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# 360 Power Group radial + axial <sup>™</sup> Scalable Proprietary Electric Motors and Generators Provide 33% Fuel Savings

# \$20 Million Sales Agreement with the GreenTech Fund Introduction into Indian Markets



Proprietary Architecture: radial + axial<sup>™</sup> (r+a<sup>™</sup>) pronounced: "rita" the "r+a 40 " generator output: 40kW @ 1800 - 2200 RPM weight: size: 120 kg 17"x7" no exotic materials

The GreenTech Fund has received

authorization from the Indian Federal Government and various Indian State Governments to provide electrification and clean water to the more than 80,000 villages in India that have neither.

The 360 Power Group and GreenTech have entered into a Cooperation Agreement, valued at more than \$20 Million, for 1,300 of 360 Power's proprietary *Radial* + *Axial* ("r+a 40") gensets, as the first phase in GreenTech's electrification/water purification solution package.

In addition, because many of India's 390,000 Telecom Towers are located near these villages, the 360 Power gensets will also be used to supply them with dependable power.

## India – Target Markets

India is a \$2 Billion genset market growing at 10%-15% per annum. Genset growth in general is driven by a wholly inadequate grid and power system evidenced by:

- Nationwide, grid power is only available in India from 4 to 20 hours per day, depending upon the region. Accordingly, prime-power gensets are mandatory in order to operate any commercial or industrial business.
- 400 Million people, in more than 80,000 villages, in India still lack electrification.
- The country depends on 390,000 Telecom Towers for its communications. 261,000 of these towers, spread throughout the country including the non-electrified rural areas, are powered by fuel subsidized, conventional gensets.

# The Customer Perspective - affordable genset electricity for markets that otherwise could not afford dependable power

• The unprecedented, 33% fuel savings delivered by *r+a* gensets translates into an unprecedented "pay-back" period of 1 year or less, based on fuel savings alone and with the genset used only half-time.



## The Specific Advantages and Opportunities for the 360 Power *r+a* gensets:

- In order to maintain economic, agricultural growth and stability, the Indian government is expanding its rural electrification programs.
- However, the Indian government has already recognized that it must phase-out or reduce its diesel fuel subsidy programs; as it has already done with the removal of subsidies for gasoline.

## The Introductory Product – the *r+a 40* kW genset

- 360 Power's proprietary *r+a* generator, is integrated into a 360 Power-designed Variable-Speed, Direct-Drive Prime-Power Diesel Genset, driven by a 66 HP, 2.4L John Deere, Interim Tier 4 diesel engine, with proprietary power electronics designed by One-Cycle Controls.
- Variable-Speed means that the generator can constantly adjust to the electrical load (lights or motors, etc. being turned on and off) so that the diesel engine always operates at its most fuel-efficient level for the power required; in this model, between 800 and 2200 rpm. This is instead of the higher fuel consuming, conventional fixedspeed gensets that typically operate at 1800 rpm @ 60Hz (U.S.), or 1500 rpm @ 50Hz (India & Europe).
- 33% annual fuel savings. For a 40kW genset, operating only half-time (4400 hrs/yr.), that can translate into annual savings in excess of US\$17,500.
- Generator Efficiency: >96% instead of ~88% for 360 Power's primary competitor.
- Generator weight: 120 kg (265 lbs.) vs. 271kg (596 lbs.) for 360 Power's primary competitor.
- Substantially smaller "footprint" than a conventional generator.
- Substantial reduction in operating noise and vibration.
- Reduction in overall size and improved operating characteristics facilitates multiple unit installations in locations not otherwise possible.
- Subsequent models will also use natural gas, compressed natural gas, methane and propane, in various, market-determined sizes.

#### 360 Power's Proprietary Technologies

- Protected by 9 foundational patents in International markets.
- In either its generator or motor forms, the unprecedented density of power is derived from the *radial + axial*, or "*r+a*" architecture of 2 radial flux and 1 axial flux, permanent magnet "machines" operating simultaneously in the same unit. The result is 2–10X the density of power production, per kg or cm<sup>3</sup>, relative to current technologies.
- "Switchable" coils:
  - An internal, electronic gearing system a superior form of direct drive. This system eliminates the equipment and maintenance costs, as well as the weight and energy transfer losses that are unavoidable with gearboxes and transmissions.



- Eliminates the 30-60%, "torque-up" drain on the battery (or similar requirements for more fuel/input from a power source) to reach so-called "Peak Power".
- >96% efficient at all power production ratings:
  - At 200kW± (268HP±), conventional generators typically operate in the 90-93% efficiency range.
  - At 40kW± (53HP±), conventional generators drop to an efficiency range of 85-89%.
  - At 12kW± (16HP±), conventional generators efficiency ranges drop even further to 80-84%
- Fully scalable without the logarithmic increases in size and weight that are necessary in other direct drive systems in order for them to increase power production.
- "Inherent" magnetic bearings that can be part of a unit's design when desired; not an added component as in other systems.
- Modular internal design. This allows for reduced manufacturing and maintenance costs. Additionally, because of this proprietary modular design, up to 80% of the coils could fail and the unit would still function. For a conventional unit, the failure of a single coil or wire is a catastrophic failure, and the entire unit stops immediately.
- Fabrication costs are reduced because the "density of power" architecture is modular and uses substantially less raw materials.
- No "exotic" materials are used in fabrication.
- Extensive computer simulations have been completed, demonstrating and testing the proprietary technologies and commercial designs.
- The 40kW commercial model is under construction.

#### **Global Implementation & Leveraging Strategies**

360 Power's technologies have a direct, materially advantageous impact wherever generators and motors are used; and that is especially true in high-value applications or where the direct and indirect costs of fuel are especially significant.

Though 360 Power has identified a number of high-value applications it plans to pursue, for the next several years 360 Power will be primarily opportunistically driven; entering markets, and expanding its product line with partners that have access to significant markets that they have identified; and who can fund product development and local operations.

#### "Go to Market" with Strategic Partners

- To exploit markets as vast as those provided by its "disruptive", *r+a* generators and motors, 360 Power takes advantage of strategic partnerships like the one with John Deere for exclusive engine supply and engineering support for its *r+a* generators. As 360 Power's *r+a* gensets are shipped and installed in India, the Deere dealer network, especially throughout agricultural rural India, will stock parts and support the engines used in the *r+a* gensets. This relationship will allow 360 Power to grow faster than if it had to establish its own support organization.
- *r+a* gensets of 2kW, 12kW, 200kW, 500kW, 1MW and 3MW are planned for subsequent distributed power generation applications, each with a targeted market



segment and purpose. Because 360 Power's generators and motors are fully scalable and modular, and through the use of advanced computer modeling and testing, a wide range of r+a generators and motors can be developed in relatively short periods of time.

• With its larger r+a gensets, in addition to the Deere engine supply and support relationship. 360 Power plans on accessing the industrial markets in India through a distribution joint venture with **The Talbros Group**, an Indian industrial leader with established relationships with Tata, Mercedes, Fiat, Honda and other transportation companies.

Consequently, rather than duplicating the substantial capital, time and opportunity costs that are inherent in creating a vertically integrated company, as demonstrated with entry into the Indian markets, 360 Power intends to leverage its entry into other markets through joint ventures with partners for specific fields-of-use or licensing in specific territories; while its R&D parent company, ClearWater Holdings, Ltd focuses its resources and expertise in the development of specialized technologies that will support these joint venture partners or licensees.

360 Power's business growth is supported by its Intellectual Property foundation; currently provided by nine (9) different international patents already allowed and issued in multiple markets, as part of an aggressive, expanding patent program. Additional patents have been filed and are pending.

#### Joint Venture Implementation Model – How It Functions & Generates Revenues

In return for licensing a particular application(s) or territory, 360 Power holds an ownership interest in the joint venture; and receives product development fees from the joint venture to develop the technology for products within the specified market. In addition, 360 Power receives royalties from the joint venture for its proprietary technologies as well as its share of distributed profits.

As the Company is doing in India, 360 Power prefers to partner with established firms to commercialize the Company's proprietary technologies. The joint venture partner generally would be responsible for funding the joint venture and overseeing its operation, e.g., manufacturing, distribution, service and support.

- **Manufacturing:** Primary manufacturing and final assembly will typically be the responsibility of the joint venture partner. Manufacturing of the coils, power electronics, and control systems, initially, will be the responsibility of 360 Power.
- **Sales/Marketing:** Likewise, the joint venture partner will typically have the primary sales/marketing, distribution and servicing responsibilities on behalf of the joint venture.

#### Recognition

In recognition of the significance of it's technologies, management and growth potential, 360 Power was invited to become one of the first Portfolio Companies of the Los Angeles CleanTech Incubator ("LACI"). LACI is a consortium of the Los Angeles Mayor's Office, the Los Angeles Department of Water and Power, the Los Angeles Chamber of Commerce, CalTech, USC and UCLA.



360 Power's Technical Team and Business Partners are significant leaders in their respective fields.

#### Management:

**G. Noah Newmark – President:** Former head of Corporate Real Estate, Managing Director, Merrill Lynch; Former Partner, Becker Paribas. Thirty-eight years experience as an investment banker and international entrepreneur.

**R. Morgan Harwith – Executive Vice President:** Former VP & General Counsel and Group VP, Reynolds and Reynolds Company (NYSE). First international attorney for Amway Corp. Thirty-five years experience as an international corporate attorney and entrepreneur.

#### **Commercialization Team Leaders:**

Keith W. Klontz, Ph.D. & Howard (Haodong) Li, Ph.D. – Electric Motor/Generator Commercial Design: Advanced MotorTech, a computer-aided engineering (CAE) services company with an emphasis on electric machine and magnetic component design.

**Gregory T. Smedley, Ph.D. – Systems Power Electronics:** CoFounder/CEO, One-Cycle Control, Inc. 2009 Dept. of the Army, SBIR Achievement Award for "Load-Following Variable-Speed Gensets." Formerly research/teaching faculty at CalTech and researcher at JPL.

**Craig Hodgetts – Design/Project Coordination:** CoFounder, Hodgetts + Fung, Architects/Designers. Technical design lead, Hollywood Bowl; AIA, 2008 CA Firm of the Year; Yamano Gakuen Complex, Tokyo; Professor of Architecture, UCLA.

Western Power Products – John Deere Master Distributor (U.S. & India): Expertise in diesel engine integration, fabrication, maintenance & support.

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