supply  
And  
Offshore Electrification

Hybrid and full electric solutions



### FAST CHARGING

Heavy Duty fast and ultra-fast charging



### ENERGY STORAGE

Common enabler across onshore and offshore



# Dedicated smart grid application software

## Integrated smart grid software provides



### Power quality

- Harmonics / Interharmonics / Flicker
- Switching operations



### Static grid support

- Frequency and active power control
- Voltage and reactive power control



### Dynamic grid support

- Low-voltage ride through (LVRT)
- High-voltage ride through (HVRT)



### Grid code compliance



Immediate disconnection when unexpected islanding mode is detected



Robustness against load unbalances and grid disturbances

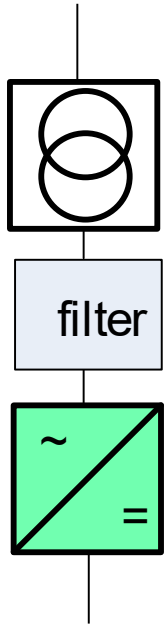


High configuration versatility

# Grid Converter (PCS)

Topology with Grid Converter : Normal charging output range from  $600V_{DC}$  -  $800V_{DC}$  or  $800V_{DC}$  -  $1100V_{DC}$   
 Bi-directionality available , Wide range of different power units available.

[VACON NXP air cooled](#)  
[VACON NXP liquid cooled](#)



## Air Cooled



Frame	Charger with 600 - 800V <sub>DC</sub>	Charger with 800 - 1100V <sub>DC</sub>
	P <sub>DC</sub> [kW]	P <sub>DC</sub> [kW]
FI9	114	110
FI9	138	127
FI9	175	151
FI10	259	231
FI10	309	288
FI13	773	812
FI13	874	909
2x FI13	1660	1727
3x FI13	2490	2591
4x FI13	3320	3453



## Liquid Cooled



Chassis	Charger with 600 - 800V <sub>DC</sub>	Charger with 800 - 1100V <sub>DC</sub>
	P <sub>DC</sub> [kW]	P <sub>DC</sub> [kW]
CH62	350	407
CH62	398	444
CH62	438	522
CH62	492	575
CH63	553	663
CH63	620	725
CH63	694	814
CH63	775	911
CH64	923	1044
CH64	1105	1150
CH64	1388	1327
CH64	1550	1504

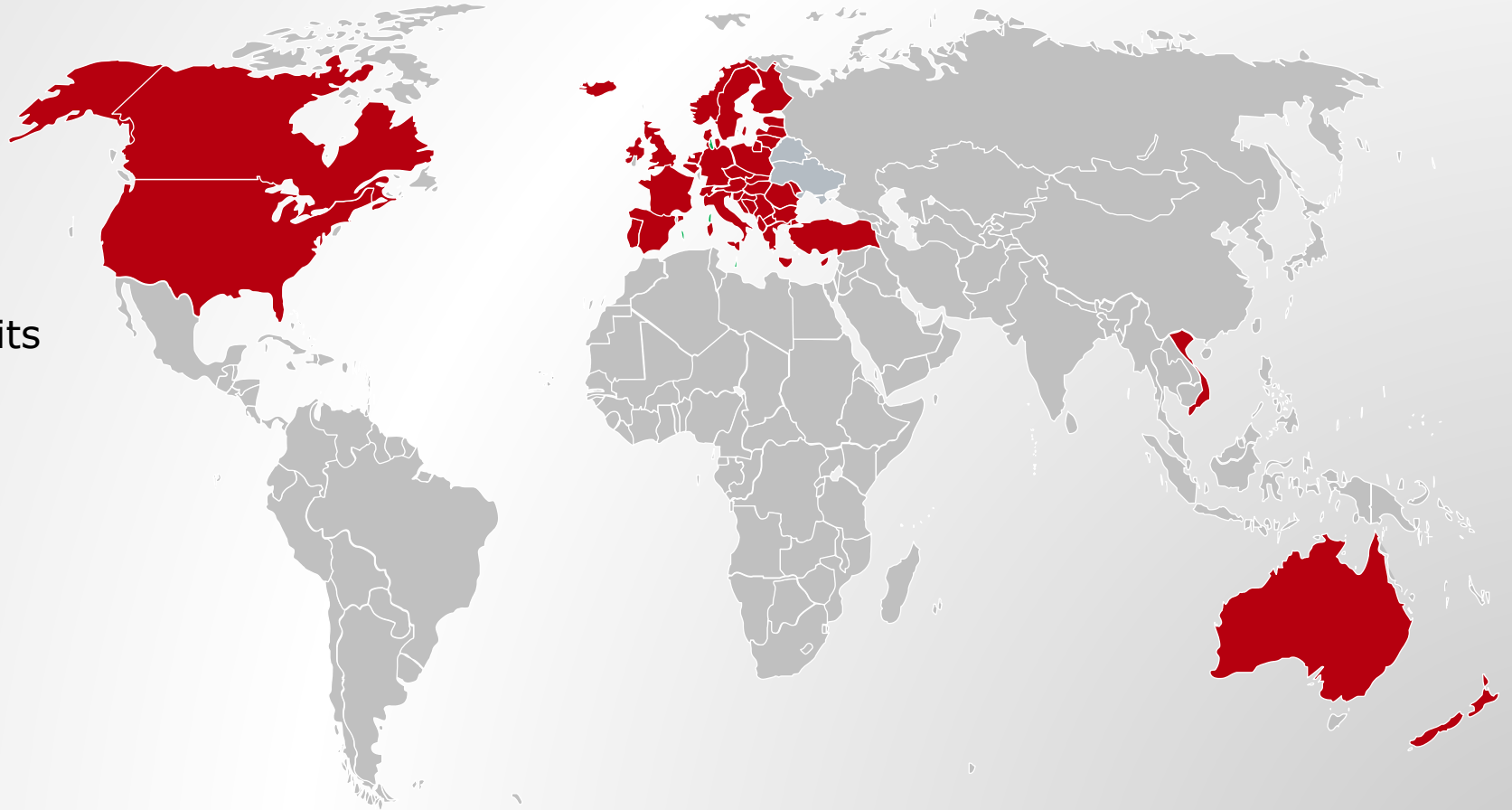
# Grid code and **safety certifications**

## Grid Codes

- IEC 62116:2014
- ENTSO-e (2016/631/EU)
- BDEW
- VDE-4110/4120
- AS4777.2:2015 Air cooled units
- IEEE 1547 (600VAC)
- Hawaii rule 14H
- California rule 21
- Thailand PEA 2013

## Safety Regulation

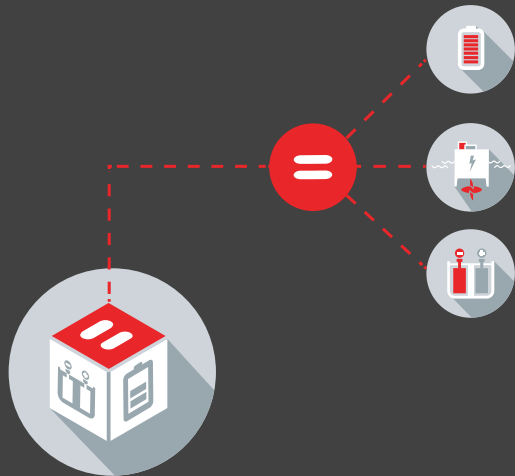
- UL1741 (600VAC)
- IEC 62109-1 & IEC 62109-2 Air cooled units





# DC/DC Converter application

DC to DC power conversion for energy storage and power supply applications



## Bi-directional DC/DC power conversion

### Key takeaways

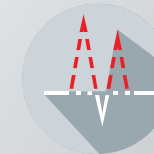
- Freedom to connect any energy source or storage at any voltage to a stable DC-bus voltage
- Create a robust and accurate high-power DC-power supply
- Ideal solution for megawatt-scale charging applications
- DC/DC with integrated MPPT



Energy storage & DC-power supply



Back-up power



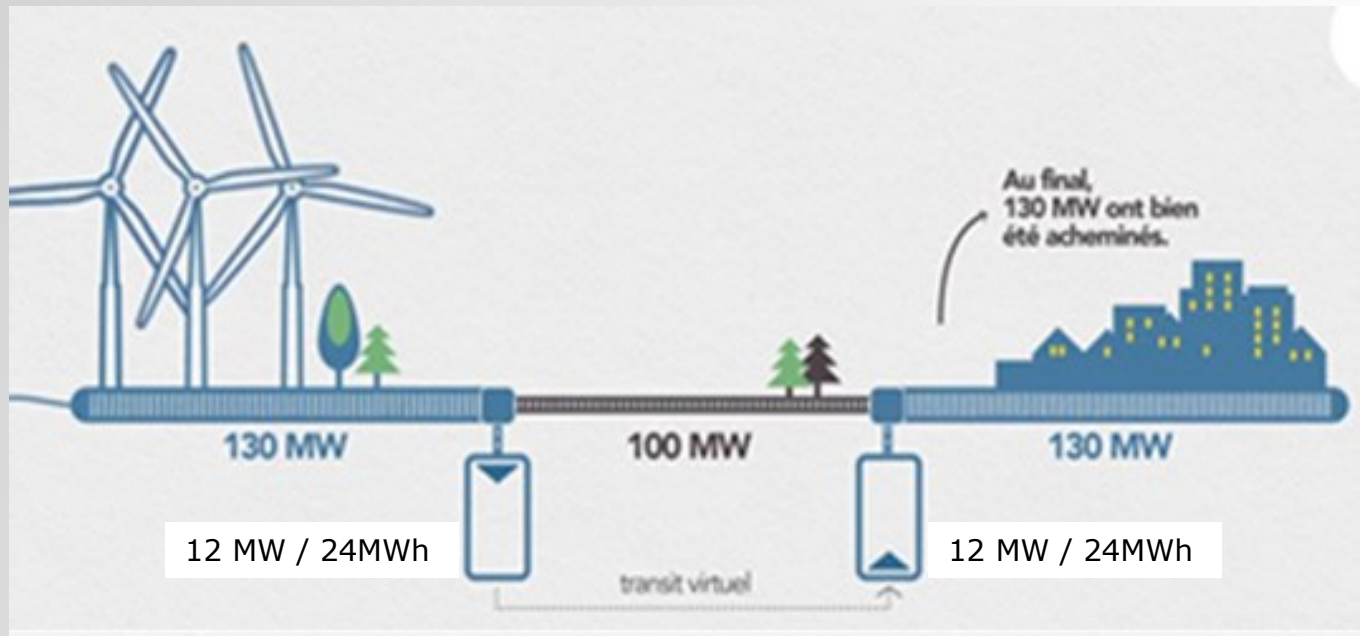
Time shifting



Peak shaving



# Use Case : Virtual power line "RINGO Project"



The ENGIE via SCLE-SFE Ringo project is part of the French utility RTE's initiative to create a "virtual power line" that came online in 2020 for a test period of three years, with the possibility of an extension.

The project uses energy storage systems to alleviate congestion on the power grid without constructing additional power lines.

The battery storage systems are strategically placed where the lines are congested and absorb large amounts of fluctuating renewable energy resources. The battery capacity at each site is 12 MW / 24 MWh.

ENGIE's INEO SCLE SFE has been involved in designing, delivering, and maintaining storage systems since 2009 and has developed its own versatile Energy Management System.

The company applies proprietary technology resulting from 14 years of R&D to storage system and micro-grid projects across 23 countries.

# Hospital St Damien, Haiti

## Diesel-PV-battery hybrid system



**Reduced** electricity cost and less down time.



**Increased** power supply reliability.



**Improved** air quality.

# Solar PV farm: Electric vehicle rapid charging

On- and off-grid  
energy storage  
systems rated up  
to

**100**MW

## PV-battery hybrid systems



**Flexibility** in variable  
price rates.



**Increased** power supply  
reliability and peak loads  
decreased.



**More sustainable**  
charging station.

# Supplying water pumps

**Supplying** of the water pump 90 kW up to 1 min. in case of main grid failure.

**Stopping** the pump even for seconds **causes**:



process disturbance



cleaning of the water supply system



losses of several thousands of Euros per failure





## Facts behind

- Volkswagen Group Services GmbH is a subsidiary of Volkswagen AG
- Electrification / 2<sup>nd</sup> Life BESS
  - VACON NX
  - SISO-LCL-Filter



11MW battery storage project:

Together by two technology partners  
Mercedes Benz Energy and Loccioni.

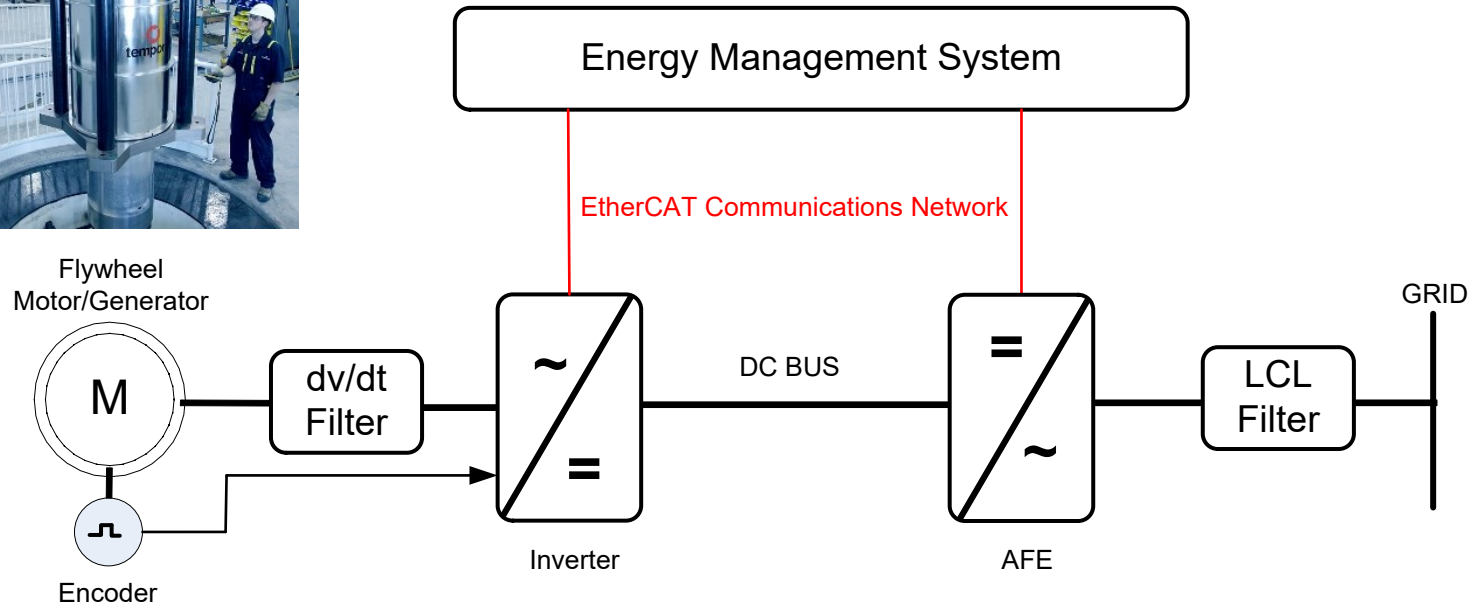
The aim is to help Mercedes Benz Energy  
to scale their battery storage business,  
Mercedes is using our FI10 NX Grid  
Converter with SISO technology.

The 11MW BESS / Storage is a great  
project with two business cases

1. FFR (fast frequency response)
2. Optimization of the base load of the  
neighboring 800 MW gas power plant

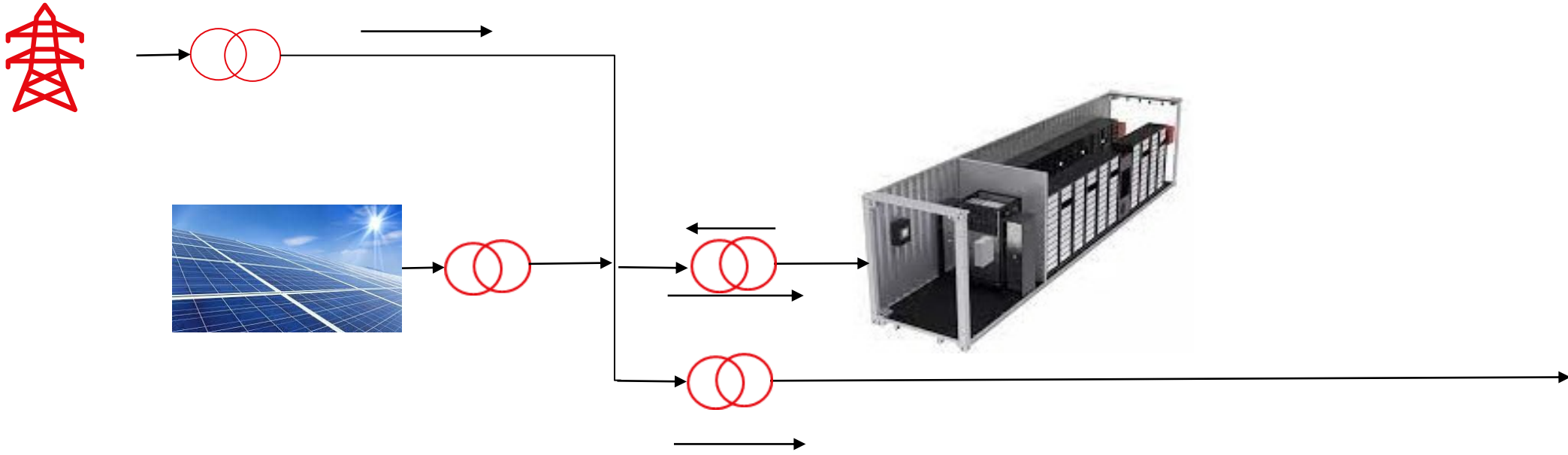
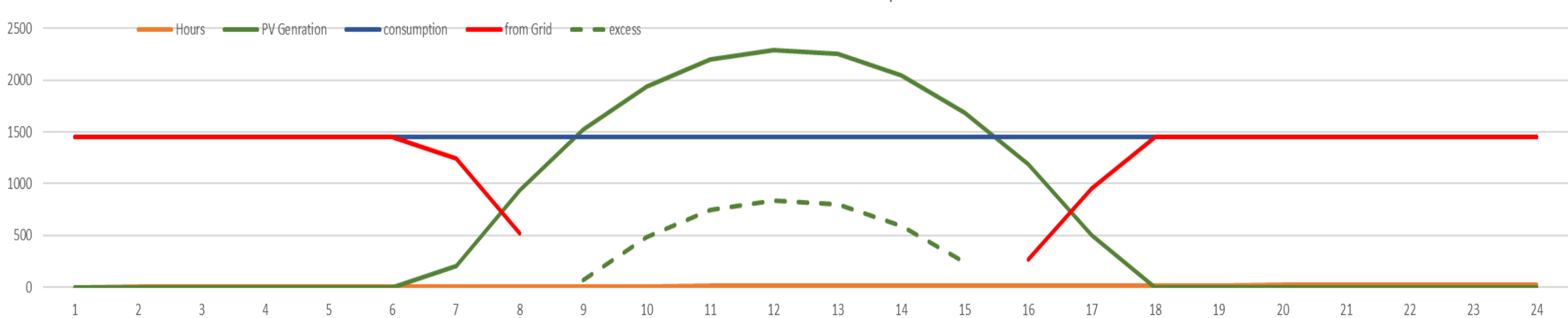


# POWER CONVERSION SYSTEM:



**SIMPLIFIED PCS SINGLE-LINE DIAGRAM FOR A SINGLE FLYWHEEL MOTOR/GENERATOR**

# Typical BESS for Behind the Meter





# IC7 Hybrid

Slim and lightweight – optimized for ease of integration and flexibility



Cooling air intake from front or from bottom for channel cooling (outside air)

Size	Non-regenerative Front End			Active Front End				
	NR11	2 x NR11	3 x NR11	AM10	AM11	2 x AM10	2 x AM11	3 x AM11
Nominal DC power [kW] @480 V	812	1550	2321	378	596	758	1190	1785
Nominal DC power [kW] @400 V	676	1288	1932	338	537	676	1074	1611
Voltage rating	3x 380-500 V AC, 460-800V DC							
Overload	110%/150%, 1 min per 5 min cycle							
Rated temperature	-15 to 40 °C/5 to 104 °F							
Maximum temperature (with derating)	55 °C/131 °F							
Environmental	3C3							

90% of losses to the cooling channel

	Enclosure size				[mm]	Enclosure size				
	AM10	AM11	NM11	LCL		AM10	AM11	NM11	LCL	
Width	170	210	235	235		Width	6.7	8.3	9.3	9.3
Height	990	990	921	1502		Height	40	40	26.3	59.1
Depth	502	502	502	502		Depth	19.8	19.8	19.8	19.8

# Grid friendliness

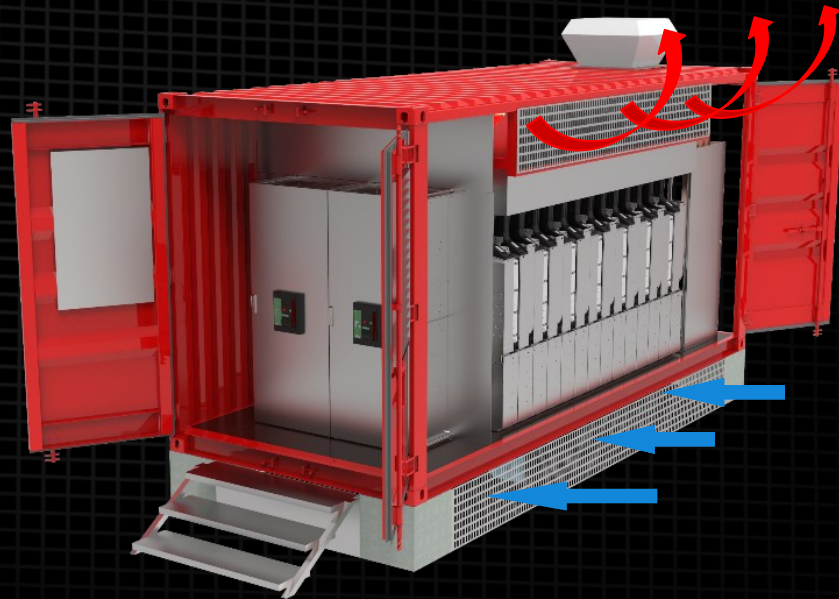
- Typically, less than 3% total harmonic distortion of the grid (THiD)
- >98% efficiency for any electrolyzer load conditions – from beginning-of-life to end-of-life of the electrolyzer
- Clean DC voltage with low ripple ensures high electrolyzer efficiency

**<3%**  
total harmonic  
distortion



# Power conversion for PtX plant

- The Danfoss Drives Grid Converter and LCL filter are equipped with a segregated IP54 cooling channel ensuring that approximately 90% of the heat is led outside the container. The remaining approximately 10% of the losses inside the container can be freely ventilated with direct outdoor air as the power modules are 3C3 rated.



**90%**  
of heat losses  
led outside the  
container





# Market exclusive independent paralleling

Unmatched redundancy without communication between the units

Paralleling  
Grid Converters

## Flexible paralleling options

Choice of paralleling topology is in your hands:

1. Unlimited number of Grid Converters can be paralleled independently with full redundancy
2. Up to 16 power units can be paralleled using single control unit which simplifies upper level control

Valid against main competitors

## Benefits

- Independent & fully redundant converters ensure availability
- Enables long distance AC- and DC-buses between port and starboard
- Reduced wiring in Grid Converters



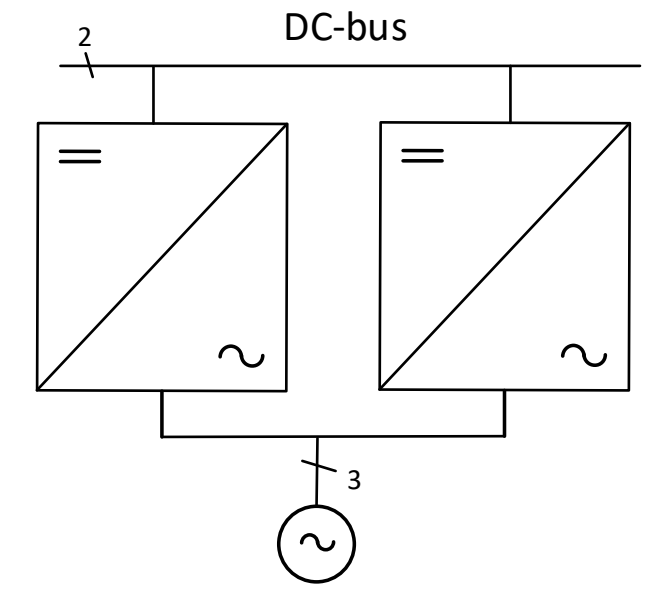
...increased availability & redundancy



...more flexible vessel & power system design



...reduced cost of redundant system



- iC7 makes a difference with**
- Paralleling without communication between units
  - Fast control loops



- Intelligence with new sensors

# Reduce other equipment needed

**Grid Converter can cover more functionality without additional equipment**

## Benefits

- Synchronization relay is not needed when connecting two grids together
- Grid Converter voltage measurement option can be used for voltage compensation instead of external components and reference
- Grid data can be monitored with iC7



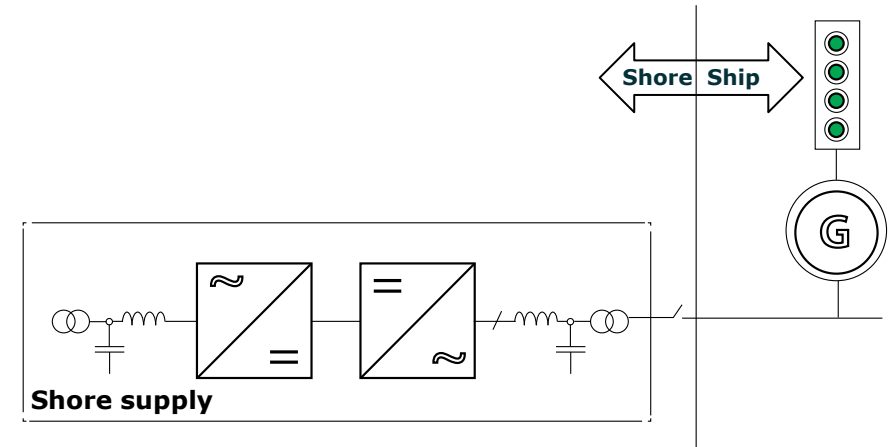
...simplified system design



...reduced engineering effort



...reduced cost of system



## **iC7 makes a difference with**

- Unique control modes
- Automatic limit controllers & mode change
- Fast control loops

# What **Danfoss India** offers



# 1.12 MW Solar Power Generation

Planned Capacity : 1125 KW  
Ground Mounted : 90 KW  
Roof Mounted : 1035 KW

Annual Generation Capacity  
1.3 Mn Units - 1105 Ton  
CO<sub>2</sub> Emission Reduction

PV modules use 300W x 3338, 330W X 380  
Danfoss invertor used 56 Nos.  
25 KW - 4 Nos.  
17 KW - 50 Nos.  
12.5 KW - 2 Nos.  
Solar module covered area : 8500 sq mt



# Grid-Diesel-PV-Battery (250Kw/270KWh) hybrid system- Danfoss INDIA -2022

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TOMORROW



Use  
case

**Danfoss, Chennai INDIA**

Needs

- Utilize solar energy
- Build PV Battery hybrid system
- Backup power supply

Benefits

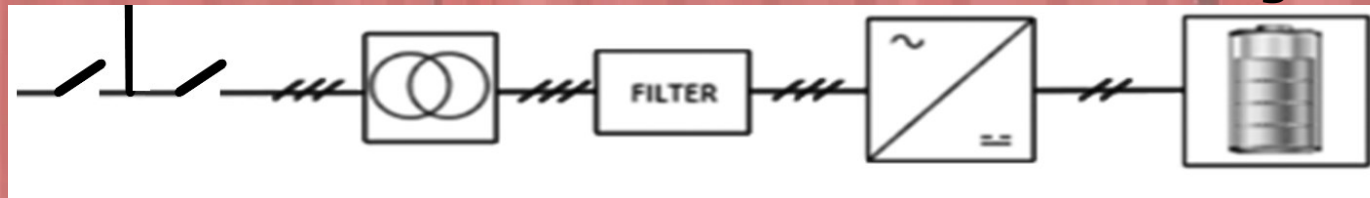
- Reduced electricity cost / Time shift
- Less down time
- Increased power supply reliability
- Improved air quality





# Danfoss

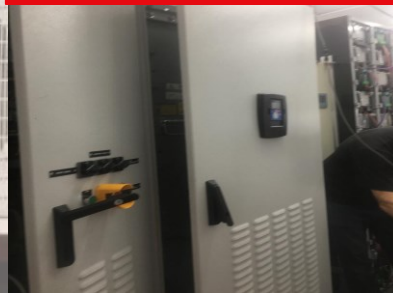
## Line diagram



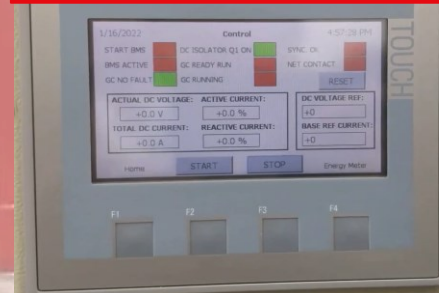
Galvanic Isolation cum  
voltage matchin  
transformer  
260kVA,415V/460V



Grid convertor NXA 0325  
6 +LCL 0325 6



EMS with PLC & HMI



Battery & BMS  
274kWH,900V Nominal



# Q&A Session





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