

# HYBRIDYNE – RENEWABLE ENERGY TECHNOLOGY GENIUS, STARTING FROM SCRATCH

**T**HE HYBRIDYNE STORY began with two friends sitting at a restaurant discussing the future. Thomas Cleland and Les Mac were both veterans of the technology industry, Cleland being involved in several leading edge technology and power quality companies over the years, and Mac having many years in high availability power in the data center and power quality industry behind him. The two enterprising friends met in 1999, when Mac was a client of Cleland's.

In 2003, Cleland and Mac were having lunch on an outdoor patio in Richmond Hill, discussing the power backup systems (UPS's) that they were both installing in multiple locations around the GTA. The pair discussed whether it would be possible to recharge the batteries with renewable energy, thereby saving energy purchased from the grid. At the time, renewables were a

relatively new idea in Canada, and were not normally used in commercial buildings. In fact, the use of renewables was extremely limited at the time. As Cleland and Mac had

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years of experience in high availability electricity and power electronics, the pair realized at that particular meeting there was a potential opportunity to address the



North America's first Hybrid Renewable Energy supported Datacentre.

disconnect in the renewable energy industry at the time.

When Cleland and Mac began the process of exploring renewable power options, developers of wind turbines and PV panels were working to improve their individual collection devices, making them more efficient, but were not utilizing advances in power electronics to their full potential.

What came of that meeting was the basis of a solution for that renewable power disconnect—and the basis of several proprietary and patent-pending conversion/inver-

sion technologies—, the first hybrid iterations designed on a restaurant paper place-mat. This would be the inspiring creation of Hybridyne Power, a company that has seen its share of success and looks to be a leader for years to come.

CIO had the opportunity to learn more about Hybridyne's incredible journey to commercial success from Richard Leverton, the company's Vice President. "Cleland and Mac saw a way to make wind energy and solar energy work together for the first time, and designed a system that could do it efficiently," he said.

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Hybridyne’s beta site, set up to deliver energy to a building and protect it from blackouts is still in operation. According to Hybridyne, the site showcases the first effective hybrid (wind and solar) Behind The Meter system in the world.

### HYBRIDYNE POWER SYSTEMS CANADA INC. FORMATION

Cleland partnered with an electrical construction firm of his long acquaintance in 2004, forming Hybridyne Power Systems Canada Inc. Building the company continued quickly from there. In recent years, because Hybridyne saw the dangers of unskilled and sometimes unscrupulous operators installing Solar arrays in Ontario, Cleland wanted to educate colleagues and the public about the technological challenges of renewable power generation, and published a series of white papers, the first of which was called “The Renewable Energy System Equation”, which formalized

the harmonized calculation of yield from renewable-energy powered installations.

For the first few years, Hybridyne focused on Behind-the-Meter (BTM) systems, due to the fact that there was no way to profit from selling power to the grid in Ontario. However, once the OPA’s (Ontario Power Authority) Renewable Energy Standing Offer Program (RESOP) came into play in 2008, the landscape for domestic power changed. Through RESOP there was a way to sell electricity to the grid. At this point, the original Hybridyne team came to the conclusion that there were several different businesses to tackle: building BTM systems, electronics, and selling power to the grid. Because these were such different areas, the company split the company responsibilities into separate units, each with its own shareholders, investors, and mandate. The original entity has been separated into a group of sister companies. Hybridyne Power Systems Canada Inc. (HPS), the original company, is still in the business of BTMs, and is the design, engineering and construction arm of what is now the Hybridyne Group of Companies.

One of Hybridyne’s projects, spawned the use of a lighting product, which was transferred to Hybridyne-RHS Inc. (RHS), which



PortaDyne off-the-grid remote systems

concentrates on “Portadyne TM” Remote Hybrid Systems – designed to have no connection to the standard power grid. All of Hybridyne-RHS’s Portadyne TM products are designed for remote, off-the-grid applications

Design, manufacture, and sales of power electronics, conversion and inversion technologies live under Hybridyne Power Electronics Inc. (HPE). Hybridyne Power Generation Corp. has the responsibility to own, sell, and operate grid-supply systems.

## PIONEERING IN NEW ENERGY

From 2005-2007, Hybridyne developed new terminology to apply to solar arrays and wind farms that could co-exist with the public. The company copyrighted the term “Energy Park©”, in 2006 a term that implies people can happily coexist with distributed electricity generation in a park-like setting (with safety protocols and setbacks observed). The company says “We even investigated having turbine bases disguised as massive tree trunks, if turbines were to be installed in tree-lined walking



## BEHIND-THE-METER SYSTEMS



areas, so as to not impede the enjoyment of the surroundings with grey or white steel and concrete structures.”

“Further we believed that every wind project could be hybridized to include solar, and that most solar projects could be hybridized to include wind. Therefore the phrase Hybrid Energy Park© was coined and copyrighted. Later when rooftop solar became an interest, we labelled these Mini-Energy Parks©.”

## FIT PROGRAM CHANGES THE GAME

The Ontario Power Authority announced the Feed In Tariff (FIT) program in 2009, and the announce-

ment changed the renewable energy game in Ontario forever. “ Suddenly, everybody who had ever seen a picture of a solar panel (and to a lesser degree wind turbines) were running around promoting themselves as a Renewable Energy expert (particularly in the small residential or Micro-FIT-10kW and under arena),” the company says. Hybridyne suddenly was in the spotlight for their expertise in the renewable energy technology.

Hybridyne was able to enter the new market that was a result of FIT with a very advanced offering, and has since been working on many building-mounted PV arrays which have been awarded FIT contracts.

“Hybridyne Power Generation has received and executed a contract under which the Ontario Government has agreed to purchase electricity from our Clarington Township ground-mounted array for the next 20 years. We have plans to do a number of rooftop arrays in the next few years, and that will be a huge shorter-term focus for us,” Leverton adds.

One of the most remarkable things about Hybridyne, however, is that the company isn't just focused on FIT or doing projects as part of a 5-year strategy. As one of the leading companies in renewable energy technology, the company's founders recognize that solving environmental problems that will be part of our future for 100 years requires a longer-term vision. Hybridyne has a 50-year business plan, which is intended to be a multi-generational feature of helping to solve the global environmental challenges to come. An example of Hybridyne's vision is its line of enhanced solar inverters. Using the core technology first visualized on the restaurant placemat, these inverters can achieve up to a 30% improvement in the annual yield of a solar array. Increasing the yield has two significant benefits: first, investment in solar facilities will be encouraged by a greater payback, and second, it helps achieve the long-term goal of

renewable generation – grid parity, the point at which renewable energy costs the same as the traditional oil- and nuclear-powered generation widely in use today.

The company articulates this vision perfectly: “Improved technologies already being patented and developed by Hybridyne and others will dramatically increase renewable energy system yield. New explanatory papers are being written, the new products will find new homes, and new productive and cooperative partnerships will allow us ever-increasing opportunities to use our ever increasing expertise and influence to do our part to help better the world.”

## THE FUTURE

Leverton says that Hybridyne plans to continue its series of whitepapers to teach new renewable energy companies what to do and what not to do in the Ontario market. “There will be a shake-down in the industry—many companies came to the solar gold rush, but most will not survive. The ones that do, will thrive,” he explains. “We see a golden era of solar here in Ontario because of FIT.” Leverton says that Hybridyne has technology in the works so sophisticated that it will be able to generate power with moonlight.

Leverton concludes: “our job is to make technology work for customers, and if we can't do it right we won't do it at all. With our technology, and our company, we now have the opportunity to improve the world.”

## WHAT IS A BEHIND THE METER SYSTEM ?

A Behind the Meter system (BTM) is a Renewable Energy system uniquely designed and built for a single building or facility. Its purposes are :

- to reduce the carbon footprint of the building by generating electricity 'locally' from renewable sources
- to reduce the amount of electricity purchased by the building (typically reducing the electrical bill by about 80%)
- to take the structure “off the grid” for some or all of the working day
- to provide power conditioning and UPS characteristics for the whole building
- to eliminate blackouts to the building, providing un-interruptable

power during grid failures

- to eliminate the damaging effects of brownouts on the building
- to buy electricity at the lowest possible purchase rates
- typical payback is 8 years

## A BTM CONSISTS OF THE FOLLOWING COMPONENTS :

- a solar array to capture energy from sunlight
- a number of wind turbines to capture wind energy
- a storage system to store electricity from the RE components and any purchased from the grid
- a control system to manage the production, storage and delivery of the electricity

**HOW DOES A BTM WORK?**

Currently, buildings have a single source of energy: the grid (excluding backup generators)

The BTM operates as a large UPS within a building, charging its batteries from renewables, and buying any extra energy as needed from the grid.

**BECAUSE BUILDINGS ARE LIMITED TO THAT SINGLE SOURCE, THEY ARE EXPOSED TO :**

- whatever price structure is imposed by the area's jurisdiction
- whatever blackouts the location experiences
- whatever brownouts happen in the location
- random and destructive power 'spikes' that can affect or even destroy electronics

**BECAUSE THE BTM'S SMART CONTROLLER IS CONSTANTLY MONITORING ALL THE ENERGY SOURCES AS WELL AS THE LOAD BEING DRAWN, IT CAN :**

- constantly determine the amount of electricity being drawn
- constantly determine the amount of electricity being generated
- constantly determine the 'state of charge' of the storage system
- know how a load normally varies with time

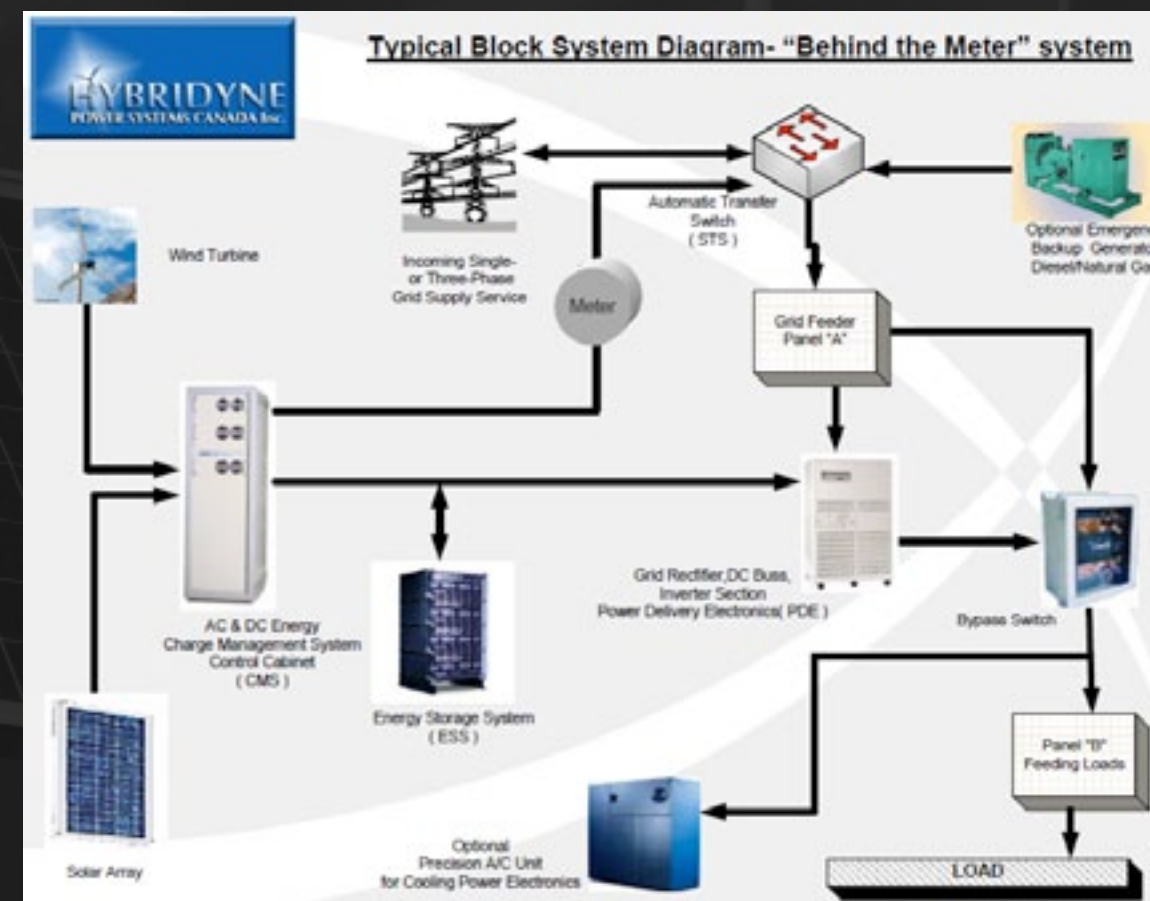
**A BTM ACCESSES ELECTRICITY FROM :**

- Renewable Energy sources (typically both wind and solar)
- the grid (as backup)
- energy stored within the Battery Storage of the BTM

**USING THIS INFORMATION, THE BTM DOES THE FOLLOWING :**

- constantly receives energy from the Renewable Energy sources (unless it is both dark and windless) to charge the batteries
- supplies energy from the storage system directly to the load (the equipment within your building)

- if necessary, buys electricity from the grid when the grid supply price for electricity is at its lowest



## WHAT IS AN ENHANCED INVERTER ?

The main problem with conventional inverters is that they were designed with the philosophy that since sunlight is free, why spend time and money designing an inverter to capture all of it. Therefore, conventional inverters wait until the 'raw' DC voltage coming from the PV panels is high enough that it's easy to convert it to AC.

An enhanced inverter is designed with the philosophy that since we're going to all the expense and work of building an expensive solar array, why not capture as much energy as possible. Therefore, an enhanced inverter will 'wake up' at a much lower DC voltage, and stay on longer.

What that means in practical terms is that instead of waiting until mid-morning to start gathering energy, the enhanced inverter will start sooner, keep gathering under clouds, and wait until later in the day to turn off. The end result is that a properly designed solar array with an enhanced inverter can gather up to 30% more electricity per year – significantly encouraging investment, and pushing solar electricity toward Grid Parity

The graph opposite illustrates the difference between a conventional inverter and an enhanced inverter.

- The DC power from the solar array (pale yellow line) starts shortly after daylight, dips when the clouds go over, rises toward noon, and declines as evening falls.

- The conventional inverter (pink area) waits until the DC voltage rises to about half of the maximum, turns off again when clouds reduce the DC voltage, and 'goes to sleep' in the afternoon

- The enhanced inverter (blue area) starts to work at a much lower DC voltage, so it can 'ride through' cloud cover and work for more hours of the day. Moreover, since its efficiency is higher, it generates more energy even at times when the conventional inverter is on. This greater yield is replicated throughout the year, so the enhanced inverter will gather electricity even during the fall, winter, and spring, when conventional inverters are largely ineffective. [IM](#)

