

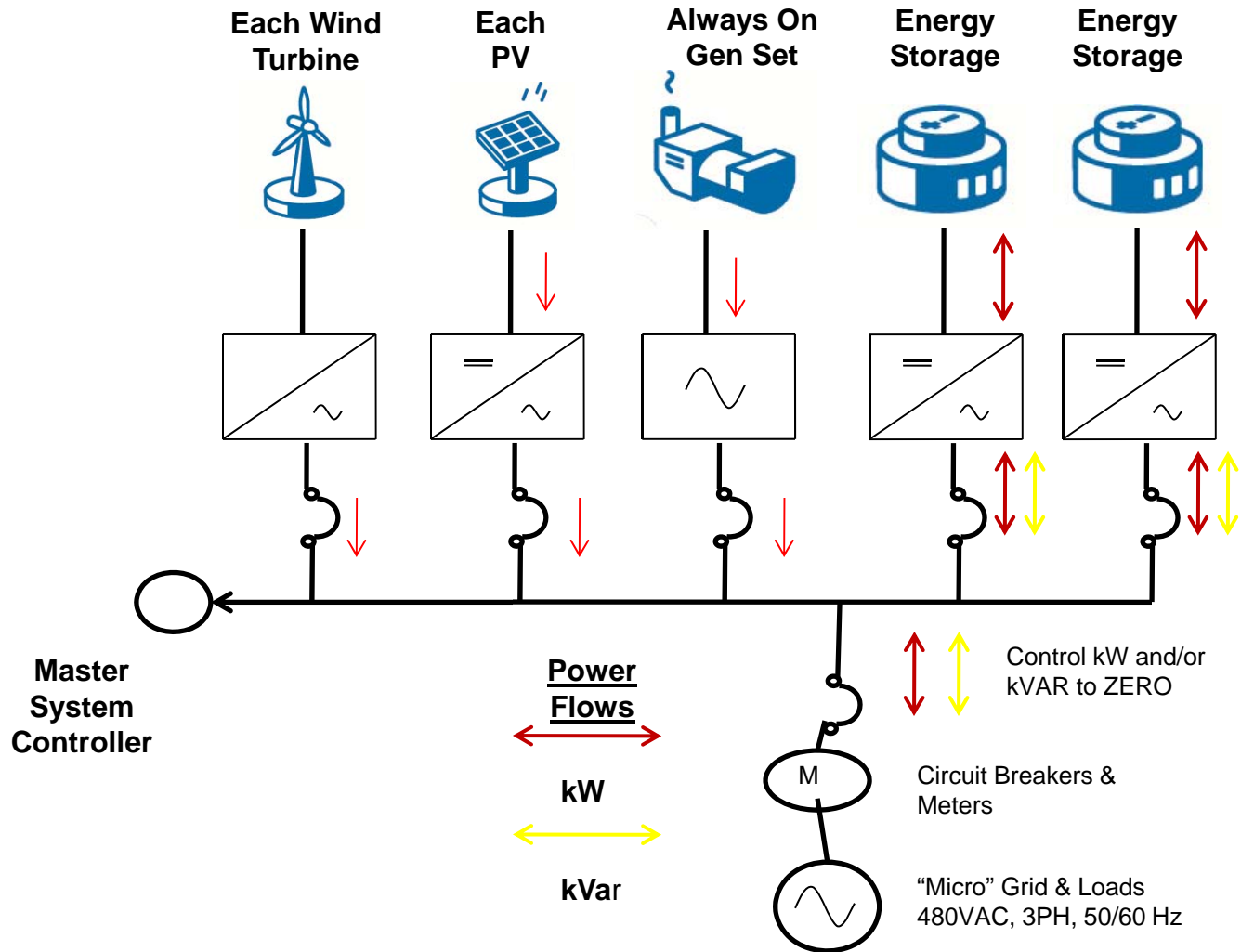
# Micro-grid's: Challenges and Solutions

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ZBB Energy

# Micro Grid Conventional Architecture

## Off Grid Non-Modular Power Plant



# Micro Grid Conventional Architecture

## Off Grid Non-Modular Power Plant

- Not a factory integrated and tested Energy Storage and Power Conversion System (PCS)
- Customer required to set up control dispatch or for load following
- Energy Storage suffers extra 'round-trip' across inverters (6 to 10% efficiency lost)
- Multiple inverters from various manufacturer's
- Challenging to expand or change given typical microprocessor controls
- At least one (1) gen set is required to ALWAYS run to provide voltage & frequency regardless of load on it.

# Micro Grid Conventional Architecture

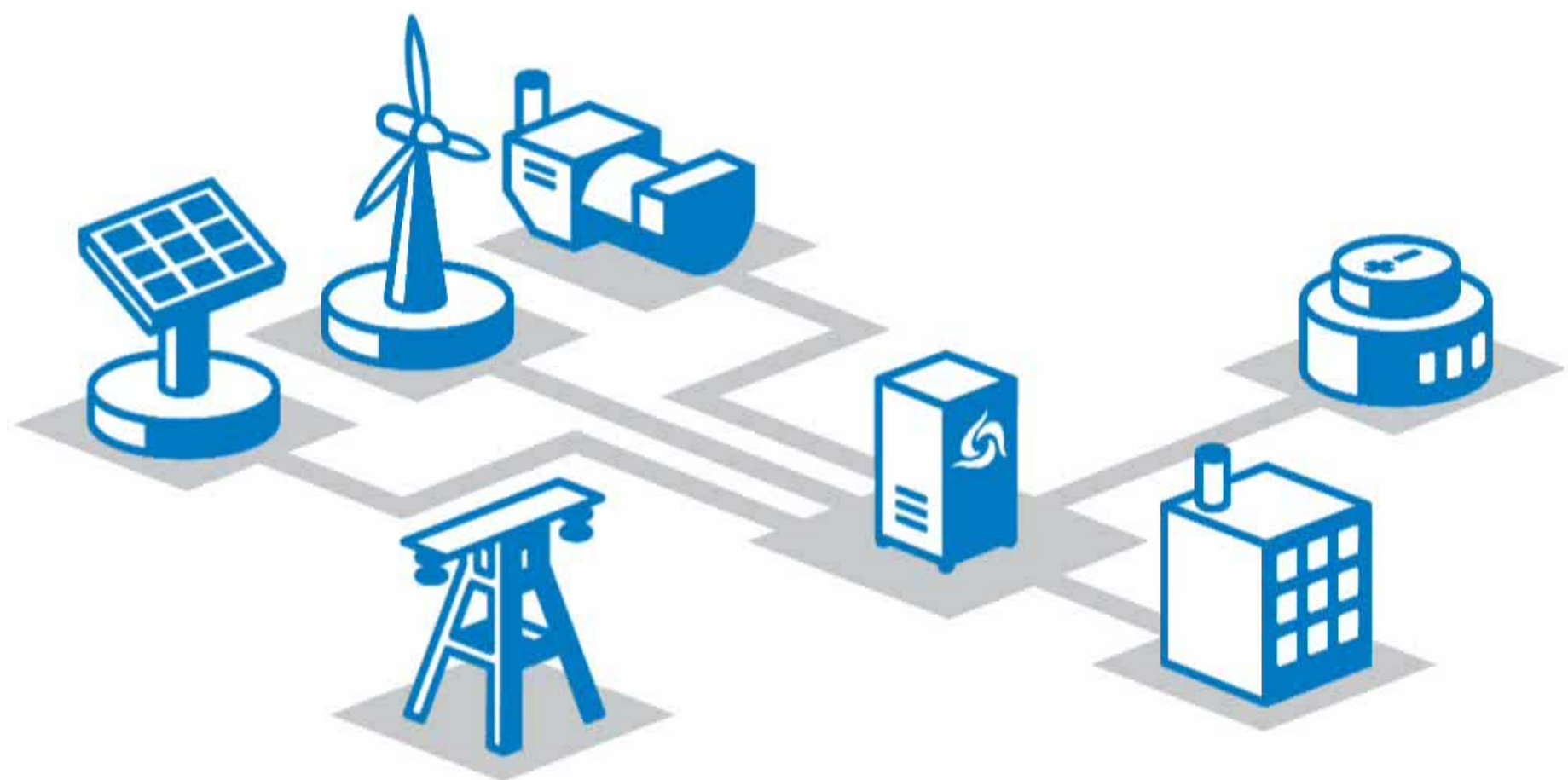
## Off Grid Non-Modular Power Plant

Operating independent of the grid and face these challenges?

- Often entirely reliant on diesel generation sets with their high costs of supply and maintenance
- Desire to have wind or solar as a main energy source but they are too variable
- Remote area with no connection to grid resources and no back up
- Integration of multiple and various supplies of technology, leads to conflicting requirements and needs

Need for a platform configuration that supports your electrical demands – while meeting your requirements for operating independent of the grid.

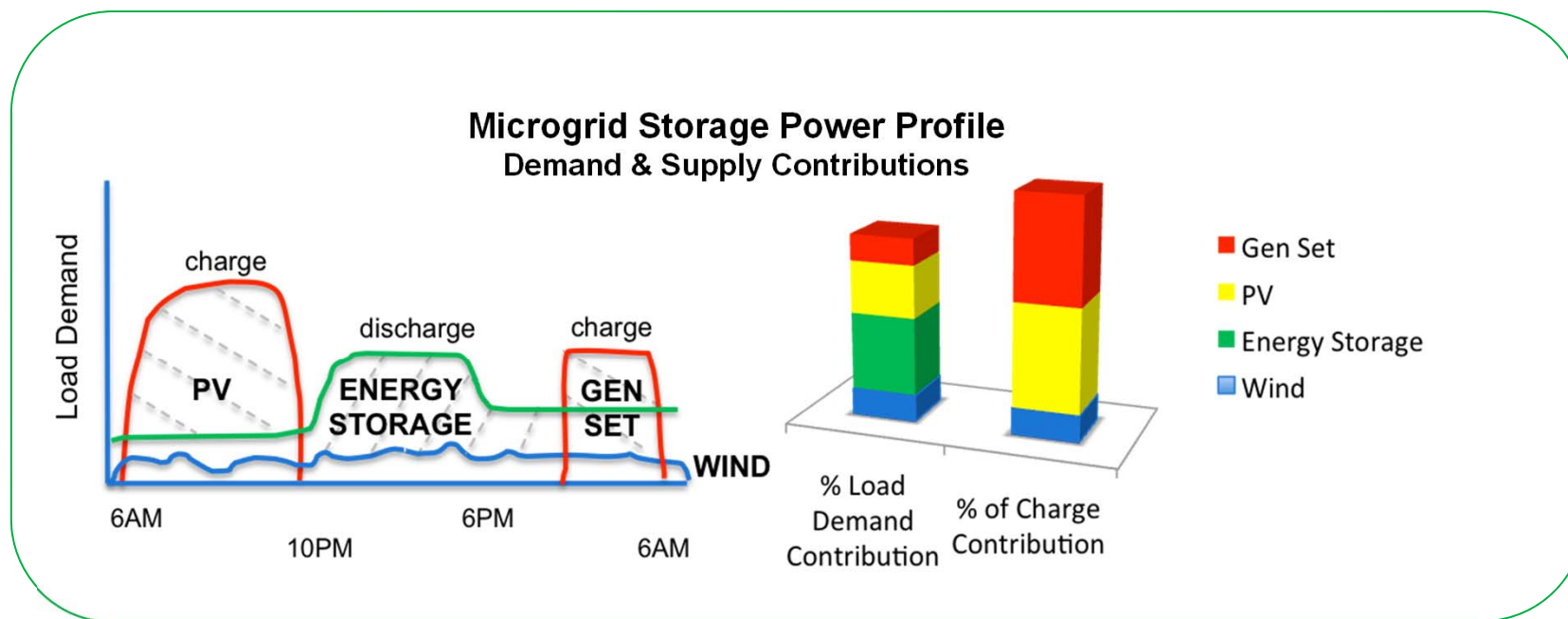
# Optimized Micro-Grid Solution



# Optimized Micro-Grid Solution

- Factory Integrated and tested Energy Storage and Power Conversion System (PCS) with connections for multiple power inputs
- Fully managed energy and power between the generation and the load demand
- Energy Storage provides “after hours” power plant operation
- Complete Reactive and Active Power supply for the load and / or grid demand
- Can be equipped & configured to operate ‘independently’ of the grid (as an EPS) or even have the grid as a power input

# Optimized Micro-Grid Solution



# ZBB EnerSection™

## Power & Energy Control Center

- **ZBB EnerSection** - “Cisco router” for power
- Microgrid-in-a-box
- Patented common DC bus
- Identical power modules; software configured
- Easily expanded in the field
- Proprietary inverters to 125 kW; ETL certified to UL 1741
- -30°C to +50°C temperature range





# ZBB EnerStore™ Energy Storage System

- Zinc-bromide flow batteries
  - Lowest long-term cost of ownership
  - Wide temperature range
  - 1-8 hour discharge times
  - 5x energy density of vanadium flow batteries
- Modular and transportable
- Scalable from 50kWh and up
- Environmentally friendly, easy to permit
- Multiple patents and trade secrets



**250kWh ZBB EnerStore**



**50kWh ZBB EnerStore**

# Optimized Micro-Grid Solution

- The ZBB EnerStore™ Zinc-bromide flow batteries or other energy storage devices, the platform creates an expandable system that independently optimizes the supply of each generating source while providing a grid-forming, load following steady-state power output to the electrical loads.
- The ZBB EnerSystem integrated energy management platform:
  - Provides a continuous supply of energy and optimizes all of the interconnected resources
  - Reduces the dependence on gen sets and minimizes fuel consumption
  - Eliminates the variable output of renewable energy sources
  - Easily integrates one or multiple energy generation sources now and in the future
  - Provides storage devices for both inexpensive and premium application needs
  - Uses off-grid inverters or inverter sets that form their own highly reliable micro-grid

# Optimized Micro-Grid Solution

- The ZBB EnerSystem is a solution that creates an independent power plant that:
- Ensures constant voltage and frequency
- Eliminates the need for ramp control of the renewable energy supply
- Gives you control over your active/reactive power dispatch, regardless of your generation sources
- Provides hybrid combinations of storage with generator start/stop signaling
- Minimizes the headaches from fuel supply bottlenecks and market pricing fluctuations

# Thank you

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