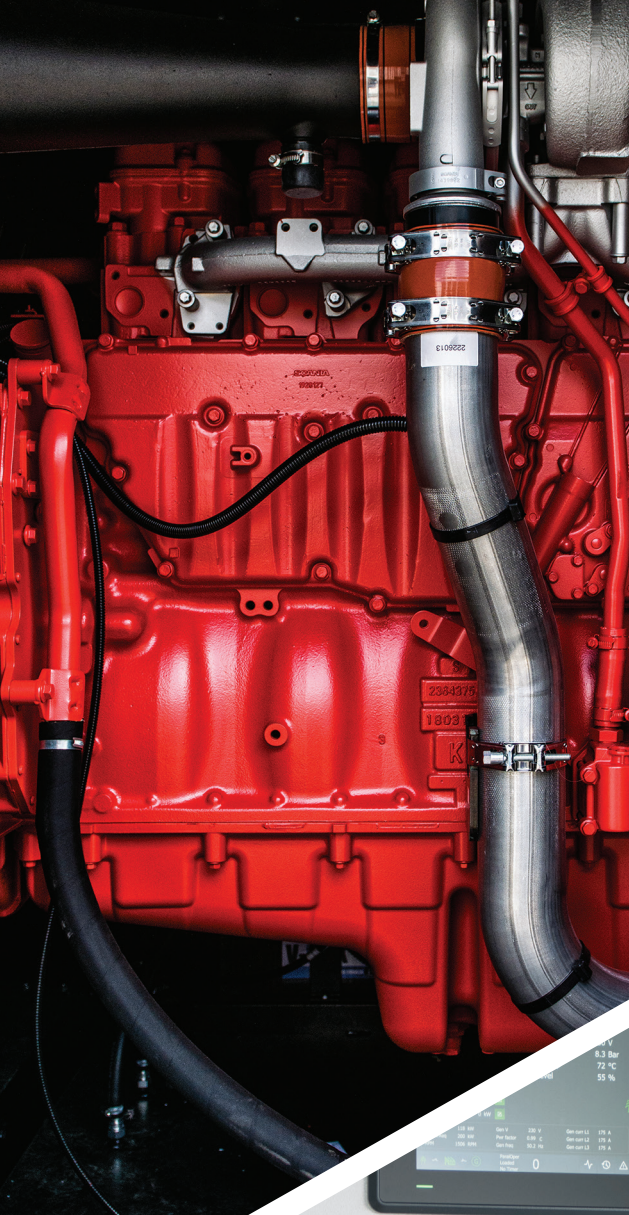


**Saving fuel and  
maximizing power  
system efficiency  
That's smart  
control**





# About ComAp

ComAp specializes in creating electronic control and management solutions for use in the power generation industries and drive power markets. Our portfolio of products, software and accessories is designed to support emergency power, standby power generation and engine driven applications all over the world.



Continuous investment in our specialist global network enables us to maintain excellence in customer service, empowering our people and partners to deliver the highest standards of technical expertise, and local support to our customers across the world.



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**Italy** Quinto di Treviso

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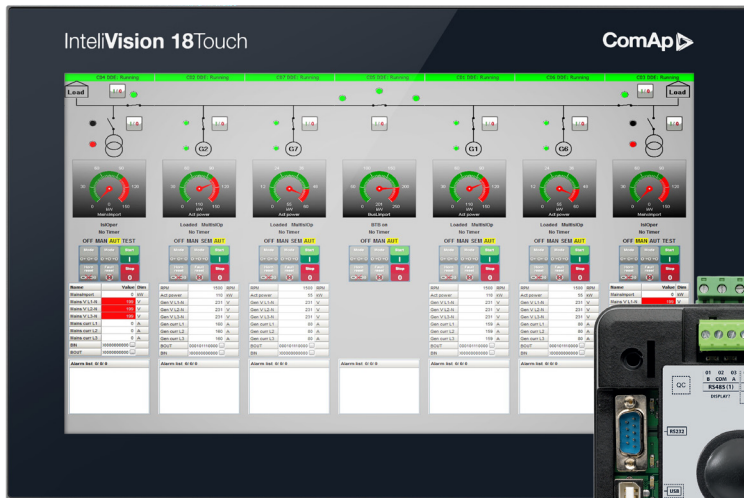
**Singapore** Singapore

**United Arab Emirates** Dubai

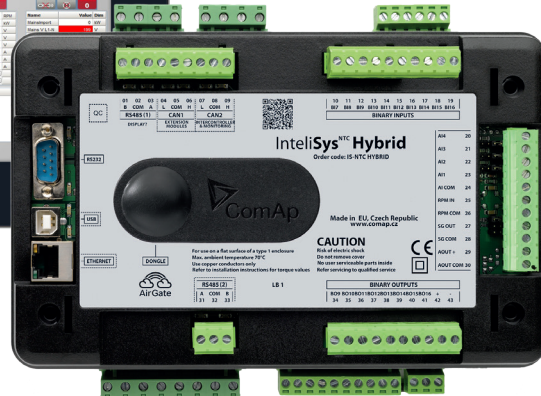
**United States of America** Roscoe

**comap-control.com**

# Hybrid Solutions



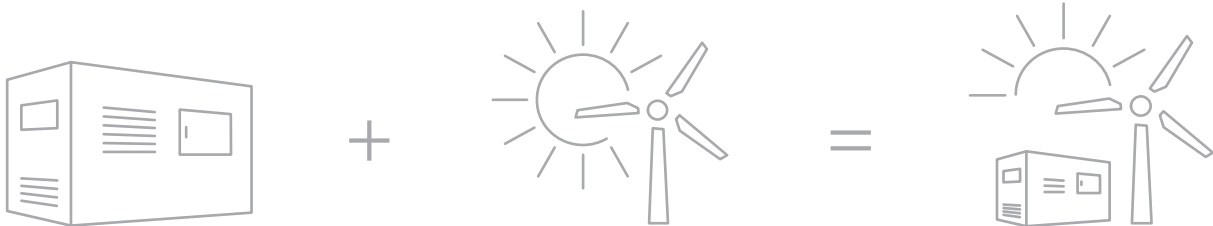
The usage of renewables significantly reduces the consumption of fuel and the amount of CO<sub>2</sub> emissions released into the atmosphere.



## Hybrid: The Future of Microgrids

The hybrid system uses a combination of renewables and conventional reciprocating gen-sets (engine generators) to generate electricity. ComAp's control system for hybrid applications enables you to use the best combination of renewables and diesel to save fuel and maximize your power system efficiency and reliability.

# The Advantage of Hybrid Applications



## Diesel Generator Systems

- + Reliable source of power
- + Variable load coverage
- + Quick availability and reaction
- Cost of fuel and maintenance
- Pollution and emissions

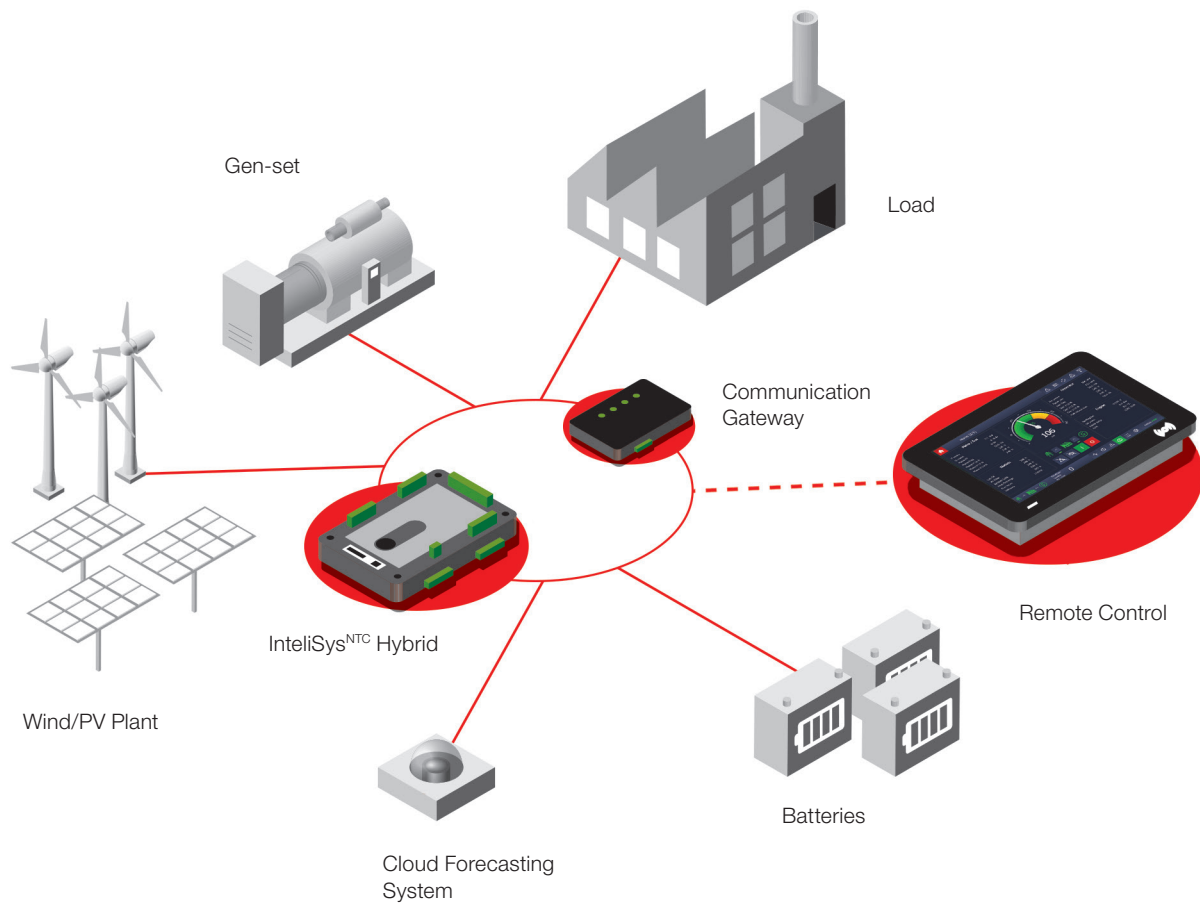
## Photovoltaic or Wind Turbine Systems

- + No fuel is burned
- + Environmentally friendly technology
- + Less maintenance
- Intermittency of production
- Unable to react on changing load
- Expensive energy storage required

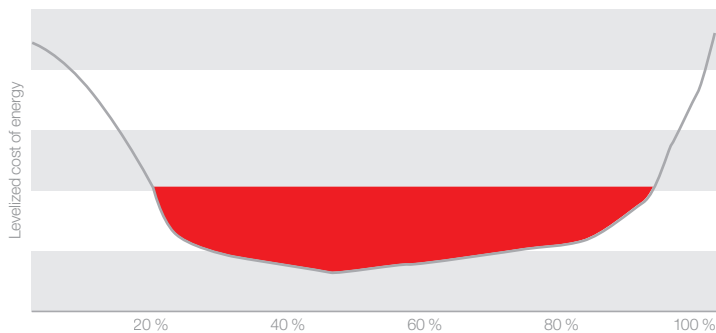
## Hybrid Power Systems

- + Lowering electricity costs and pollution, while keeping reliability
- + Less dependency on fuel shipments
- + Lower maintenance costs
- + Save fuel
- + Economical, even without subsidies
- + Lower requirement for power storage



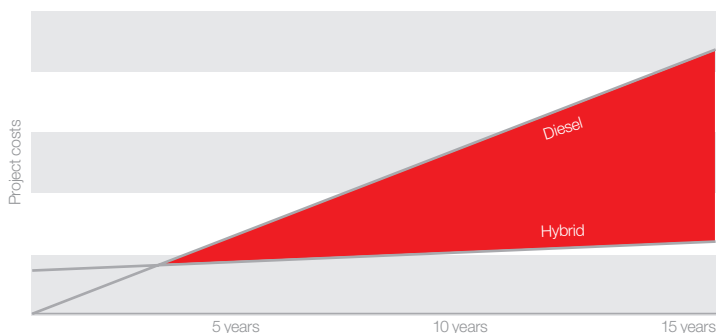


## Economic Viability



### Influence of Renewable Energy Penetration on Electricity Costs

The ideal penetration is between 40–60 %. Lower penetration means more fuel is burned and higher penetration means that expensive battery storage is needed.



### Return on Investment Period

The return on the investment period for a hybrid system is much shorter when compared to a purely renewable generation setup. The hybrid system begins to pay for itself faster, due to the lower cost of generating electricity with a renewable system.

# Typical Hybrid System Application



## Mining

Mines are often located out of reach of the electricity grid. Up to 30% of operating costs are spent on power generation through diesel power.



## Off-Grid Agriculture

Off-grid agricultural sites can get most renewable sources by combining biogas and other renewable sources of energy.



## Remote Hotels and Resorts

People like to get far away from civilization, but they don't want to give up the technology and comforts of home. Remote resorts can use hybrid systems to lower their bills for diesel.



## Island and Village Electrification

Islands pay amongst the highest prices for electricity in the world. Island nations are also concerned about global warming and rising sea levels. Adopting renewables is a must for them.



## Remote Industrial Facilities

Industrial and manufacturing facilities in remote locations with weak or no grid rely heavily on diesel generators. A hybrid system can significantly cut electricity costs.



## Defence

Temporary or permanent military bases in remote locations and war zones have to rely on diesel transports. They can lower this reliance by using renewables alongside the diesel gen-sets.



## Telecom

ComAp telecom solutions have been designed in a way to comply with requirements of both mobile operators and tower companies, as well as OEMs and gen-set packagers.



## Oil & Gas

The Oil & Gas market services the power generation market in which electrical power is generated by gas engine gen-sets running on natural or renewable gas types, including all other gas derivatives.





# Cloud Forecasting System (CFS)

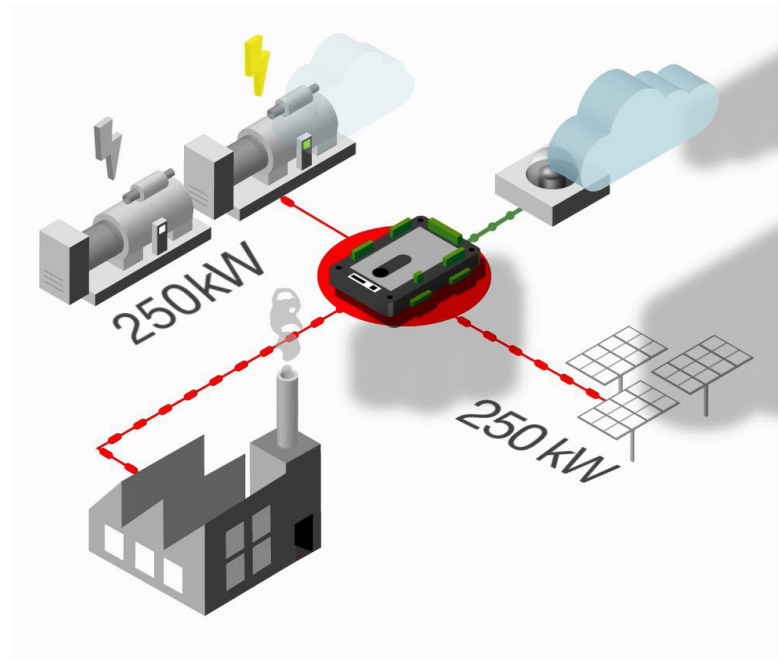
The Cloud Forecasting System is a complementary extension of ComAp's hybrid microgrid controller IntelliSys NTC Hybrid, which significantly increases the efficiency of the site operation while maintaining the high reliability and safety of power supply provision.

It is recommended for use in PV-Diesel applications with high penetration of renewable energy where it significantly reduces the operational costs by minimizing the Dynamic Spinning Reserve and thus reducing the diesel consumption.

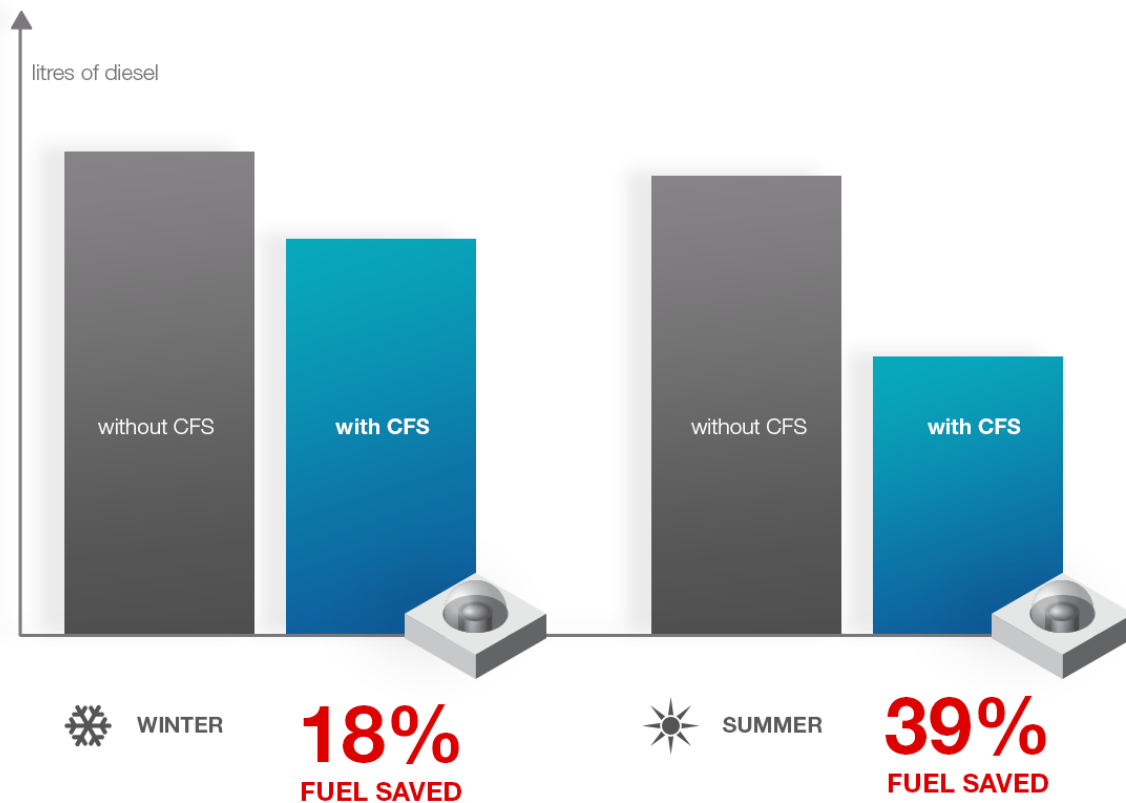
The Cloud Forecasting System monitors the cloud movements in a real time and predicts the overall solar irradiation above the photovoltaic power plant.



Animated Scheme in Digital Brochure



## Fuel Consumption\* with and without CFS

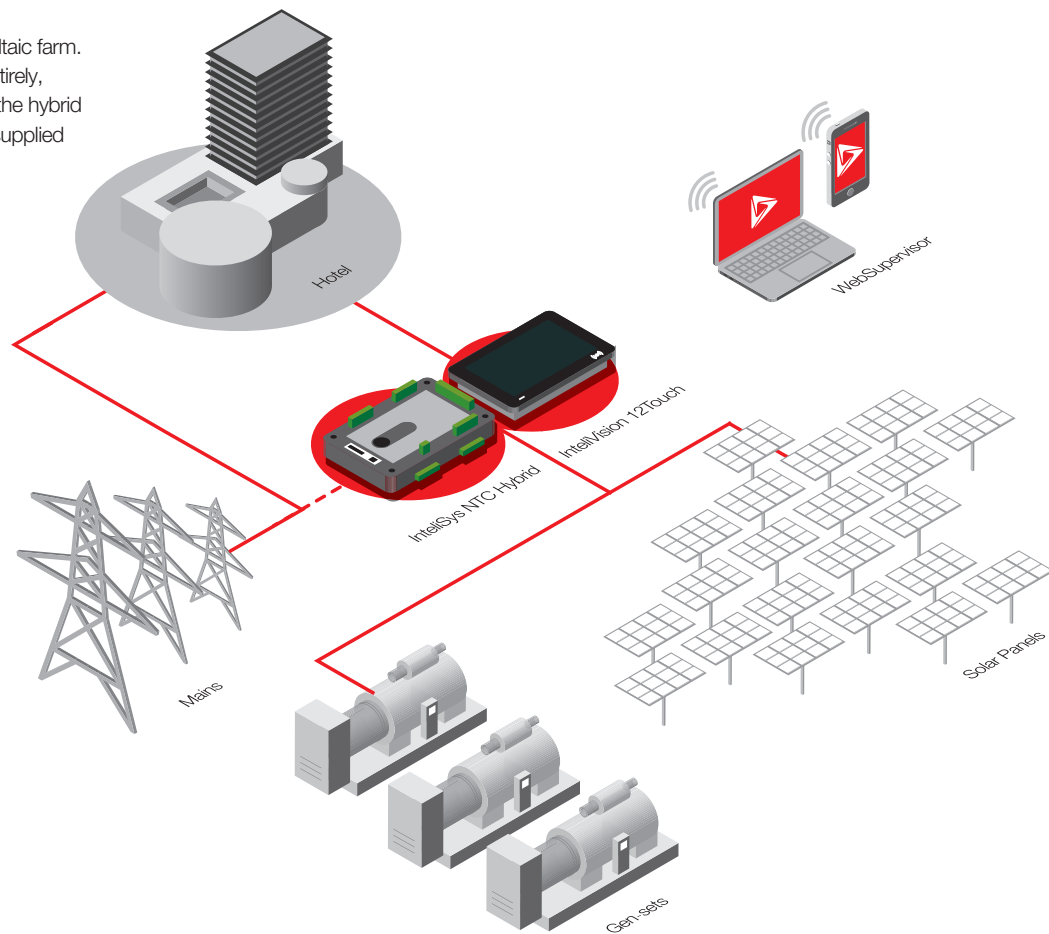


\* Results of a case study from production facility with industrial load profile and 375 kVA diesel generator connected in parallel with a 1MWp PV plant. Location: California. Solar output data source: NREL

# Examples of Renewable Applications

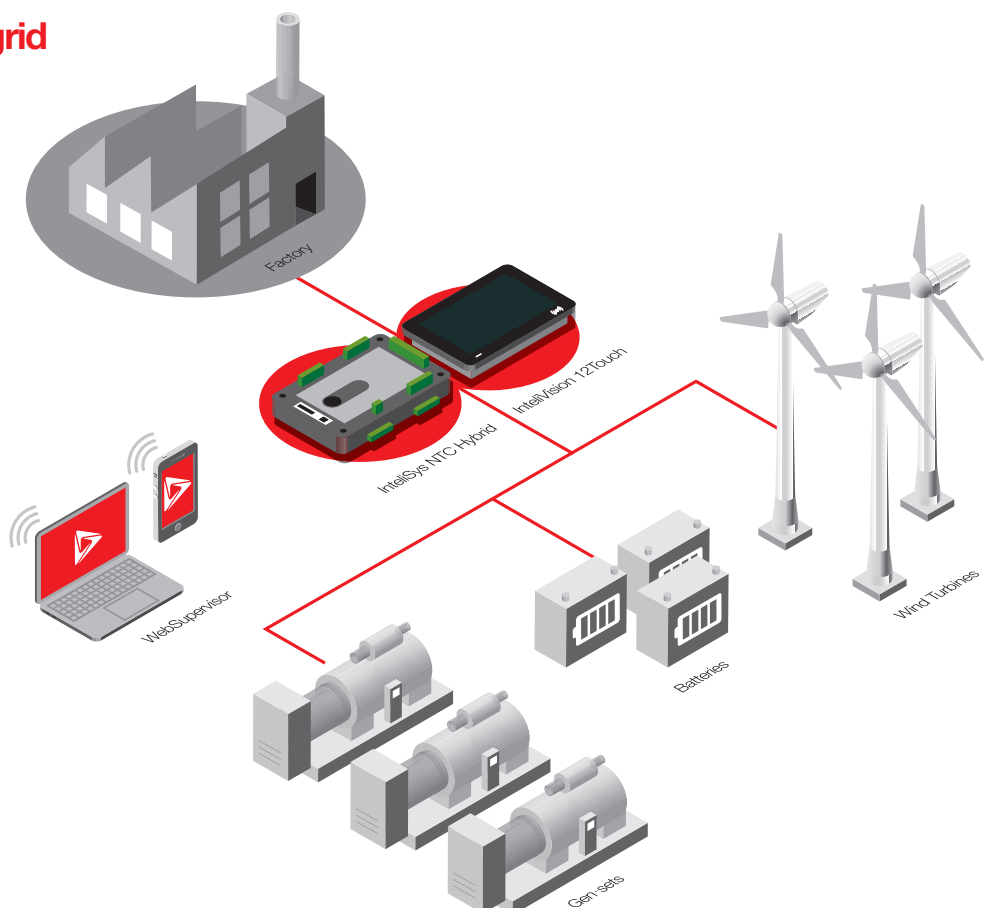
## A Hotel with Supplemental Microgrid

This scenario shows a hotel in a location where the unreliable grid is supplemented by a photovoltaic farm. Should the mains become unstable, or cut off entirely, the other distributed energy resources (DERs) in the hybrid microgrid takeover. They ensure that the load is supplied until the supply becomes viable again.



## A Factory with Island Microgrid

In this scenario, a factory located on a remote island is supplied by a wind turbine farm and a battery storage. When energy harvested from wind is insufficient to power up the factory, the generators start up, ensuring a stable power supply until the wind turbines are able to charge the batteries again.

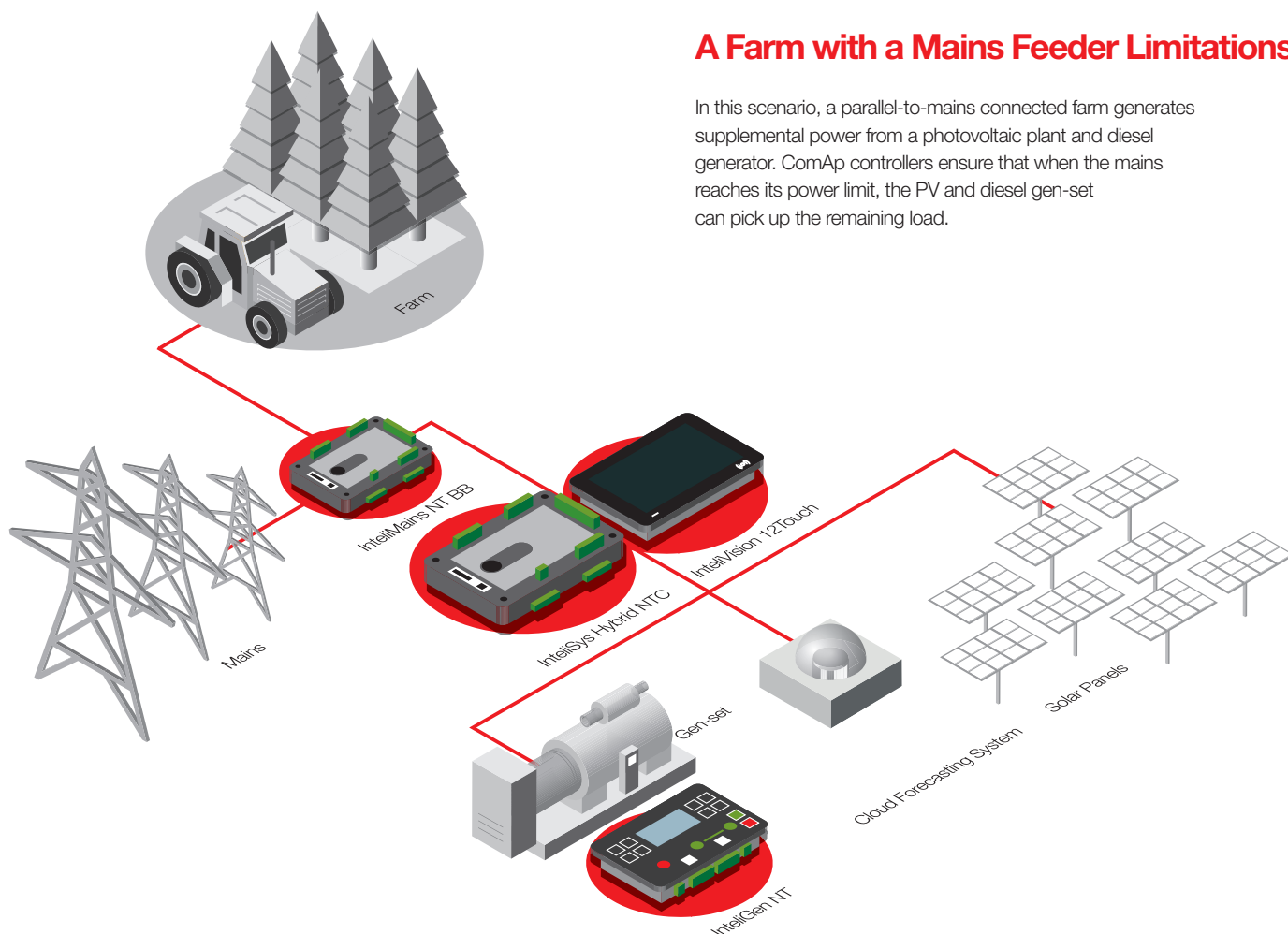




# Examples of Renewable Applications

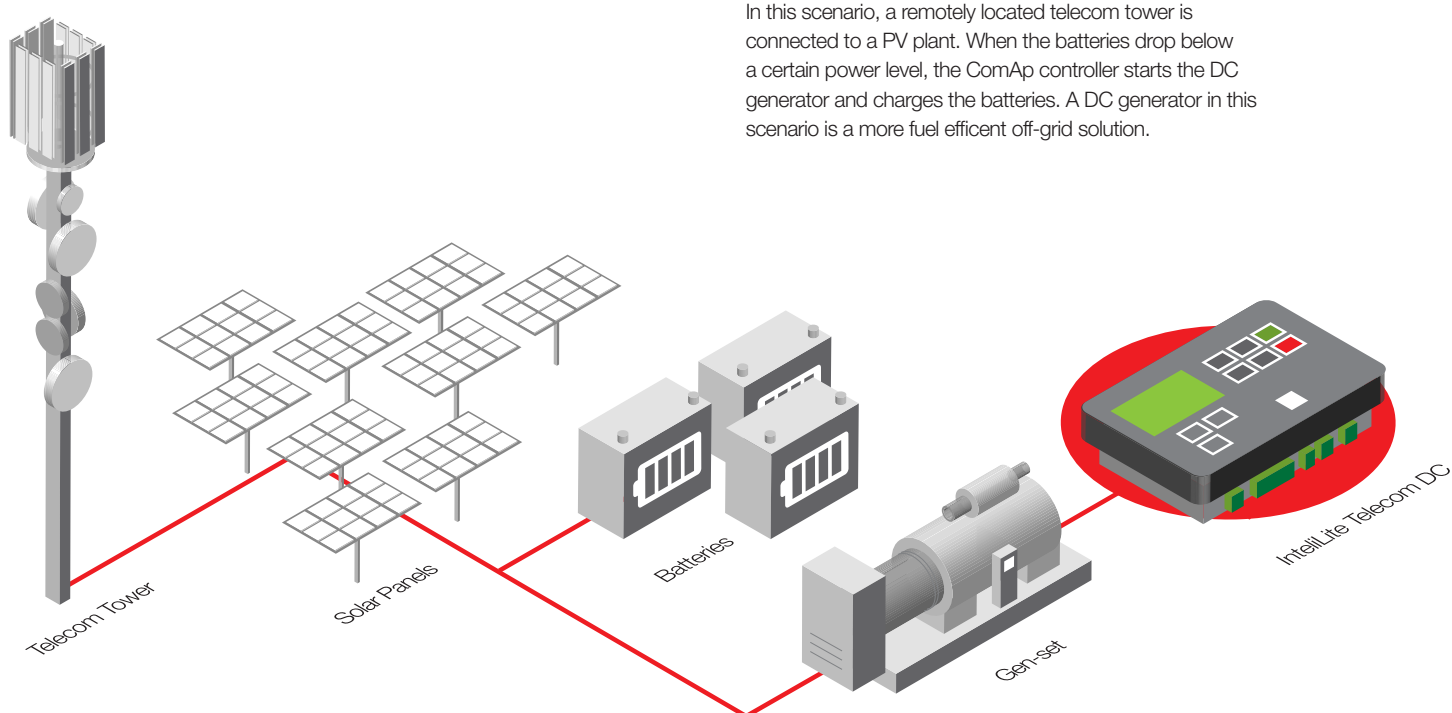
## A Farm with a Mains Feeder Limitations

In this scenario, a parallel-to-mains connected farm generates supplemental power from a photovoltaic plant and diesel generator. ComAp controllers ensure that when the mains reaches its power limit, the PV and diesel gen-set can pick up the remaining load.



## A Telecom Tower with DC Gen-set

In this scenario, a remotely located telecom tower is connected to a PV plant. When the batteries drop below a certain power level, the ComAp controller starts the DC generator and charges the batteries. A DC generator in this scenario is a more fuel efficient off-grid solution.



# Key features of ComAp system



## Power management

Starts and stops the gen-sets based not only based on the load demand, but also based on the requested load reserve regardless of the size, rated output and manufacturer. A fully automated digital system with user-friendly interface.



## Full Generator Control

Starts and stops the gen-sets not only based on the load demand, but also based on the requested load reserve regardless size, rated output and manufacturer. A fully automated digital system with a user-friendly interface.



## Load Sharing

ComAp load sharing of active and reactive power works seamlessly with any renewable energy source including all frequency and voltage regulations.



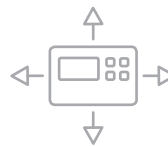
## Cloud Forecasting System

The Cloud Forecasting System significantly increases the efficiency of site operation while maintaining high reliability and safety concerning power supply provision.



## Dynamic Spinning Reserve

ComAp controllers only keep the necessary spinning reserve that can be dynamically changed according to the actual site requirements. This achieves the highest level of fuel consumption efficiency without threatening the power supply delivery.



## Side-demand Management

In order to assure security of the power supply, ComAp controllers provide controlled disconnection of various load circuits based on their priority and pre-set side-demand logic.



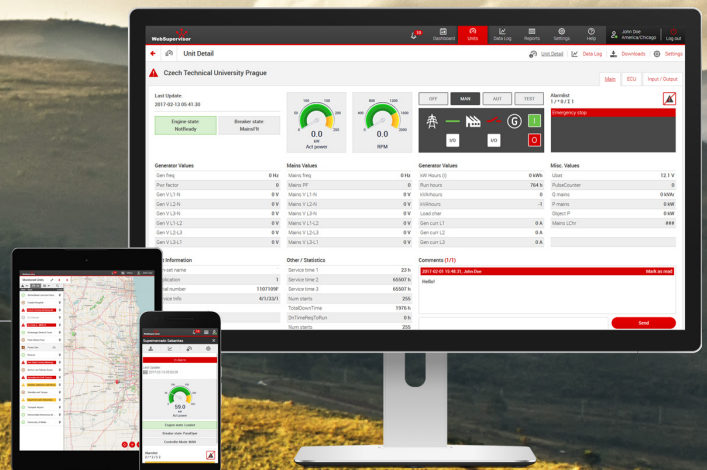
# WebSupervisor

WebSupervisor defines a new standard in cloud fleet management systems for managing ComAp and monitoring 3rd party devices via the Internet. This system offers a number of beneficial features that help optimize revenue for machinery fleets, as each piece of equipment can be individually monitored for all important operation values.

WebSupervisor gives you an overview of all of your asset's status, location and other important data and alerts all on one screen. Detailed data-logging, historical trends and asset management are all easily accessible. From your PC, tablet or mobile phone, you can instantly reach the most important and relevant data. WebSupervisor is also capable to generating automatic alarm-based e-mails. The responsive design ensures easy-to-use operation on any screen size.

WebSupervisor offers equipment owners a number of powerful reporting tools allowing monthly summaries of availability and revenue to be created. This ensures that maintenance scheduling and asset utilization can be maximized for individual equipment and the entire fleet. The information generated from each controller can be archived on the central server for future analysis and trend evaluation.

- > **List and map of assets and alerts on one screen**
- > **Dashboard with fleet statistics**
- > **Advanced trend representation**
- > **Easily customizable through REST API. By integrating data with the application, you can easily automate data analytics in Excel, Power BI and other programs**
- > **3rd party device monitoring (all devices under one system)**
- > **Customizable look with your logo and URL**
- > **Automatic reports with the possibility to customize**
- > **Single machine or group control**
- > **Quick connection to PC tools**
- > **Automatic download of history records from the controller**
- > **Option to run in public or private cloud**





# Case Studies



## PV/Diesel Power Plant Controls

The Republic of Kiribati is an island nation in the Pacific Ocean. Tarawa, one of Kiribati's 33 atolls is home to more than 50,000 inhabitants and, as with most of the islands in the Pacific, it originally used diesel generators to generate 100% of its electricity.

To reduce the dependency on diesel imports, a 500 kWp photovoltaic power plant was built on the island, to be integrated into the Public Utilities Board's electrical grid. Today the PV plant covers around 10% of Tarawa's electricity consumption, but the plan is to increase this number by installing more PVs in the future.

Originally, the control system was hardwired utilizing relay logic, timers and hand switches to manually operate the plant. This setup was unable to react on the constantly changing power output from the PV plant, so a fully automatic system using the IntelliSys NTC Hybrid controller was installed.



## Hybrid System for Rottnest Island

A popular tourist destination in Western Australia; Rottnest Island has recently seen the initiation of a large scale hybrid project, completed in March 2017. The project combines renewable energy and smart controls to reduce the amount of diesel fuel required to produce clean drinking water and generate power for the remote island. The project was led by Hydro Tasmania for client Rottnest Island Authority (RIA) and funded by the Australian Renewable Energy Agency (ARENA).

In this high-profile project, Hydro Tasmania commissioned ComAp Pty Ltd. to upgrade the existing diesel power station at Rottnest Island in order to enable it to seamlessly integrate with Hydro Tasmania's hybrid power system controller. This allowed for wind turbines, photovoltaic and water storage integration.

ComAp engineered a solution to the transition of the existing diesel engines and 11kV feeders to a new unit control platform, enabling real-time communication and control via its diesel station controller. Hydro Tasmania's hybrid power system controller interfaces directly with the ComAp system and manages the wind, solar, water storage facility and desalination plant in combination with its dynamically controlled resistor to manage excess spill energy.





## British Virgin Islands

### Hybrid Wind Power System

A popular honeymoon destination, Peter Island, in the British Virgin Islands, has recently seen an upgrade of the island's power generation control system leading to more efficient automatic control of the four diesel gen-sets alongside the wind turbines operation. Completion of the project also laid the necessary groundwork for future photovoltaic installation. The project was executed by ComAp for their client, the Peter Island Resort and Spa.

This project was divided into two phases. During phase one, ComAp retrofitted the existing diesel gen-set control system to allow for automatic control of the gen-set operation to supply the load alongside the wind turbines. The main objective was to lower the load reserve by optimizing power management. Thanks to the fact that the ComAp control system allows for stabilized operation of only one gen-set on a bus, the wind turbines produce 35% of the annual energy requirements.

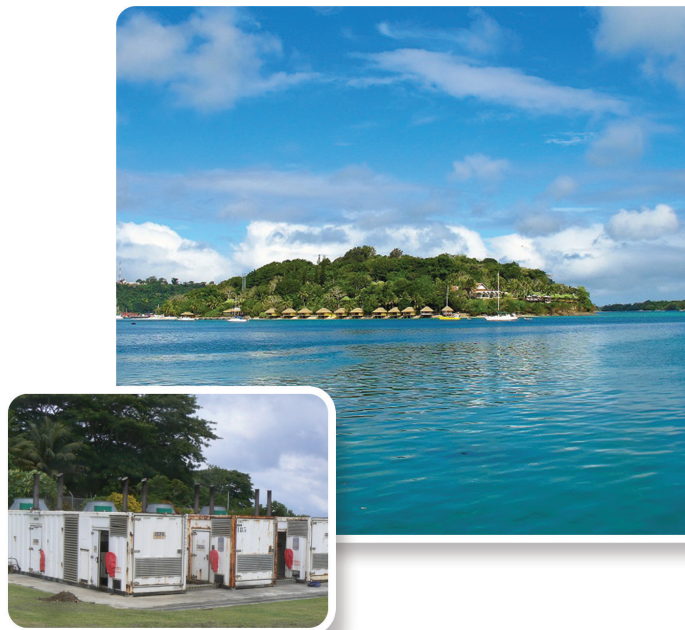


## Vanuatu

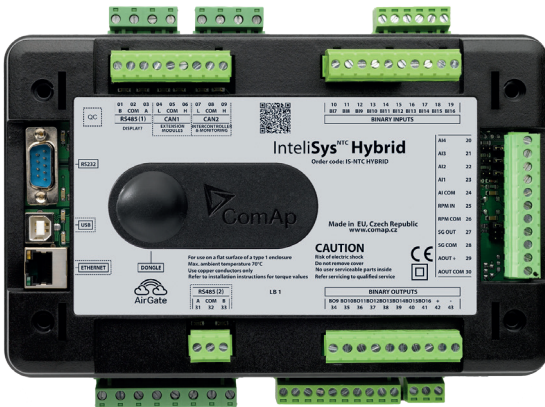
### Wind/Diesel power plant controls

Vanuatu is a small island located in the South Pacific Ocean. Vanuatu's main industry is tourism and it is noted as being one of the top holiday destinations in the world. Vanuatu used two 4 MW gen-sets to generate electricity. However they also have a 3 MW wind farm and the output of this obviously varies greatly from zero to 3 MW. An additional issue which needed to be countered was that if the wind gets too fast the wind farm automatically shuts down to protect itself. This meant that the output would go from 3 MW to zero in 30 seconds.

ComAp designed a system where four spare 800 kW Cummins sets were upgraded with IntelliGen controllers and these run in power management mode. Most of the time one set is running, but as the wind drops off, other sets start up through ComAp's standard power management. Normally it takes only 15 seconds to get an idle gen-set running and synchronized. All relevant data can be seen through our IntelliMonitor SCADA system. The system had a tough test when there was a major earthquake and the wind farm shut down instantly. All the sets then immediately started to cover the load. This was the first time that the island had lost power from the wind farm and didn't lose the whole system as well.



# Product overview for hybrid applications



## Key Functions

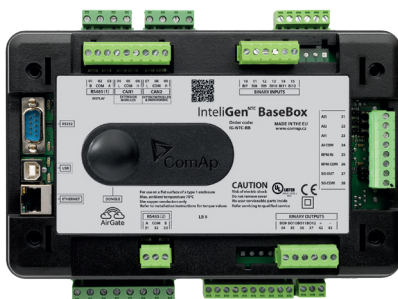
- > Overall site control and data acquisition
- > Protection against gen-set underloading
- > Unlimited PV power penetration
- > Optimized Dynamic Spinning Reserve calculations for high-power supply reliability
- > Configurable Zero-export functionality

## IntelISys NTC Hybrid

- > The IntelISys NTC Hybrid controller offers complex control for power generation applications which combine conventional diesel gen-sets with renewable sources of power.
- > It continuously monitors data from all sources of energy including solar, wind, gen-sets and batteries. It also dispatches individual resources while maintaining high reliability, safety and site efficiency.
- > The IntelISys NTC Hybrid calculates the necessary Dynamic Spinning Reserve (DSR) which should be kept on the gen-sets to ensure a sufficient power reserve is available in case the PV power output drops suddenly.
- > The DSR is communicated to the ComAp gen-set controllers over CAN bus, where it is considered in the power management which automatically selects the most efficient combination of gen-sets based on the demand, gen-sets rated output, and running hours to maximize fuel savings.
- > The IntelISys NTC Hybrid controller maximizes the output from renewable energy resources at all times and only curtails it when the minimum gen-set loading limit is reached in order to prevent the engine from running underloaded.

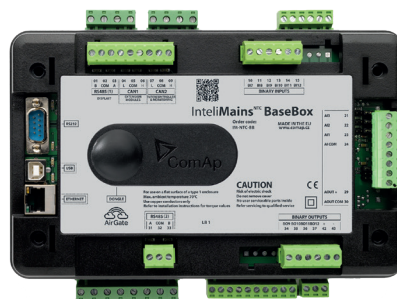
## Key Features

- > Extensive flexibility due to built-in PLC
- > Native communication with ComAp gen-set controllers
- > Interoperability with battery inverters, BMS and wind turbines
- > Pre-defined interface for various PV inverters
- > Ethernet, Modbus and CAN communication
- > PV output control via Modbus, analog or binary outputs
- > Configurable inputs, outputs and setpoints for various customer needs
- > Event-based history (up to 4,000 records)
- > 160 additional programmable protection options



## IntelGen<sup>NTC</sup> BaseBox

- > IntelGen<sup>NTC</sup> BaseBox is a comprehensive gen-set controller for both single and multiple gen-sets operating in standby or paralleling modes.
- > The modular construction allows easy installation with the potential for many different extension modules designed to suit individual customer requirements.



## IntelMains<sup>NTC</sup> BaseBox

- > IntelMains<sup>NTC</sup> BaseBox is a controller designed to connect a group of gen-sets to the mains.
- > On places where exporting to the mains is not allowed, it can be used as zero export protection by limiting the PV inverters output.



## IntelLite Telecom DC

- > The IntelLite Telecom DC is the perfect gen-set controller for DC telecom applications and offers complete monitoring, control and protection of the DC system.
- > The ComAp IntelLite Telecom DC controller takes full advantage of the latest technology by using variable speed DC generators to charge the batteries (cycling operation) or provide power to the load.



## IntelPro

- > IntelPro is a highly flexible mains decoupling relay with an extensive range of protective functions to meet the strictest utility interconnection requirements. It can be used in various distributed generation applications, cogeneration units, renewable energy sources or as redundant/back-up protection for gen-sets.



## IntelPro SYNC

- > IntelPro SYNC is a highly reliable protection relay designed for synchronization in parallel-to-mains applications, such as generators, cogeneration units, gen-sets and cogeneration units connected to distribution network. IntelPro SYNC is an ideal substitute for a manually synchronizing relay.



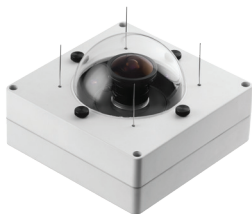
## MainsPro

- > MainsPro is a protection relay for parallel-to-mains applications, including generator sets, cogeneration units, micro turbines or renewable energy sources such as photovoltaic plants or wind turbines. It provides adjustable voltage, frequency and loss of mains protections to safeguard both the distribution network and the generators.



## MainsPro LITE

- > MainsPro LITE combines simple installation and usability with valuable mains protection. It offers essential protection against a power supply to an islanded grid and is an attractive choice when vector shift and rate of frequency change protections are not required. It represents a cost-effective solution for mains connected applications including gen-sets and renewable energy sources.



## Cloud Camera

- > Cloud Camera is part of the Cloud Forecasting System, a complementary extension of ComAp's hybrid microgrid controller IntelliSys NTC Hybrid, which significantly increases the efficiency of site operation while maintaining high reliability and safe power supply provision.



## UC-7112-LX Plus

- > The ComAp Communication Gateway provides a solution to several applications where data from 3rd party devices need to be transmitted either to a ComAp controller or to a ComAp monitoring tool.
- > Part of ComAp's Cloud Forecasting System.
- > Allows integration of 3rd party products to collect and process information for WebSupervisor.



## WebSupervisor

- > WebSupervisor is a cloud-based system designed for managing ComAp controllers via the internet. This system offers a number of beneficial features that help optimize revenue for machinery fleets, since each piece of equipment can be individually monitored for all important operation values.



## Internet Bridge 4G/LTE

- > Internet connection for one or more ComAp controllers, either by Ethernet cable or by built-in cellular modem.
- > Wireless high speed GPRS/UMTS modem built in.
- > Supports all cellular packet data systems from GPRS to LTE (2.5G to 4G).
- > 3G variant has full multiband support and modem works globally.
- > Two 4G variants supporting two different frequency band groups.
- > An Ethernet wired connection for local LAN connection.



## IntelliVision 12Touch

- > IntelliVision 12Touch is an industrial operator panel equipped with 12,1" colour, multi-touch screen, dedicated along with the main ComAp controller to visualise and control single gen-sets in various applications.



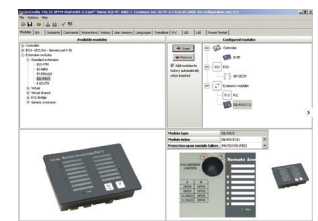
## IntelliVision 18Touch

- > The new IntelliVision 18Touch is an 18,5" touchscreen display unit perfectly suitable for the most complex and simple applications. With IntelliVision 18Touch you can easily monitor and control sites consisting of many controllers or you can use it for your CHP or Hybrid application.



## IntelliVision 8

- > IntelliVision 8 is an industrial operator panel equipped with an 8" colour screen dedicated along with the main ComAp controller to visualise and control single gen-set in various applications.



## GenConfig

- > New generation of the PC Configuration and Monitoring Tool supporting the latest IntelliGen and IntelliSys controllers.
- > Allows users to modify the controller configuration such as defining peripheral modules, assigning functions and/or protections to inputs and outputs, creating PLC programs and more.
- > Controller firmware upgrade.
- > Adjust initial values of setpoints.
- > ScreenEditor software included.



## Full support for your projects

At ComAp, we closely cooperate with you to fulfil your existing requirements. It is our knowledge of focused markets, which we gain through unrivalled local expertise, that allows us to deliver intelligent, electronic control solutions that anticipate your needs.

What is more, we are able to assist you at every stage of your project. We can help you **design** the system, along with **wiring** and **installation, commissioning** and **programming** the controller and other settings. We deliver all of this through our specialist network of local experts operating across the world.

Please contact your local distributor for more information regarding this service.



### Manufacturer:

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### Local distributor / partner: