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RESPONSE TO REQUEST FOR INFORMATION

U.S. General Services Administration

GS-00P-12-BSC-0867

Grid Based Projects

Power Purchase Agreements (PPA) Issues

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Technology Summary

Herein the Integrated Power Technology Corporation (IPTC), a California S-Corp formed on July 19, 2006, presents new renewable resources based on technology it has patented, along with financial and physical parameter models supporting feasibility for the General Services Administration (GSA)-proposed 10 year Power Purchase Agreement (PPA) limited by the Federal Acquisition Regulation's (FAR) Part 41 ten (10) year contract authority.

IPTC's proposed technology satisfies the criteria of new renewable resources not located on GSA property through deployment of remote-controlled unmanned autonomous renewable energy recovery systems in the form of several classes of patented and patent pending mobile buoyant structures. For purposes herein, one class of these mobile structures effectively scales to an average baseload of 10MW and comprises rapid installation of modular extant clean power systems. The technology also includes a Supervisory Control and Data Acquisition (SCADA) system wherein an algorithm optimizes fuel production/storage (battery charging), and delivery efficiency of the aforementioned mobile structures by accounting for wind probability/weather tracking data from satellites (i.e. DMSP, SAR, GOES), Geospatial Information System (GIS) databases (NOAA, NWS, NHC, TPC, etc.), and from sensors on the mobile structure (GPS, IMU's, fuel gauges, etc.), while relating these data points to vessel Velocity Performance Prediction (VPP) Computational Fluid Dynamics (CFD) models to determine greatest yield and/or least cost path.

One of the aforementioned several classes of mobile structures, the Turbine-Integrated Hydrofoil, or Turbofoil®, readily scales to 10MW deliverable in and from an offshore environment. IPTC herein proposes a most simple configuration of the Turbofoil® with Lithium Ion (Li-Ion) or Sodium Sulfur (NaS) batteries, each delivering stored energy to where inverters couple to the grid serving GSA locations. The proposed concept is a modular, distributed energy system in which numerous mobile structures can harvest wind and wave energy off the entire coast or be directed to high energy events such as storms. Since the vast majority of the population is clustered in coastal areas, this means that the energy is produced near the point of use, eliminating the need for new infrastructure, like high power transmission lines or special docking facilities, as conventional marinas suffice. Furthermore, since no structures are permanently left offshore, the permitting process should not present the political hurdles seen with permanent offshore installations.

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The patented innovation embodied in the Turbofoil® exists in the integration of a turbine coupled to a battery charging generator all within a hydrofoil reducing drag and providing lift. As the hydrofoil design provides lift to an energy extracting sailing vessel, some seawater passes through the gate of the turbine along the foremost edge of the hydrofoil thereby generating DC for charging batteries or hydrogen electrolysis. Also integrated within the hydrofoil could exist a hydrogen electrolyzer whereby the motive fluid for the turbine is also the electrolyte for the generation of hydrogen, as well as the coolant for the electrolyzer electrodes. A Turbofoil®-equipped vessel represents a singular mobile combined generation, storage, and delivery system with means to optimally respond in a controlled manner to changes in velocities of the media.

By utilizing wind prediction and tracking technologies; and through its novel exploitation of wind and hydropower resources in a concurrent energy extraction, storage, and delivery process, the Turbofoil® will expedite installation and facilitate maintenance, eliminate regulatory and aesthetic objections, diminish the environmental impact compared to typical offshore wind farms while attaining a positive net energy earlier upon implementation, and uniquely prosper from severe weather conditions.

Obvious inherent advantages of the proposed offshore renewable energy recovery system comprising one or a fleet of remote-controlled mobile structures include mitigating or circumventing prevailing new renewable resources grid risks/costs:

- Oversubscribed grid/Curtailment losses (by storing the resource);
- Resource Intermittency (by patented weather tracking SCADA system);
- Storage feedstock scarcity (by NaS battery chemistry readily available);
- Regulatory Delays (deployed in international waters under limited jurisdiction);
- Land-Use Restrictions (deployed in international waters under limited jurisdiction);
- Load Balancing/Baseload Functionality (through high-efficiency storage/delivery);
- Installation and Maintenance Difficulty/Costs (port side manufacturing/service/distribution infrastructure already established);
- Susceptibility to Damage from Severe Weather; (rugged vessels prosper, others "dock")
- Aesthetic Objections, "NIMBY"; (mobile, availing deepwater, too…)
- **SCADA patent** invigorates floating turbine concept; (stored energy over time is cubically proportional to wind/water turbine motive fluid velocity, optimized by weather prediction)
- Substantially reduces LCOE (M&O) by enhancing total recoverability (continuous, concurrent production, storage and delivery);
- Substantially reduces LCOE (M&O) w/ assembly line (not field) maintenance procedures.

Complete design of the system including the vehicle, a remote-controlled sailing vessel equipped with a turbine-integrated hydrofoil, will provide a vital first step in meeting the objectives of improved wind resource management. By utilizing the National Weather Service Geographical Information System, GIS wind prediction and tracking technologies; and through its novel exploitation of wind and hydropower resources in a concurrent energy extraction and delivery process, the completed vehicle design will expedite installation and facilitate maintenance, eliminate regulatory and aesthetic objections, diminish the environmental impact compared to typical offshore wind farms while attaining a positive net energy earlier upon implementation, and uniquely prosper from severe weather conditions. A remote-controlled mobile vehicle innately avails rapid deployment into optimal locations, continuously adapting to maximal oceanic wind resources. Success of the herein proposed project will usher environmentally friendly exploitation of presently undeveloped yet immense sources of energy, the many GigaWatt-Hours of energy expelled in tropical storms and hurricanes.

Not only will the National Weather Service continue to serve in emergency preparedness, but henceforth will increasingly contribute in grid capacity availability prediction. Whereas tropical storms and hurricanes heretofore appeared only as a bane to coastal communities, an industry predicated upon harnessing the energy from these storms will now present economic growth opportunities for these communities. In the public sector, the National Weather Service, the National Oceanic and Atmospheric Administration, the DOE, and utilities regulators will foster cooperative arrangements through entities implementing this system with the public utility operators, and other private stakeholders in the renewable energy market including those promoting hydrogen fuel, supporting the Hydrogen Fuel Initiative (HFI), fuel cell manufacturers, and even public works contractors and shipbuilders. As the successful implementation of this product calls upon many scientific disciplines such as Computational Fluid Dynamics (CFD); Velocity Performance Prediction (VPP); Thermodynamics, Electrochemistry; Catalysis; Engineering Statics, Dynamics, and Strength of Materials; Material Science; Electromagnetism; Power Distribution; Energy Storage/Conversion; Renewable Energy; Meteorology and Earth Sciences; Satellite Radar Telemetry; Communications; Control Theory; Power Supply Design; Wind/Hydro Turbine design; Offshore Wind/Hydro Resource Siting; Modeling and Simulation of combined Electrical, Mechanical, and Weather systems; Geographical Information System (GIS); Global Position Satellite (GPS); Supervisory Control and Data Acquisition (SCADA); National Weather Service (NWS); National Hurricane Center (NHC); Tropical Prediction Center (TPC); National Oceanic and Atmospheric Administration (NOAA); the Integrated Power Technology Corporation™ will continue to find many applied research areas for improvements upon and optimization of the original system design, and along with members of academia will find many applied research areas for improvements upon and optimization of the original system design.

The concept of mobile buoyant structures inherently satisfies the requirement for geographically diverse locations for ready market access. See the section entitled: **5. Proposed Locations for Commercial-Scale Mobile Buoyant Structure Deployment** below for ideal central service, maintenance, fuel distribution, command/control facilities locations.

1. Issue: Contract Term Limitations

IPTC herein proposes product development by completing the design and prototype testing of an extensible system comprising SCADA remote control of navigation and operation of offshore mobile structures that produce, store, and deliver energy in the form of charged batteries or hydrogen or hydrogen-based liquid fuels to a central distribution location. Through novel simultaneous exploitation of wind, solar, and hydropower resources, the mobile structures expedite installation and facilitate maintenance; and eliminate, mitigate, or circumvent existing risks and costs associated with resource intermittency, storage feedstock scarcity, regulatory delays, aesthetic objections, and land-use restrictions. One class of mobile structure uniquely prospers from severe weather conditions.

The Turbofoil® Feasibility Analysis spreadsheet tool assists in design feasibility and financial break-even analysis. Given fundamental physical and financial parameters such as average vessel velocity, turbine gate dimensions, competing wholesale electricity cost per kilowatt hour, crew cost and vessel amortization, the spreadsheets show, in separate tabs for Yield(W) and Yield($), profitability for various design configuration and operational paradigms and debt-financed business models.

In the spreadsheet, one may analyze various scenarios by modifying cells containing physical parameters while in the Yield(W) tab, or modifying cells containing financial parameters while in the Yield($) tab.

From the model provided by this spreadsheet tool, IPTC can offer financial and physical parameters supporting feasibility for the GSA-proposed 10 year Power Purchase Agreement (PPA) limited by the Federal Acquisition Regulation's (FAR) Part 41 ten (10) year contract authority.

The answers to the requested questions below labeled (a) through (g) will become apparent through referencing tables 1a & 1b generated by the Turbofoil® Feasibility Analysis spreadsheet tool below:

a) Can a ten (10) PPA be developed at or near current market prices?
b) What are the cost impacts of a ten (10) year term?

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c) What are the cost impacts of a ten (10) year PPA contract with a ten (10) year option?
d) Could these options help to reduce the PPA price and/or alleviate the financing risk?
e) What would the optimal financing term be for the type of renewable resource that your firm is interested in developing?
f) What are other potential solutions to overcome the current ten (10) year contract term limit?
g) What are other potential risks associated with these options?

Table 1a: Calculate Profitability of an Ocean Energy Recovery Vessel

Crew Cost/hour ($):		$90.00		
Hours/Week in operation:		28		
Monthly Maintenance/Docking Cost ($):		$10,000.00		
Monthly Gross Revenue:		$143,561.54		
Operating Margin:	1.79%			
Monthly Profit:		**$2,576.45**	**Annual:**	**$30,917.42**
Weekly Gross Energy (KWHrs):		2.76E+05		

Amortization of the Vessel

Principal	$12,000,000.00
Annual interest	3.75%
Term (years)	10
Periods per year	12
Start date	5/1/15
Monthly payment	**$120,073.49**
No. of payments	120

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Table 1b Energy Extracted by a Turbofoil®-equipped H_2 Generating Vessel

Hydrofoil Intake Length (Meters):	10	**=Hydrofoil Intake Length (feet):**	32.80833
Intake Height (Inches):	9	**=Intake Area (Square Feet):**	24.60625
Average Flow Rate (Miles/Hour):	40.25	**=Intake Area (Square Meters):**	2.286005
Average Flow Rate (Knots):	34.97688	**=Meters/Second (M/S):**	17.99343
Estimated Water Density (Kg/M^3):	1.00E+03	**=Cubic Feet per Second (CF/S):**	1452.589
		=Cubic Meters per Second (M^3/S):	41.13306
Turbine Efficiency (%):	90		
Generator Efficiency (%):	90		
Mech. & Elect. Efficiency (%):	88		
Electrolyzer Efficiency (1) (%):	77		
Hydrogen Compressor Efficiency (%):	90		
		=Total Efficiency (%):	49.39704
Wholesale Energy Price ($/KWHr):	$0.12		
Number of Turbofoils per Vessel:	3		
= Power = Kinetic Energy (1/2MV^2)/S=J/S=Watts:	6.66E+06		
=Extractable Power (includes efficiencies), Watts:	3.29E+06		
	4.41E+03	**H.P.**	
Dollars per Hour per Turbofoil:	$394.70		
=Extractable Power (includes efficiencies), Watts:	**9.87E+06**		
	1.32E+04	**H.P.**	
Dollars/Hour:	**$1,184.11**		
Kg of H2 per hour assuming 1.23V electrolysis(1)	**3.71E+02**		
ETA (hours) for 1 Metric Ton H2 for 1.23V electrolysis	2.694615		
Dollars/Kg	**$3.19**		

As seen in the tables above, a single vessel equipped with three Turbofoil®'s was estimated to cost $12MM, financed through debt amortized over 10 years at 3.75% interest. Given a 12 cents per kWh wholesale rate, operating such a vessel over the ten-year period will yield a little less than 2 percent operating margin. Once the vessel debt is paid-off, the operating margin jumps to better than 85%. The physical model describes a vessel generating power for one-third of half a year (one-third of the hurricane "season"), with the motive fluid entering the turbine at 35 knots.

a) Can a ten (10) PPA be developed at or near current market prices?

From the tables above, requiring a ten-year PPA would apply burdensome constraints on the business model. For instance, although debt-financing the project at 3.75% while possible today, present bond market conditions are not likely to persist. This would have an impact on the proposed 12 cents per kWh rate that is near current market prices.

b) What are the cost impacts of a ten (10) year term?

The most prevalent impact is on the financing itself in a debt-financed business model. Having a twenty-year term would allow 10% interest financing while yielding near 5% operating margin per vessel, given 12 cents per kWh.

c) What are the cost impacts of a ten (10) year PPA contract with a ten (10) year option?

As stated above, a ten-year follow-on option will avail a better than 85% operating margin at 12 cents per kWh, once the vessel debt is paid-off at the end of the first ten-year period. As debt-financing appears the largest single expense in operating the proposed project, once the vessel debt is paid-off, the operator can continue to enjoy healthy margins at 4 cents per kWh throughout the remaining life of the vessel. A ten-year option also brings a much more competitive Levelized Cost of Energy (LCOE) over the life of the vessel, as its life expectancy exceeds twenty years.

d) Could these options help to reduce the PPA price and/or alleviate the financing risk?

As stated above, a ten-year follow-on option will avail, once the vessel debt is paid-off, the operator to continue to enjoy healthy margins at 4 cents per kWh throughout the remaining life of the vessel and a much more competitive Levelized Cost of Energy (LCOE) over the life of the vessel, as its life expectancy exceeds twenty years. These options allow greater flexibility in financing such as adjustable rates, long-term amortization with lump-sum due in ten years, etc. Furthermore, such options could allow fleet expansion whereby newer vessels further along in the production ramp-up curve cost less to manufacture and thus may experience lower financing costs or afford reduced PPA prices.

e) What would the optimal financing term be for the type of renewable resource that your firm is interested in developing?

The vessels will be designed for a long service life, thus longer-term debt is preferred. It would be reasonable to apply a 30-year term for such a vessel.

f) What are other potential solutions to overcome the current ten (10) year contract term limit?

One potential solution includes a private equity buyout option of the GSA party obligations.

g) What are other potential risks associated with these options?

Private equity market may not take interest in a renewable project.

2. Issue: Delivery Date for Supply from the Renewable Project

a) Will the flexible start date assist project development?

Start date flexibility is absolutely necessary for most Renewable Energy Projects due to their nascent technology. The presently proposed project is no exception to such necessity.

b) How long do your project(s) typically take to develop?

Three years is the present estimate for design implementation and field test completion.

c) What is a reasonable start date range for the type of renewable resource your firm is developing?

A thirty-six month production ramp-up period instead of the proposed twenty-four months, with all other terms remaining the same.

3. Issue: Termination for Convenience (T4C)

a) What are your specific concerns with the GSA's standard termination for convenience (T4C) clause language in FAR 52.212-4(L)?

Ostensibly, the T4C clause language in FAR 52.212-4(L) appears fair. One area of concern includes fully documenting up-front all costs that cannot be avoided.

b) What types of termination schedules are typical (e.g., early termination during construction; before tax credits are utilized; after tax credits are utilized; partial termination; other)?

A termination schedule should stipulate before tax credits are utilized, resource assessment must be completed, in case of an early termination before construction.

c) Are there any other comments or potential solutions regarding T4C and/or termination schedules?

New Renewable Energy Projects tend to require assessments of resources. An initial overestimate of resources proven erroneous should trigger a T4C with unavoidable costs paid.

d) Is it possible to include a simple T4C schedule similar to an amortization schedule with a standard mortgage?

Only after fully documenting up front-all costs that cannot be avoided.

4. Issue: Indicative Pricing

a) What is the optimal contract term for your renewable projects?

While the above table indicates the FAR-limited ten-year term is possible, a more suitable term would likely be twenty years.

b) What is the best way to monetize the REC value from the renewable resource over a long term? Would it be best for GSA to guarantee a floor price for the RECs, but allow the RECs to be sold for shorter time periods to maximize potential REC value? Is there a market for long term RECs (i.e. longer than 5 years)?

The Carry-over for Tradeable REC's in California is twenty years, and of similar term in other states. However, if near term monetization of TREC's does not appear imminent, IPTC will consider deal structures such as "Partnership Flips", "Sale-Leaseback" or "Lease-Pass Through" for near term finance needs.

c) Besides the RECs, would GSA own any other environmental attributes, including any emissions credits, associated with the new renewable resource?

Besides charged batteries or hydrogen from electrolysis of seawater, IPTC's technology is modular and can also configure to provide other energy-intensive commodities from oceanic sources such as potable water, or sea salt, chlorine bleach, or lye. Recent studies indicate chlorine bleach at appropriate concentrations may act as an environmental remediation reagent, particularly abating proliferation of fouling species. Credits for this aforementioned environmental attribute need to be investigated.

d) From a settlement standpoint, GSA would prefer to receive blocks of around the clock (ATC) power deliveries for a specified number of MWs. Please explain if your firm would be able to deliver a specified ATC MW block from the new resource or if your firm would need to offer output on a unit contingent basis?

Based upon integrated energy storage, IPTC's technology is able to deliver a specified baseload ATC MW block from the new resource. Because of depending upon inherently non-constant renewable energy sources, an ATC MW rating would necessarily be based upon an average derived from annual accumulated weather data corresponding to proposed delivery sites accounting for logistics.

e) One of the potential benefits of purchasing new renewable energy is that there can be no or limited input fuel costs and the pricing is primarily the cost of financing and profit for the project spread out over the term of the contract. Other than fairly minor adjustments for operations and maintenance and taxes, what reason would there be for an annual price escalation? Should the escalation be in any way linked to the market price of power?

Labor and Materials costs for maintenance and operations could vary depending upon scarcity or socioeconomic reasons, but as stated, expected to be fairly minor. IPTC's technology delivers the new renewable resource promise of negligible input fuel costs, and thus one can foresee no annual price escalation

5. Proposed Locations for Commercial-Scale Mobile Buoyant Structure Deployment

For the Western Atlantic and Western Pacific regions, tropical storms, hurricanes, or typhoons have proven a bane to their existence until now as the invention of the Turbofoil® promises to render such co-location fortuitous. While for both regions tropical storm frequency and intensity is greatest between June and November, other locations as described below have high-energy wind patterns during the hurricane "off-season". Also historic annual average insolation data corresponding to these regions further proves another class of mobile buoyant structure, the Solar Cogeneration Vessel (SCV), economically feasible. An ideal central service, maintenance, fuel distribution, command/control facility located in Hawaii, as it sits in a central location between Alaska known for high intensity winter jet wind events, and the Western Pacific, may appreciate logistical advantages.

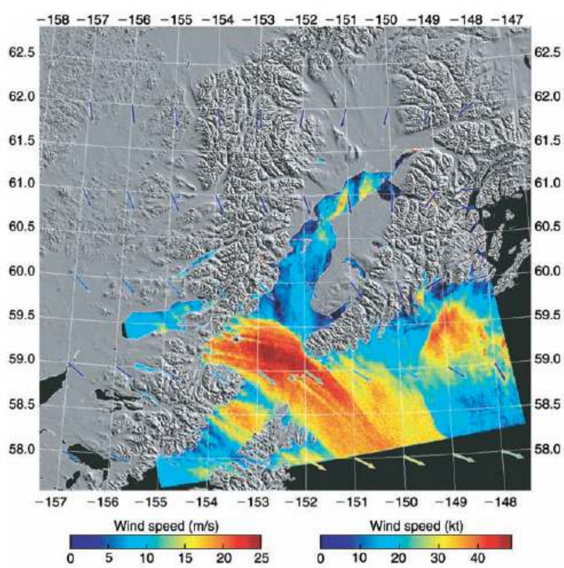

Figure 3. Radarsat-1 SAR wind speed image near Kodiak Island, Alaska.

The figure above, taken from the Johns Hopkins Applied Physics Laboratory paper entitled: Ocean Wind Field Mapping from Synthetic Aperture Radar and Its Application to Research and Applied Problems, illustrates a seasonal wind resource usually near Kodiak Island Alaska for which a vessel of streamlined design would profitably regularly serve the wind energy market, even if the design barely achieves a minimal 50% vessel to true wind velocity ratio. As these jet wind patterns drift along the coast over the windy season, a Turbofoil® in deeper water attains obvious advantages over fixed farms over relatively shallow water.

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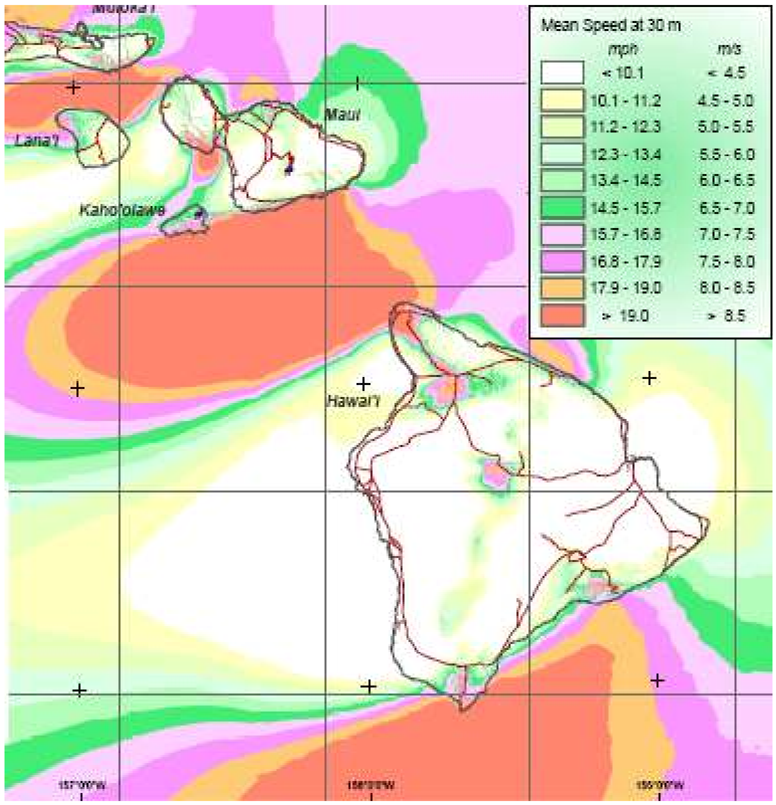

The figure above (http://www.awstruewind.com/), shows an expansive source of wind north and south of the Big Island of Hawaii. The one to the north covers approximately 2500 square miles and both extend into deep water and as such exemplify more instances where a turbine-integrated hydrofoil better serves the need for offshore wind exploitation. The Hawaiian resource appears somewhat less in magnitude compared to the Alaskan Jet wind phenomena of the previous figure, thereby suggesting a niche for a more streamlined designed vessel. Thus, given the two wind maps above, the value of streamlined designed turbine-integrated hydrofoils serve a distinct advantage in the tropical storm off-season, and therefore deserve full design consideration and characterization before deciding an optimal design approach. The VPP/CFD portion of the design effort will best characterize these two design paradigms and henceforth direct any marketing activity related to either design approach. The consistency of these Hawaiian winds also suggests a test site for Phase II of product development.

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Appendix A: Patent Portfolio Docket Status

Patents Issued

SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM FOR ENERGY EXTRACTING VESSEL NAVIGATION
US PATENT 7,698,024, Issued: 4/13/2010 see Appendix B(8)
US PATENT 7,962,251, Issued: 6/14/2011 see Appendix B(8)

TURBINE-INTEGRATED HYDROFOIL
US PATENT 7,298,056, Issued: 11/20/2007 see Appendix B(8)
JAPAN PATENT 4801156, Issued 8/12/2011 see Appendix B(8)

US Registered Trademark no. 3,499,529: TURBOFOIL ®
Registered: 9/9/2008, Int. Class 40 for Production of Energy

TRANSVERSE HYDROELECTRIC GENERATOR
US PATENT 7,088,012, Issued: 8/8/2006 see Appendix B(8)

GIMBAL-MOUNTED HYDROELECTRIC TURBINE
US PATENT 6,956,300, Issued: 10/18/2005 see Appendix B(8)

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Patents Pending

SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM FOR ENERGY EXTRACTING VESSEL NAVIGATION
Continuation application: 13/073,891 filed: 3/28/2011 pending, see: Specification, Pending Claims, Abstract Appendix B(8)
PCT Application Number: PCT/US2008/082688
Japan Patent Application 2010-534105; Filed: 11/6/2008 pending

SOLAR COGENERATION VESSEL
U.S. Patent Application Number: 13/169,236 filed: 6/27/2011 pending, see: Abstract; Specification; Drawing Figures; Pending Claims Appendix B(8)

TURBINE-INTEGRATED HYDROFOIL
Continuation application: 11/942,546, filed: 11/19/2007 pending
PCT Application Number: PCT/US2006/033373

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Appendix B: Additional Information

1) Company Website: http://www.intpowertechcorp.com
2) Private Youtube Video: http://youtu.be/dZCL9ZKdn0M
3) Company Contact: andy.gizara@intpowertechcorp.com
4) Company EIN: 03-0607579
5) Company DUNS: 786722905
6) CA Company Number: 2889565
7) To access The Turbofoil® Feasibility Analysis spreadsheet tool from which the author created Table 1a & 1b, go to: http://www.intpowertechcorp.com follow the >Renewable Energy Portfolio< link at the top of the page to the IPTC Renewable Energy Portfolio Technology Summary where "Turbofoil® Feasibility" directs one to the spreadsheet link. In the spreadsheet, one may analyze various scenarios by modifying physical parameters while in the Yield(W) tab, or modifying financial parameters while in the Yield($) tab.
8) Go to: http://www.intpowertechcorp.com follow the >Renewable Energy Portfolio< link at the top of the page to the IPTC Renewable Energy Portfolio Technology Summary where "Docket Status" directs one to .pdf files including complete issued patent .pdf documents and pending application Abstract, Specification, Drawing Figures, and Pending Claims .pdf documents.