BLACKLIGHT POWER

clean, renewable, sustainable energy

# Business Presentation

## Electrochemical and Thermal Systems

August 2014

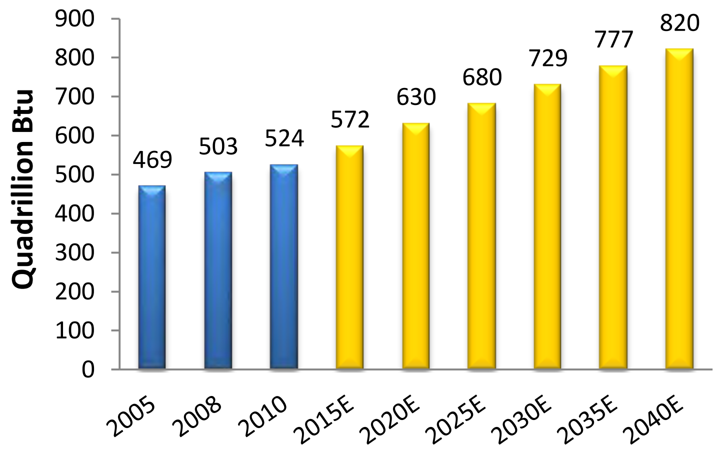
# Safe Harbor Statement

This presentation contains forward-looking statements, including statements regarding the company's plans and expectations regarding the development and commercialization of our technology. All forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those projected. The forward-looking statements speak only as of the date of this presentation. The company expressly disclaims any obligation or undertaking to release publicly any updates or revisions to any such statements to reflect any change in the company's expectations or any change in events, conditions or circumstances on which any such statements are based.

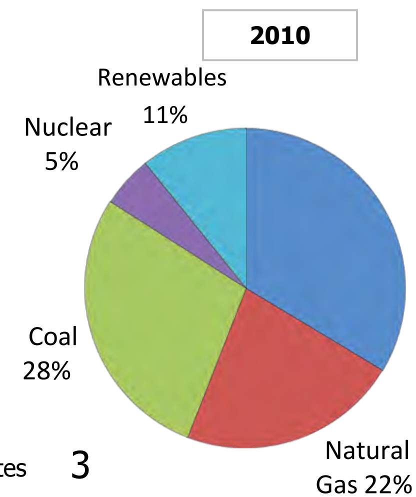
# The Opportunity

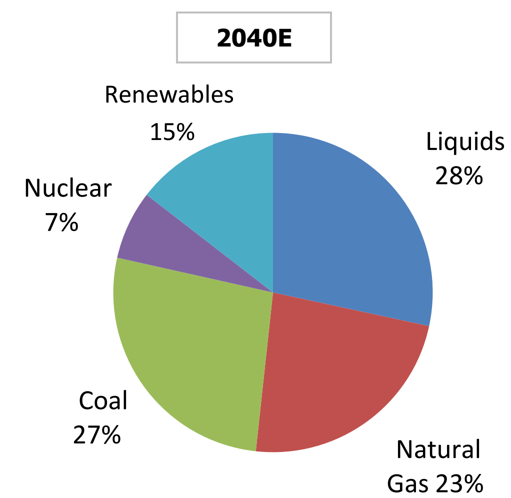
- Established energy sources are expensive, polluting and unsustainable
  - ~$8 trillion currently spent globally on fossil fuels; ~$2 trillion in the U.S.
  - Each year, tens of billions are spent on energy R&D in search of alternative solutions
- Over $1 trillion annually expected to be spent on global energy infrastructure through 2030
- Global energy demand has nearly doubled over the past 20 years, and is projected to increase 56% between 2010 and 2040
- Existing sources of renewable energy are expected to satisfy only a small portion (~15%) of 2040 demand
  - Wind and solar are relatively poor sources of baseload power
  - The remainder will be supported primarily by fossil fuel consumption, which is expected to increase nearly 46% over the same time period

## Global Energy Consumption




## Global Energy Use by Fuel Type




Sources: EIA IEO 2013, International Energy Agency and management estimates

# The Solution - BlackLight Power

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- BlackLight Power has developed a new, sustainable nonpolluting energy technology.
- BLP's technology and science have been validated by independent third parties in their own laboratories.
- Electrochemical and solid fuel systems have been validated.
- Established fuel cell and central power generation pathways to market.
- Additionally, advanced thermal power source with Licenses in place with seven firms to offer up to 8,250 MW of power.

*The BlackLight Process could be the most important energy technology of our generation*

# Unit Costs: BLP vs. Competitors

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Table 1. Capital and Generation Costs Comparisons of BlackLight Power Sources Versus Other Primary Energy Sources or Power Converters.

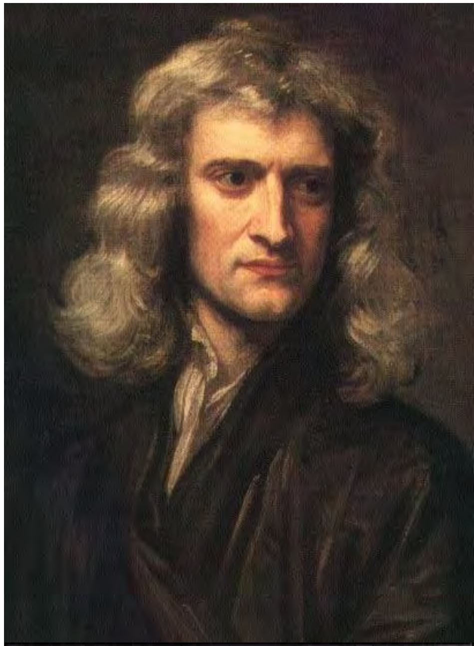
| | Average Generating Capacity (MW) | Installed Cost ($/kW) | Levelized Cost of Electricity ($/kWh) | $CO_2$ Emission (lb per MWh) |
|---|---|---|---|---|
| **CENTRAL GENERATION** | | | | |
| **BLP Thermal** | **1+** | **1,000** | **<0.01** | **0** |
| Natural Gas Combined Cycle | 550 | 1,000 | 0.06 | 800 |
| Coal | 600 | 3,000 | 0.065 | 2,500 |
| Nuclear | 1,100 | 5,400 | 0.12 | |
| **DISTRIBUTED GENERATION APPLICATIONS** | | | | |
| **BLP SF-CIHT** | **<10 MW** | **<100** | **<0.01** | **0** |
| Solid Oxide Fuel Cell | 2.4 | 5,000 | 0.21 | 850 |
| Wind | 100 | 2,000 | 0.10 | |
| Photovoltaic | 10 | 3,000 | 0.20 | |

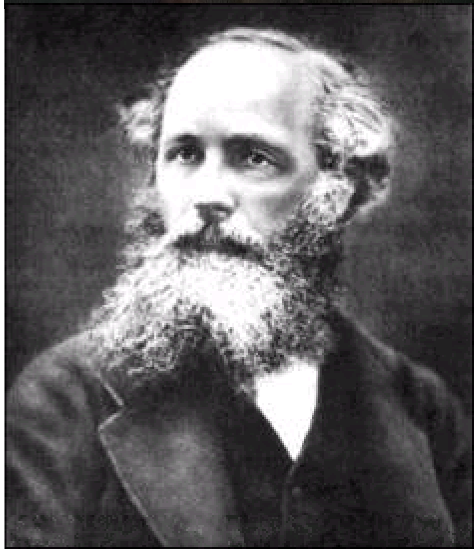
*Sources: EIA, Lazard 7.0 and Management estimates*

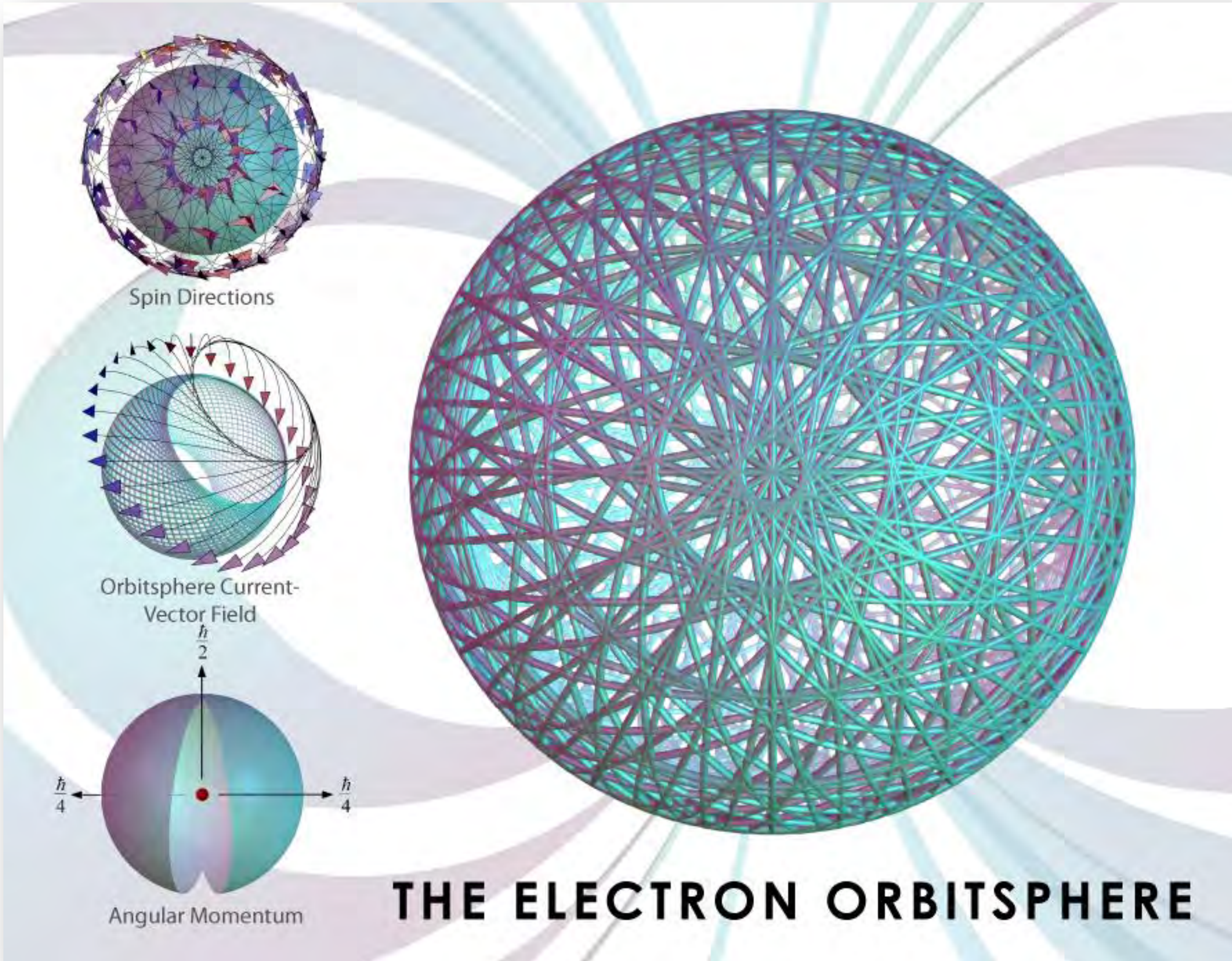
# Background

# Review of Theory

- Founder, Dr. Randell Mills, proposed a new model of the electron that was used to predict our novel energy technology
- Assume physical laws apply on all scales including the atomic scale
- Start with first principles
  - Conservation of mass-energy
  - Conservation of linear and angular momentum
  - Maxwell's Equations
  - Newton's Laws
  - Special Relativity
- **Highly predictive**– application of Maxwell's equations precisely predicts hundreds of fundamental spectral observations in exact equations with no adjustable parameters (fundamental constants only). Correctly predicts the fundamental observations of chemistry and physics in exact equations over a scale (largest to smallest) of 1 followed by 85 zeros.

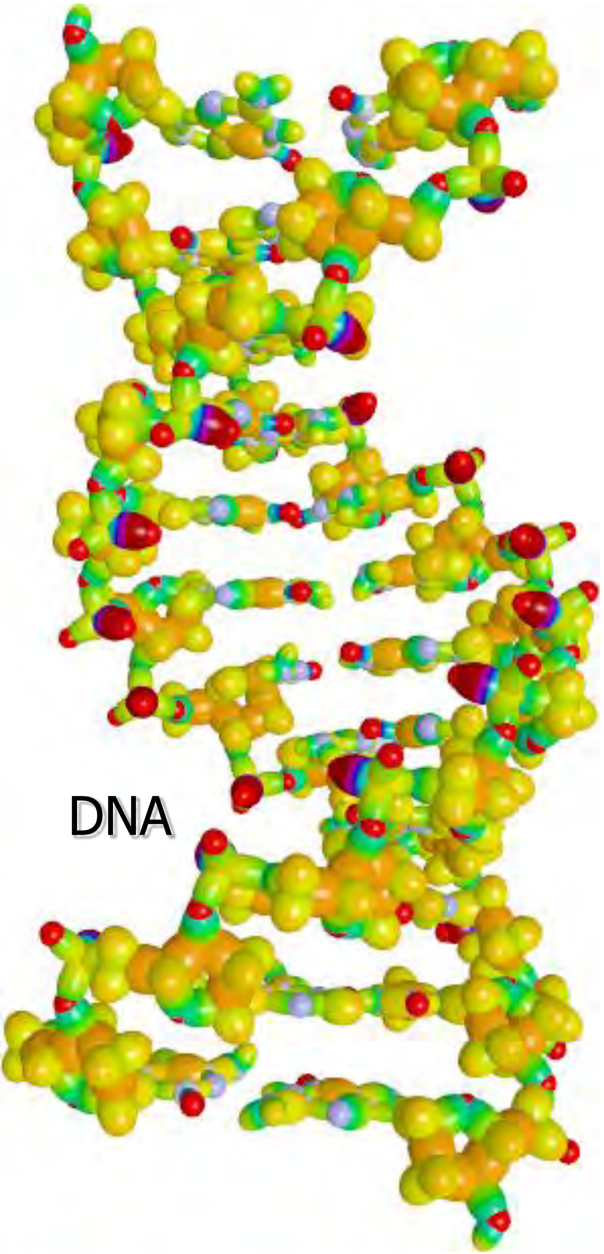


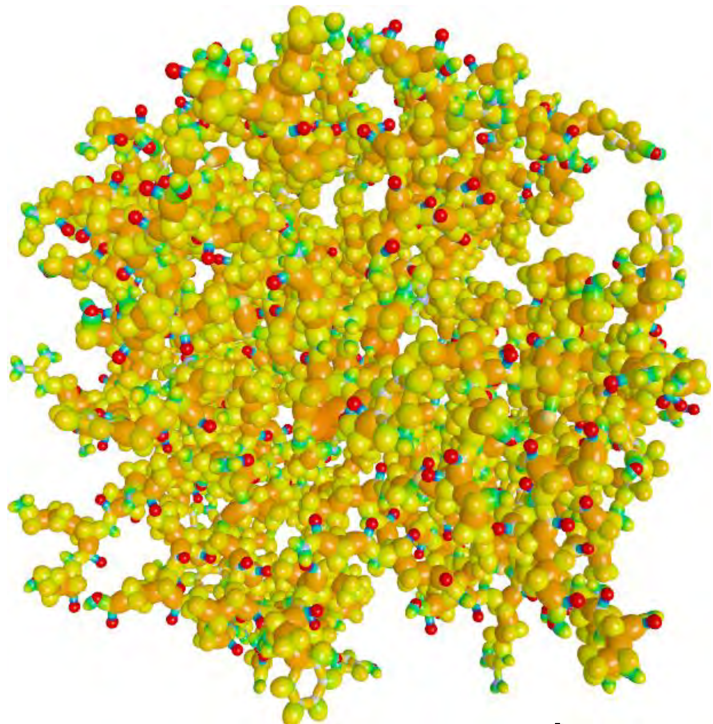


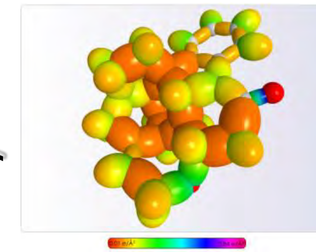

Spin Directions
Orbitsphere Current-
Vector Field
$\frac{\hbar}{2}$
$\frac{\hbar}{4}$
$\frac{\hbar}{4}$
Angular Momentum
THE ELECTRON ORBITSPHERE

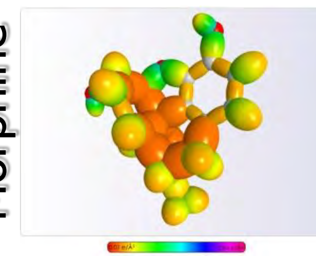
# Millsian 2.0: Modeling Molecules

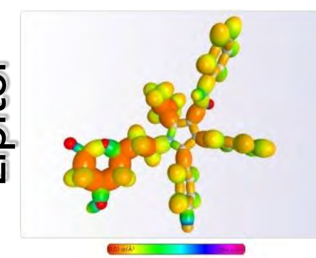


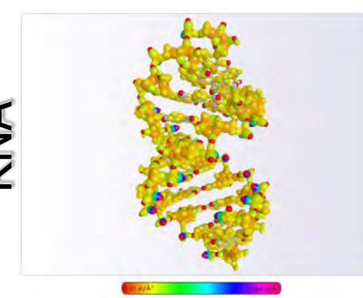

DNA


Insulin


Strychnine


Morphine


Lipitor

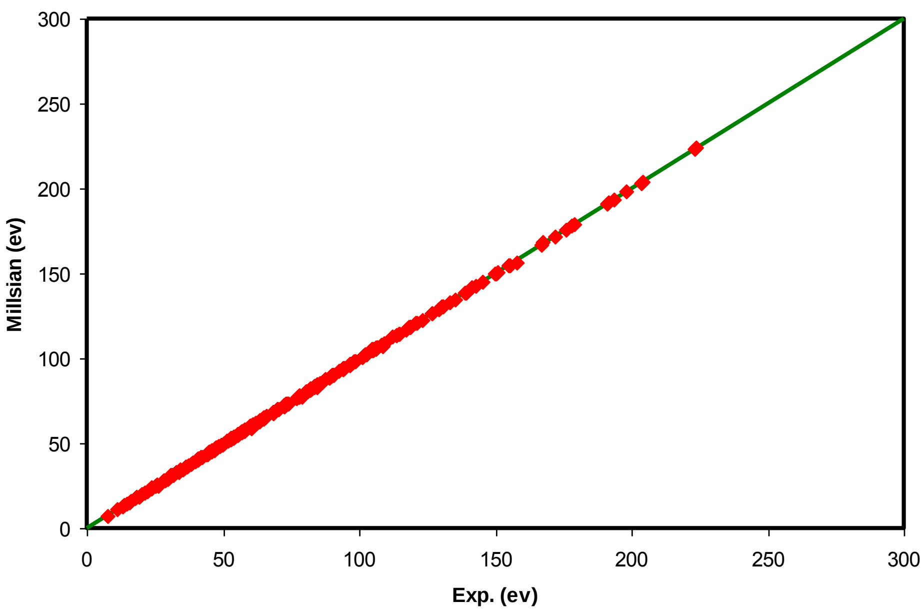

RNA

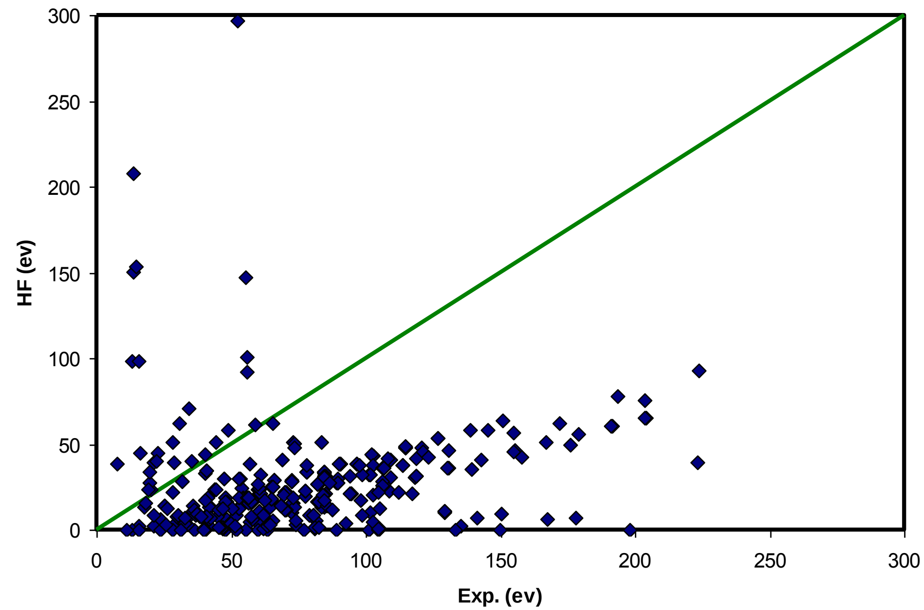
millsian.com

# Comparison of Classical to Quantum Mechanical Performance

The total bond energies of exact classical solutions of 415 molecules generated by Millsian 1.0 and those from a modern quantum mechanics-based program, Spartan's pre-computed database using 6-31G* basis set at the Hartree-Fock level of theory, were compared to experimental values.

## Millsian vs. 6-31G*




R. L. Mills, B. Holverstott, W. Good, A. Makwana, J. Paulus, "Total Bond Energies of Exact Classical Solutions of Molecules Generated by Millsian 1.0 Compared to Those Computed Using Modern 3-21G and 6-31G* Basis Sets," Phys. Essays 23, 153 (2010); doi: 10.4006/1.3310832

# Physical Image Compared to Physical Solution

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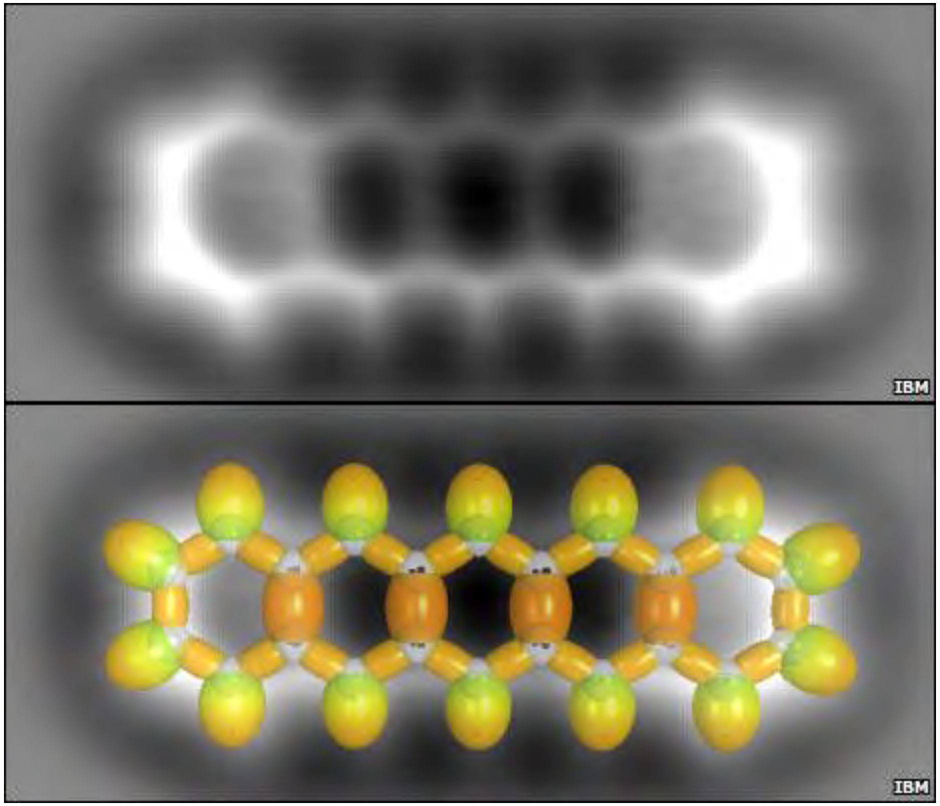
The polycyclic aromatic hydrocarbon pentacene was imaged by atomic force microscopy using a single CO molecule as the probe. The resulting breakthrough in resolution revealed that in contrast to the fuzzy images touted by quantum theoreticians as proof of the cloud model of the electron, the images showed localized bonding MOs and AOs in agreement with the classical solution.

Top, atomic force microscopy image of pentacene by Gross et al. Bottom, the superimposed analytical classical solution that matches the physical structure.




[L. Gross, F. Mohn, N. Moll, P. Liljeroth, G. Meyer, "The chemical structure of a molecule resolved by atomic force microscopy", Science, Vol. 325, (2009), pp. 1110-1114.]

# The BlackLight Energy Process

# Hydrino Reaction ("BlackLight Process")

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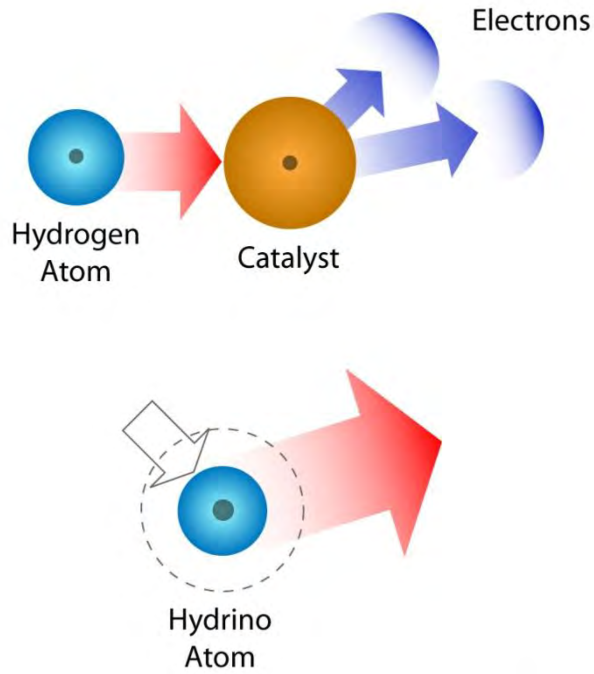
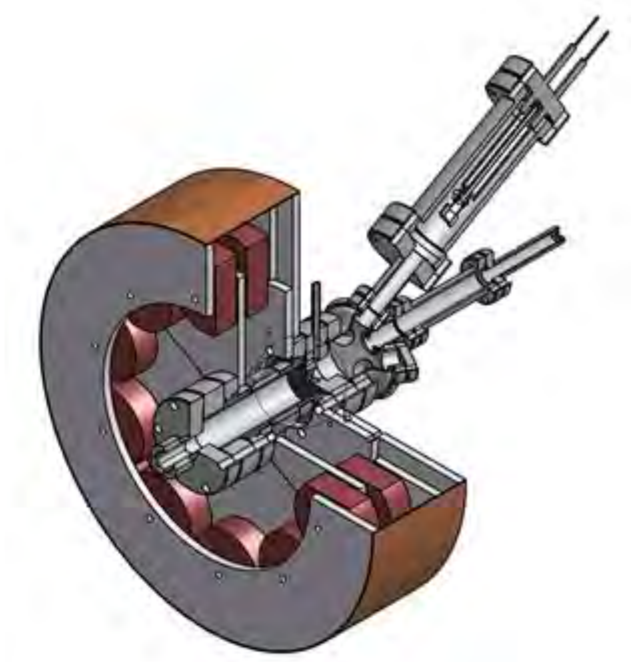
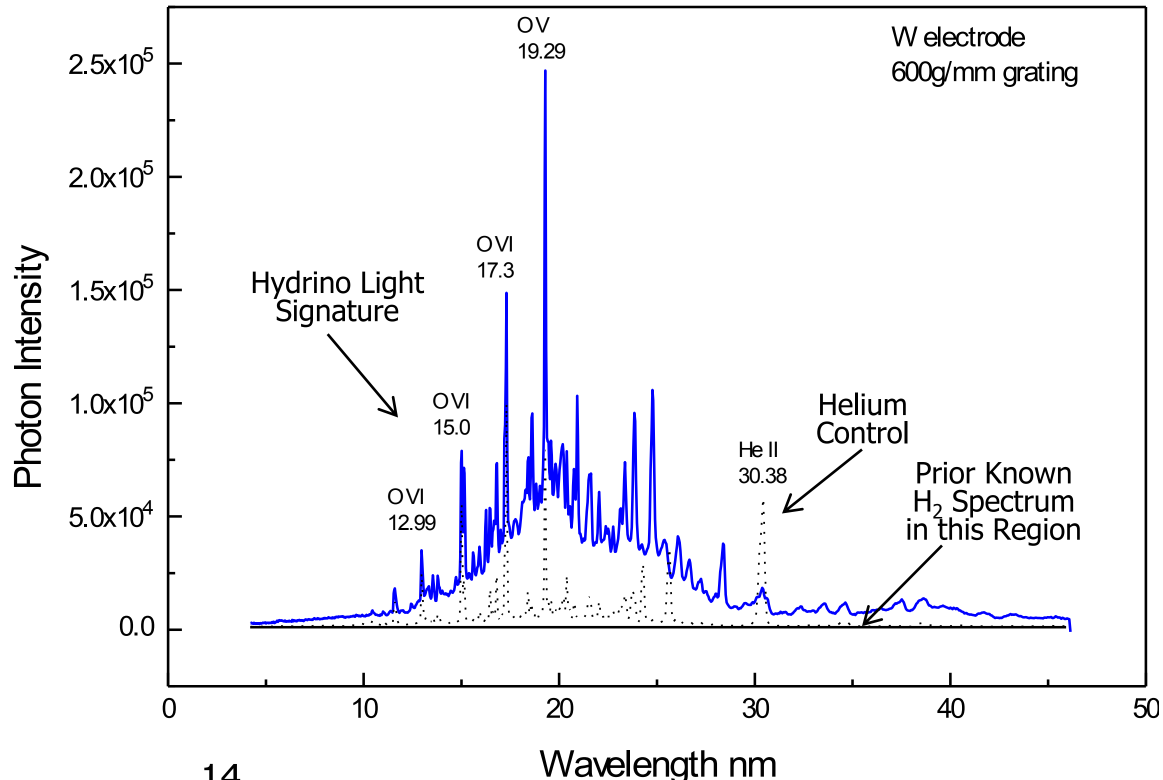
1. Atomic hydrogen reacts with an energy acceptor called a catalyst wherein energy is transferred from atomic hydrogen to the catalyst which forms an ion due to accepting the energy
2. Then, the negative electron drops to a lower shell closer to the positive proton to form a smaller hydrogen atom called a "hydrino" releasing energy that ultimately is in the form of heat
3. The catalyst ion regains its lost electrons to reform the catalyst for another cycle with the release of the initial energy accepted from hydrogen. With the imposition of an arc current condition, the limiting space charge of the ionized electrons is eliminated and the rate becomes massively high.



# Hydrino Light Signature

- Experimental Setup for the Observation of the Hydrino Light Signature
  - Light signature from pure hydrogen at much higher energy than deemed possible for this element in any known form
  - Continuum radiation showing H going below the level previously thought to be the "Ground State"





# Dark Matter Ring in Galaxy Cluster

This Hubble Space Telescope composite image shows a ghostly "ring" of dark matter in the galaxy cluster Cl 0024+17. The ring is one of the strongest pieces of evidence to date for the existence of dark matter, a prior unknown substance that pervades the universe.

Characteristic EUV continua of hydrino transitions following radiationless energy transfer with cutoffs at $\lambda_{\left(H \to H\left[\frac{a_H}{p=m+1}\right]\right)} = \frac{91.2}{m^2}\ nm$ are observed from hydrogen plasmas in the laboratory that match significant celestial observations and further confirm hydrino as the identity of dark matter.


M. J. Jee et al., Discovery of a ringlike dark matter structure in the core of the galaxy cluster C1 0024+17, Astrophysical Journal, 661, (2007) 728–749.

R. L. Mills, Y. Lu, K. Akhar, Spectroscopic observation of helium-ion- and hydrogen-catalyzed hydrino transitions, Cent. Eur. J. Phys., 8, (2010) 318–339, DOI: 10.2478/s11534-009-0106

R. L. Mills, Y. Lu, "Time-Resolved Hydrino Continuum Transitions with Cutoffs at 22.8 nm and 10.1 nm," Eur. Phys. J. D, 64, (2011), pp. 65, DOI: 10.1140/epjd/e2011-20246-5.

R. L. Mills, Y. Lu, Hydrino Continuum transitions with cutoffs at 22.8 nm and 10.1 nm, Int. J. Hydrogen Energy, 35 (2010) 8446–8456, doi: 10.1016/j.ijhydene.2010.05.098.

F. Bournaud et al., Missing mass in collisional debris from galaxies, Science, 316, (2007) 1166–1169.

# Hydrino Identification

- GUT
- Molecular modeling
- H(1/2) and H(1/4) hydrino transitions observed by continuum radiation
- Astronomy data verifying hydrinos such as H(1/2), H(1/3), and H(1/4) hydrino transitions
- $H^-(1/2)$ hyperfine structure
- $H_2$ (1/4) XPS binding energy
- $H_2$ (1/4) ro-vib spectrum in crystals by e-beam excitation
- $H_2$ (1/4) FTIR
- $H_2$ (1/4) Raman
- $H_2$ (1/4) Photoluminescence spectroscopy
- Fast H in plasma including microwave and rt-plasmas
- Rt-plasma with filament and discharge
- Afterglow
- Highly pumped states
- H inversion
- Power with multiple solid fuels chemistries
- SunCell energetic plasma
- ToF-SIMS and ESI-ToF identification of hydrino hydride compounds
- Solid H NMR
- H (1/4) spin-nuclear hyperfine transition
- Electricity gain over theoretical in CIHT cells

## CIHT Electrical Power

Catalyst Induced Hydrino Transition (CIHT) comprises the direct production of electrical power from the formation of hydrinos using $H_2O$ vapor as the only source of fuel.

# CIHT Electrical Power

(Catalyst Induced Hydrino Transition)

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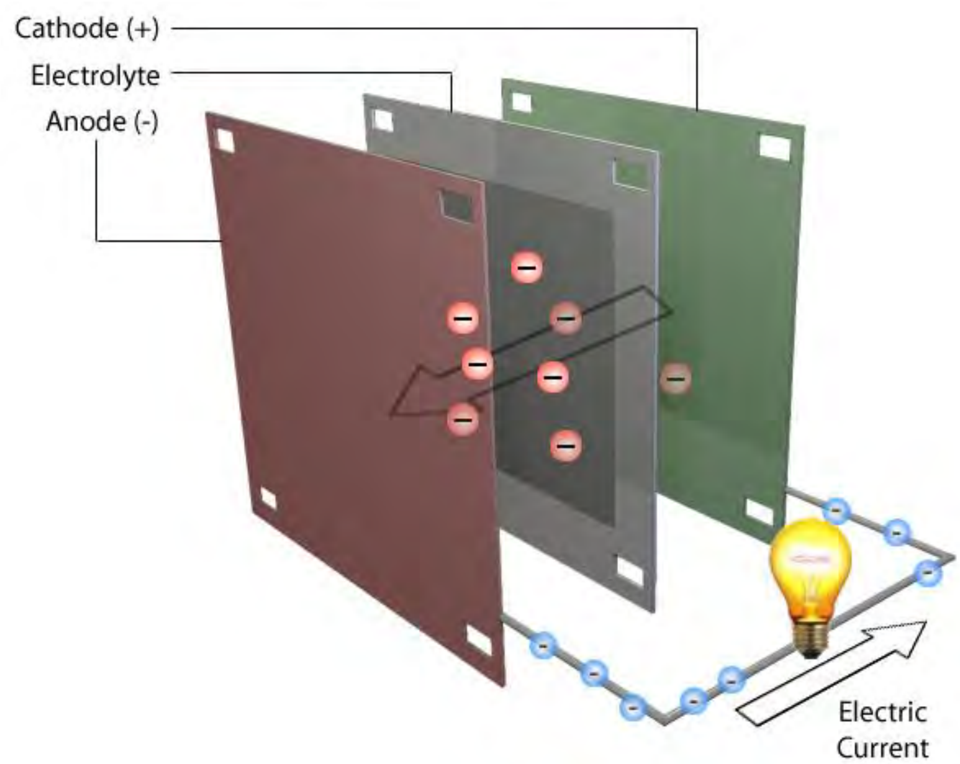
- The electrical energy release per hydrogen consumed is two hundred times that of a conventional fuel cell that produces water instead.

- No extreme conditions, or precious or exotic materials are needed.

- Consequently, the capital cost and cost per unit electricity are factors lower. Projected CIHT cost is less than a tenth that of conventional thermal based systems, wind, or solar.

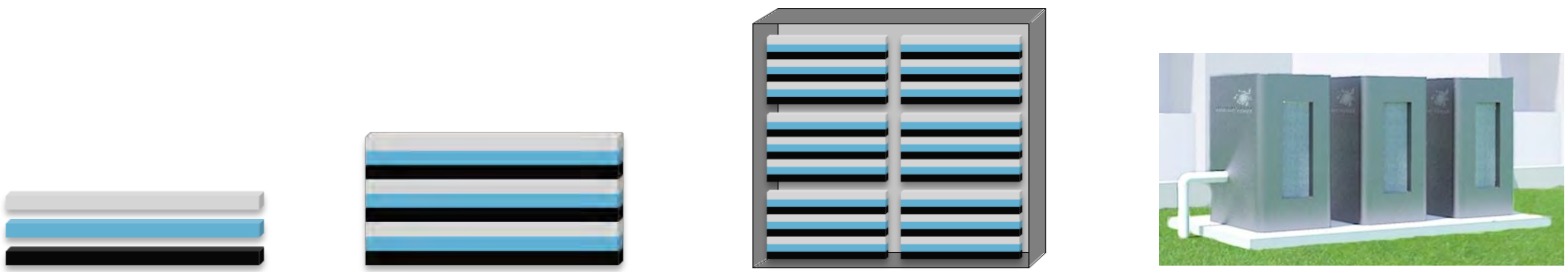


# CIHT Electrical Power

(Catalyst Induced Hydrino Transition)

CIHT offers the potential to replace all power sources: thermal, electrical, marine, aviation as well as motive sources.

CIHT allows users to become un-tethered from a fuel or distribution infrastructure, and produces no pollution, including greenhouse gases.



**CIHT CELL → STACK → MODULE → SYSTEM**

# CIHT Validation



Validators have confirmed CIHT cell performance and commercial opportunity wherein only $H_2O$ is consumed to form hydrinos and $O_2$ as electric power is produced continuously for the 30-day duration of the studies. Validators also confirmed the theory and hydrino identification.

The Validation Reports page on our website contains summary biographies for the validators and reports from:

- Dr. Henry Weinberg, CalTech Professor that advises brand name companies and institutional investment firms on technology and business opportunities;
- Dr. Terry Copeland, an industry expert, MIT PhD in chemical engineering, that managed R&D for brand name companies including battery and fuel cell product development;
- A team from a Fortune 500 firm consisting of an expert R&D manager, a PhD physics US DOD advisor, and a PhD chemist with fuel cell expertise;
- Dr. Kandalam Ramanujachary, a Professor with expertise in materials science that collaborates with world renowned battery and materials science groups;
- Dr. Nick Glumac, Chaired Professor at University of Illinois, CalTech PhD, US DOD advisor on energetic materials;
- ENSER Corporation, a defense company with strong electrochemistry R&D capabilities that manufactures missile batteries for the defense departments and top tier defense contractors.

# Scale-up

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**Completed**

- Bipolar plate achieved
- Larger electrode dimensions achieved
- 10 W stack achieved
- 50 times increase in surface power density
- Off-site validation

**Next**

- Multi-watt laboratory demonstration unit
- 1.5 kW pre-manufacturable prototype
- 1.5 kW cells will be ganged to provide stationary and motive power levels to meet those of essentially all applications

**Engineering**

- Engaged industry and academic consultants for cell design and development services

BLP Stack

Concept Stack

# Power Efficiency & Economics

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BLACKLIGHT POWER

- Independent validation reported CIHT electrical outputs of **10 to 2000 times** the input energy.
- The **capital costs** are projected to be under $100 per kW electric since no precious metals or rare earth materials are required and only readily available and highly commoditized materials are needed.
- Autonomous from the electrical transmission grid infrastructure.
- No fuel infrastructure is required to provide on-site power allowing the technology to remain autonomous.

# Key Competitive Advantages

- Availability of clean power **24/7/365**.
- $100 per kilowatt capex translates into potential for the cost per kilowatt hour to be less than **1 cent**.
- Breakeven for this technology is projected to be measured in **months** not years.
- Energy security and independence.
- 17 liters of water could power the average U.S. household for one year.

# CIHT Motive Electrical Power

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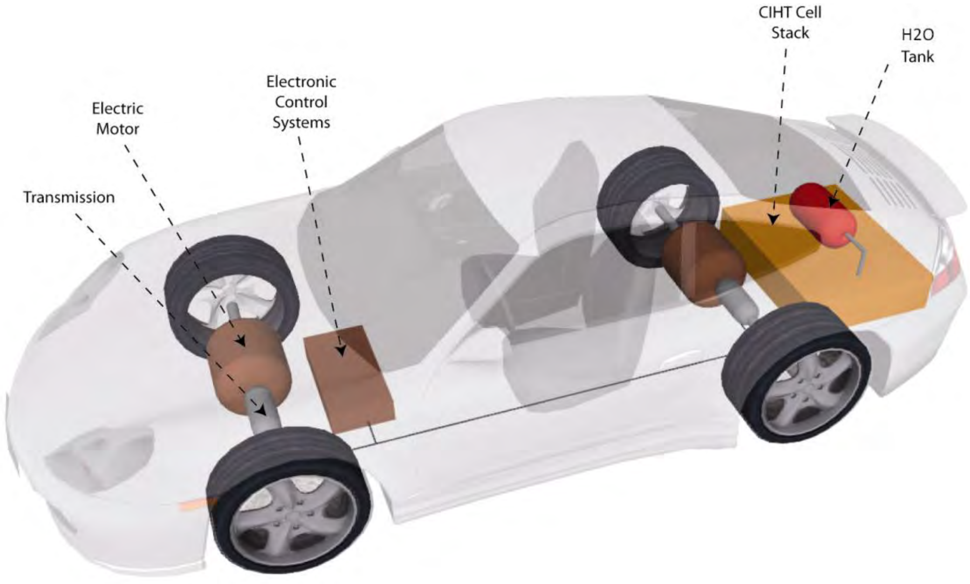
- 3000 miles per liter of water.
- **Projected cost of less than $100 per kW electric**.
- One third the weight of an internal combustion engine (ICE).
- Projected 200 kW (267 HP) CIHT stack and electric drive system is less than that of a comparable internal combustion system.
- Has the potential of unsurpassed capability in terms of range, capital cost, power, logistics, and pollution abatement to zero including zero carbon dioxide emission.




Concept car architecture utilizing a CIHT cell stack.

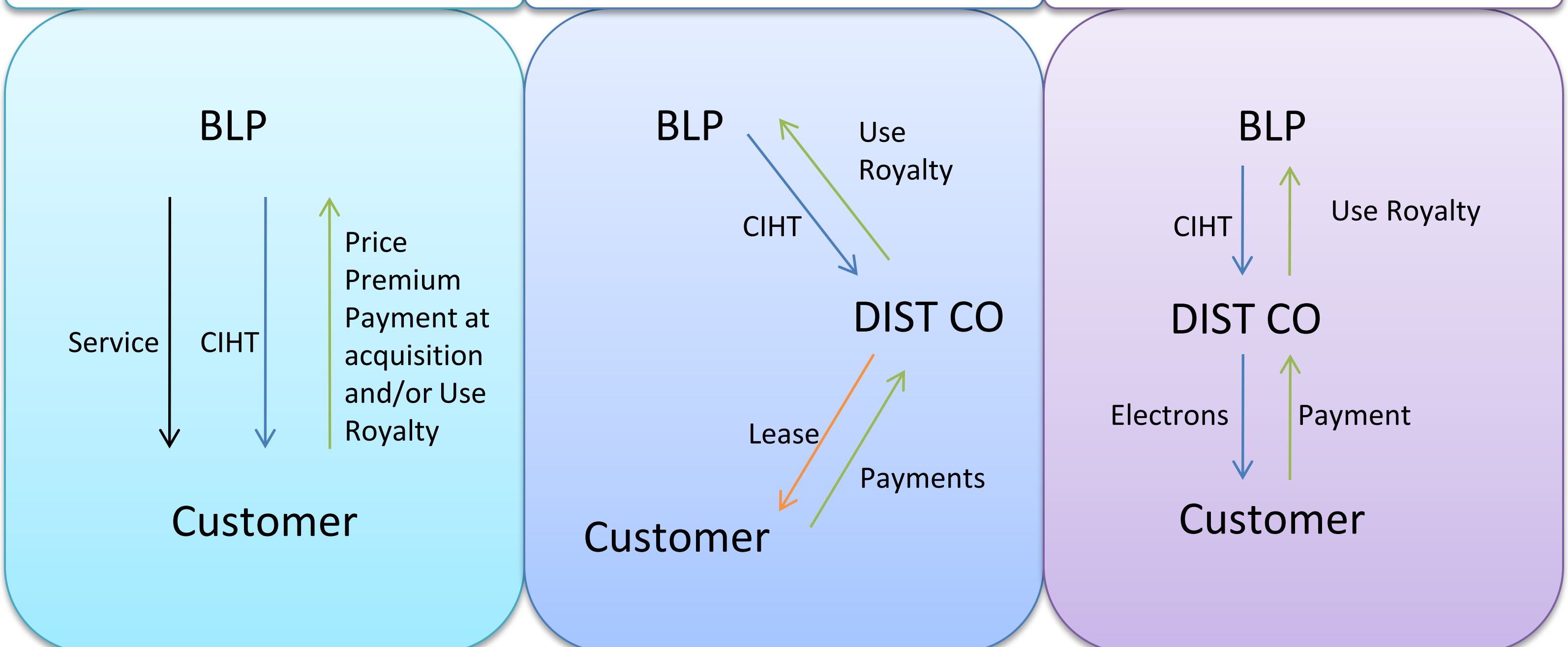
# CIHT Revenue Model

The Company plans to:

- License original equipment manufacturers to fabricate CIHT units to exclusively sell to the Company,
- License service companies to install and service the units,
- Pursue financing with the units and cash flow as collateral, and
- Lease units to power customers under power purchase agreements.

# Energy as a Service






| | PURCHASE | LEASE | POWER PURCHASE |
|---|---|---|---|
| CIHT Owner | Customer | BLP | BLP |
| O&M | Customer | DIST CO | DIST CO |
| Technology Risk | Customer | BLP | BLP/DIST CO |

# The Market Potential- CIHT

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*(Dollars in millions, except per kWh,and Single Micro-DG Device)*

| Revenue to BLP Enterprise | Single Micro-DG Device | United States (1) | |
|---|---|---|---|
| Total Deliverved Energy (kW) | 10 | | |
| Hours in a Year | 8,766 | | |
| Total Annual Delivered Energy (kWh) | 87,660 | 21 | Trillion |
| Equivalent 10 kW units | | 240 | Million |
| Average price of energy per kWh | 0.127 | 0.127 | |
| Annual Potential to BLP Enterprise | $ 11,132 | $ 2,667,000 | Million |
| Example Royalty | 50% | 50% | |
| Annual Potential BLP Gross | 5,570 | 1,333,500 | |

Source: EIA
(1) For illustrative purposes, assumes total delivered energy is derived from electrical power plants using the BlackLight Process.

# Arc Plasma Thermal Power

# $H_2O$ Water Arc Boiler Design

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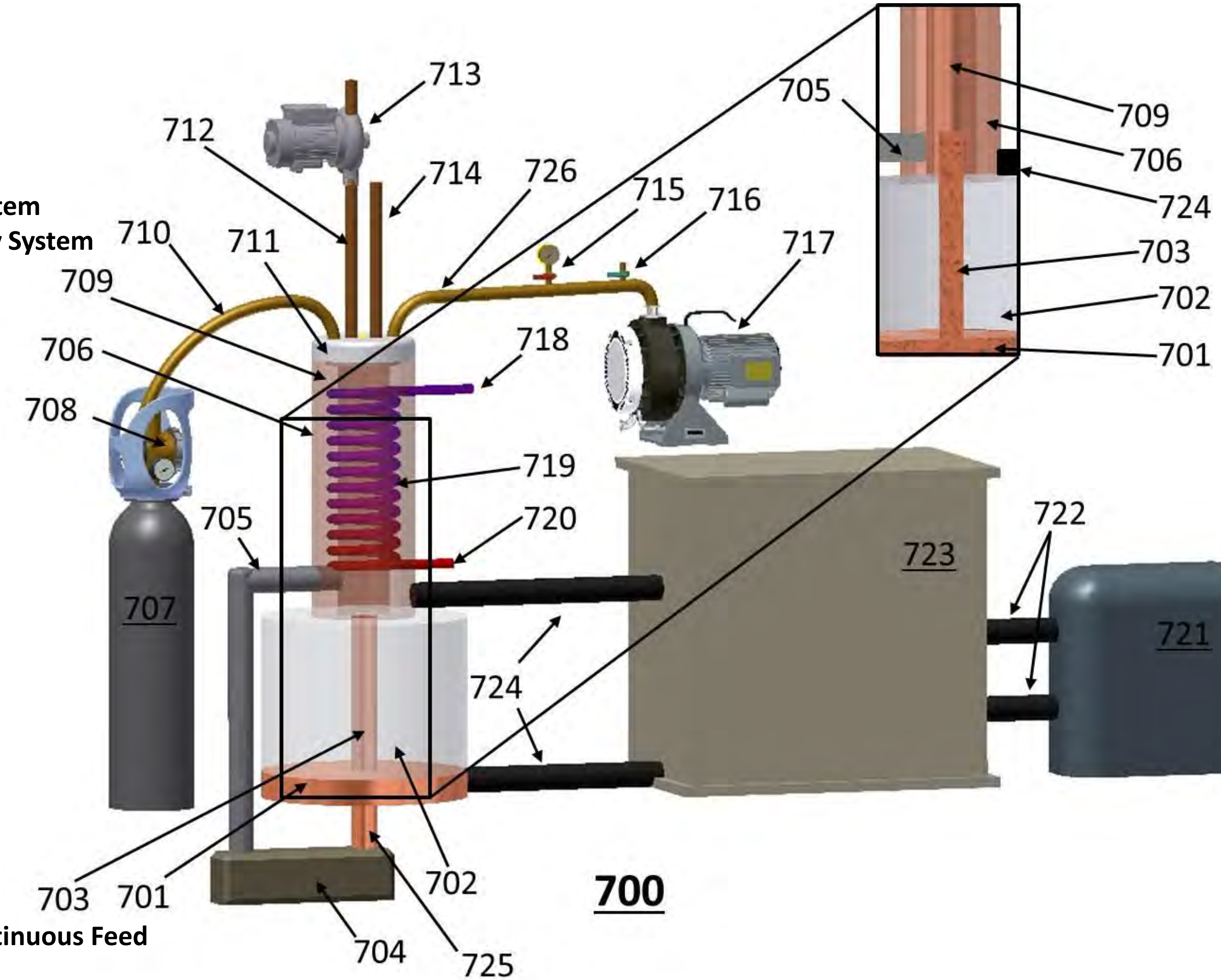
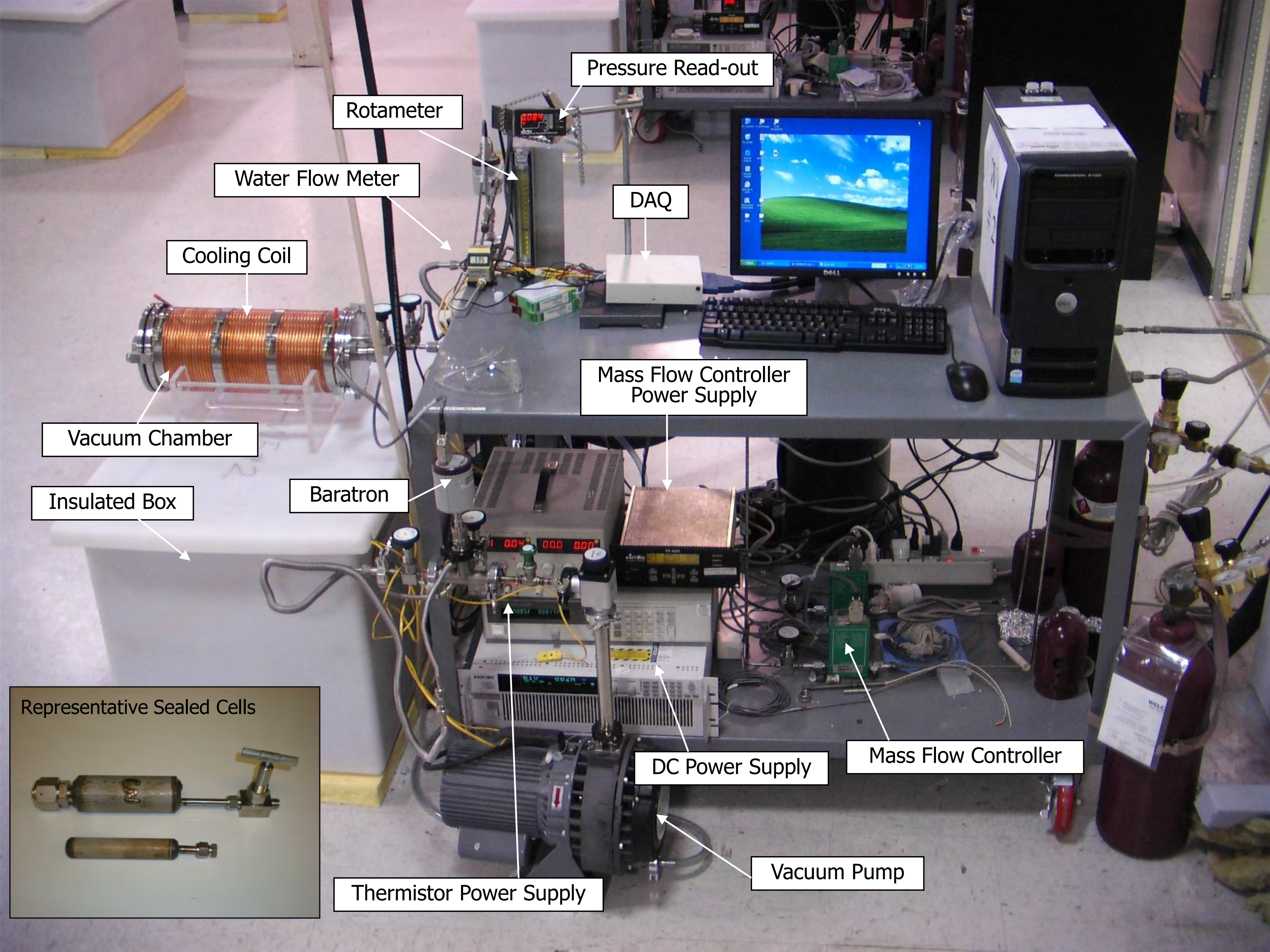
700. Arc Plasma Power System
701. Base Plate
702. Insulator Base
703. Rod Electrode
704. Electrode Regeneration System
705. Corrosion Product Recovery System
706. Cylindrical Electrode
707. Water Supply Tank
708. Water Valve
709. Arc Plasma Cell
710. Water Inlet Line
711. Cell Cap
712. Water Return Inlet
713. Return Pump
714. Steam Outlet
715. Pressure Gage
716. Outlet Valve
717. Vacuum Pump
718. Coolant Inlet
719. Heat Exchanger
720. Coolant Outlet
721. Charging Power Source
722. Charging Connectors
723. Cell Power Source
724. Cell Power Connectors
725. Regenerated Electrode Continuous Feed
726. Outlet Line



# Solid Fuel Thermal Power

# Regenerable Solid Fuels

- Fuels comprise a source of catalyst and a source of hydrogen.
- These reactants can be chemically and thermally recycled using a portion of the output thermal power and comprise a simple chemical system.
- Energy gains of multiple times the maximum theoretical have been confirmed at independent testing laboratories and academics on commercial instruments.


Pressure Read-out
Rotameter
Water Flow Meter
DAQ
Cooling Coil
Vacuum Chamber
Insulated Box
Baratron
Mass Flow Controller
Power Supply
DC Power Supply
Mass Flow Controller
Vacuum Pump
Thermistor Power Supply
Representative Sealed Cells

# Hydrino-Based Engineered Power Systems

Chemistries and engineering designs have been developed using the corresponding experimental parameters for power and regeneration for two thermal-Rankine systems.

- One comprises a multi-tube thermally interacting bundle of cells wherein cells producing power provide heat to those undergoing regeneration. As a system, the power output is constant. The capital costs are projected to be about $1,400/kW electric.
- The other comprises an array of reactors wherein power and regeneration chemistries occur synchronously, and each cell outputs constant power. The capital costs are projected to be about $1,050/kW electric.

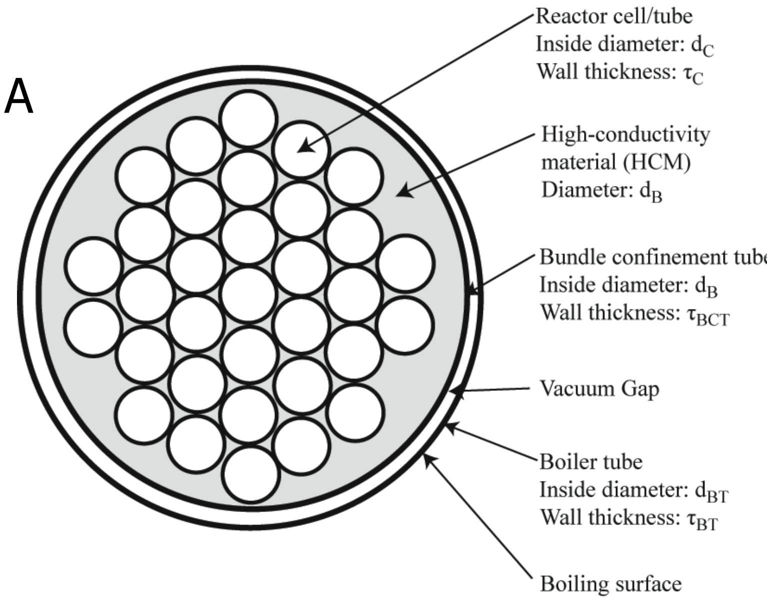
# BlackLight Power Multi-Cell Thermally Coupled Reactor

A plurality of thermally coupled multi-cell bundles wherein cells in the power-production phase of the cycle heat cells in the regeneration phase.

(A) Each bundle having a temperature in the range of 700 °C–750 °C is immersed in water wherein nucleate boiling and steam production occurs in the range of 250 °C–350 °C on the outer surface of the outer annulus with a large heat gradient across the gap.

(B) The bundles that are arranged in a boiler box.

A




B

# BlackLight Power Multi-Cell Thermally Coupled Reactor

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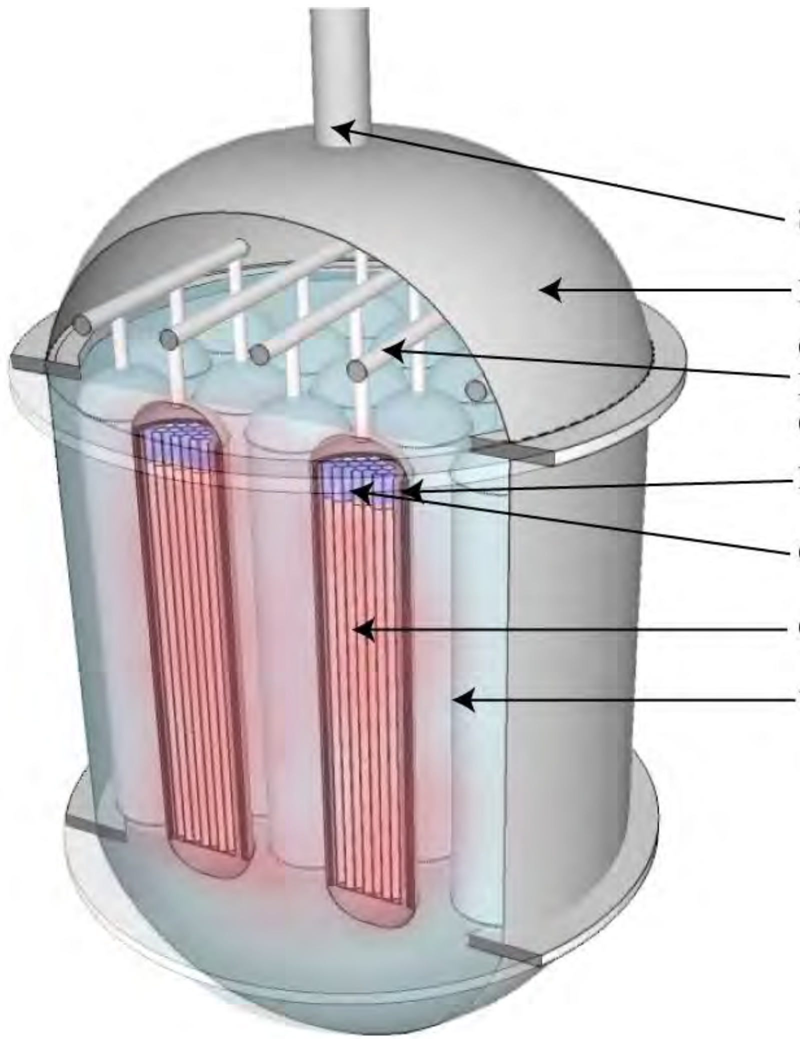
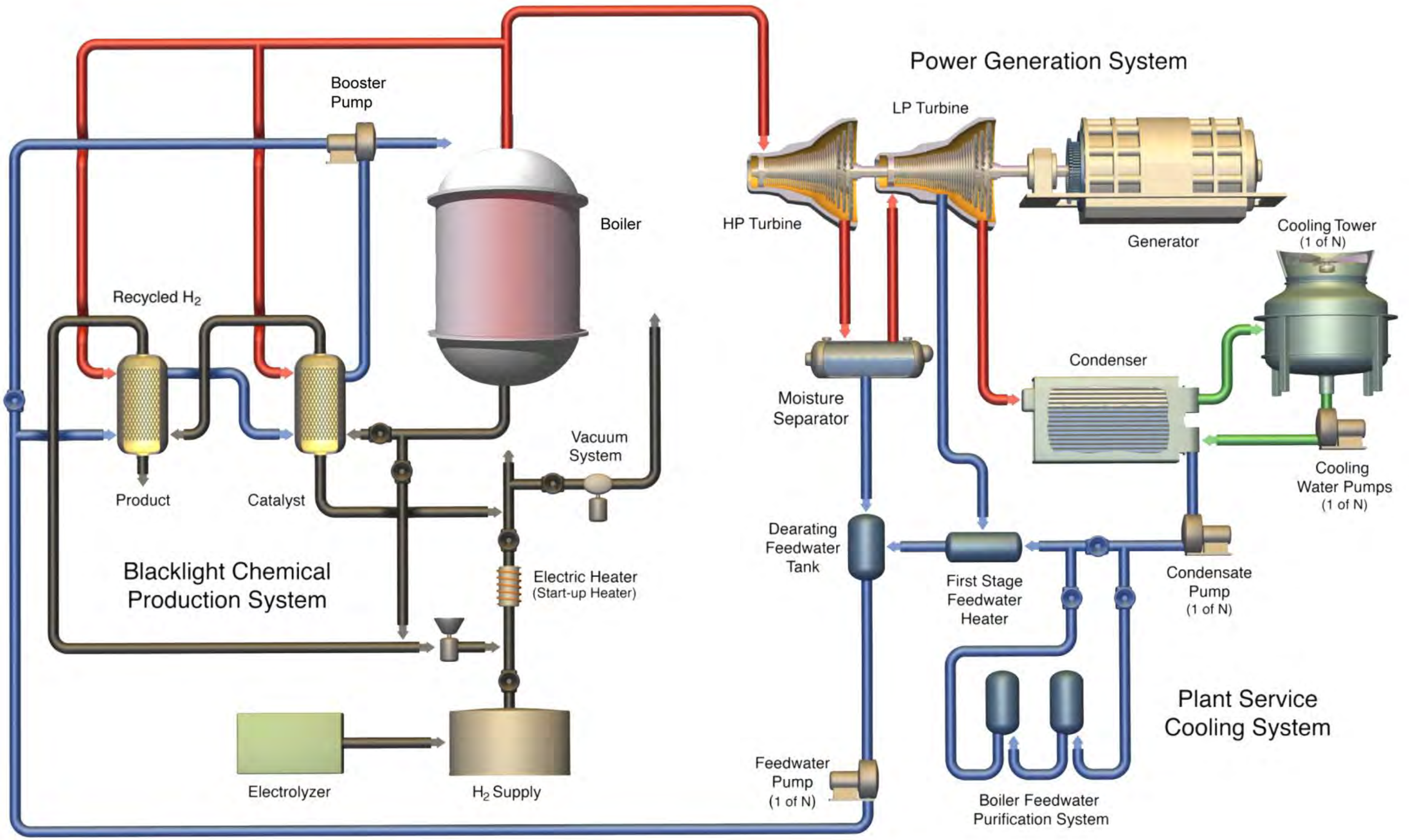



The boiler houses the reactor bundles and channels the steam into a domed manifold.

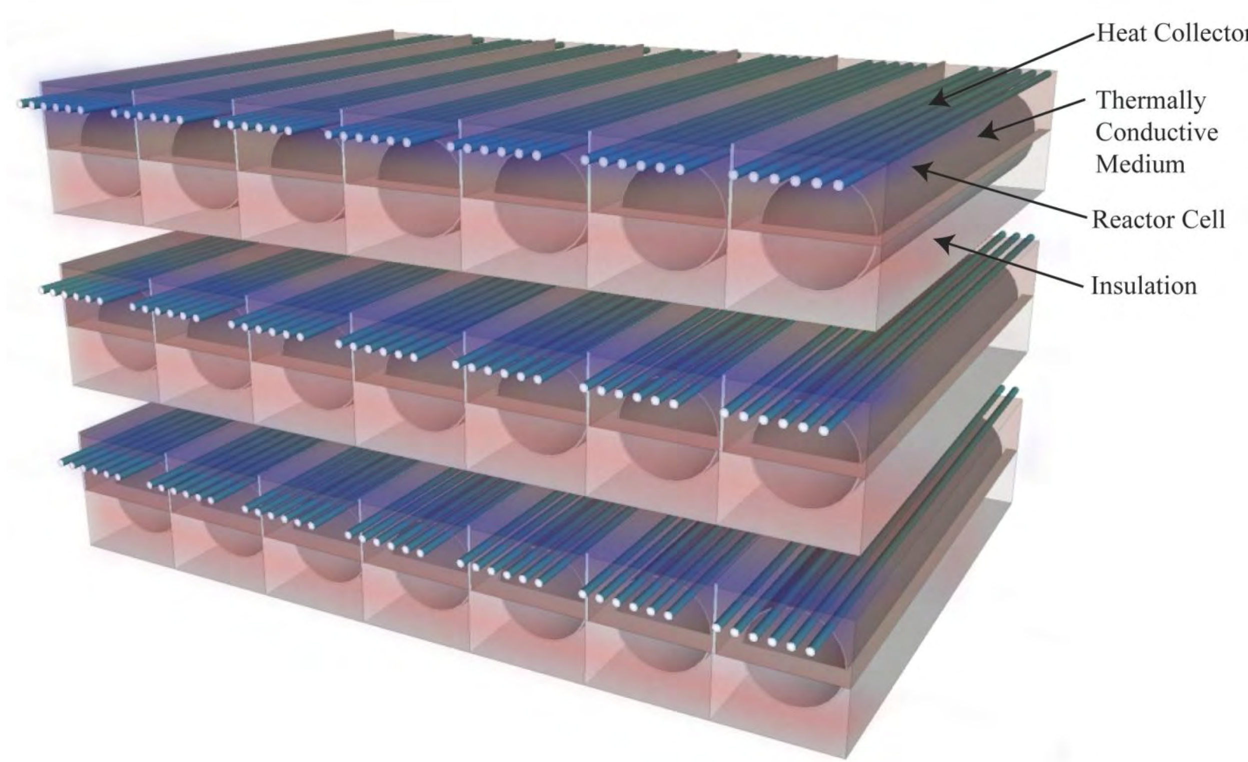
# BlackLight Power Multi-Cell Thermally Coupled Reactor

Steam is generated in the boiler and is channeled through the domed manifold to the steam line. A steam turbine receives the steam from boiling water, and electricity is generated with a generator. The steam is condensed and pumped back to the boiler.



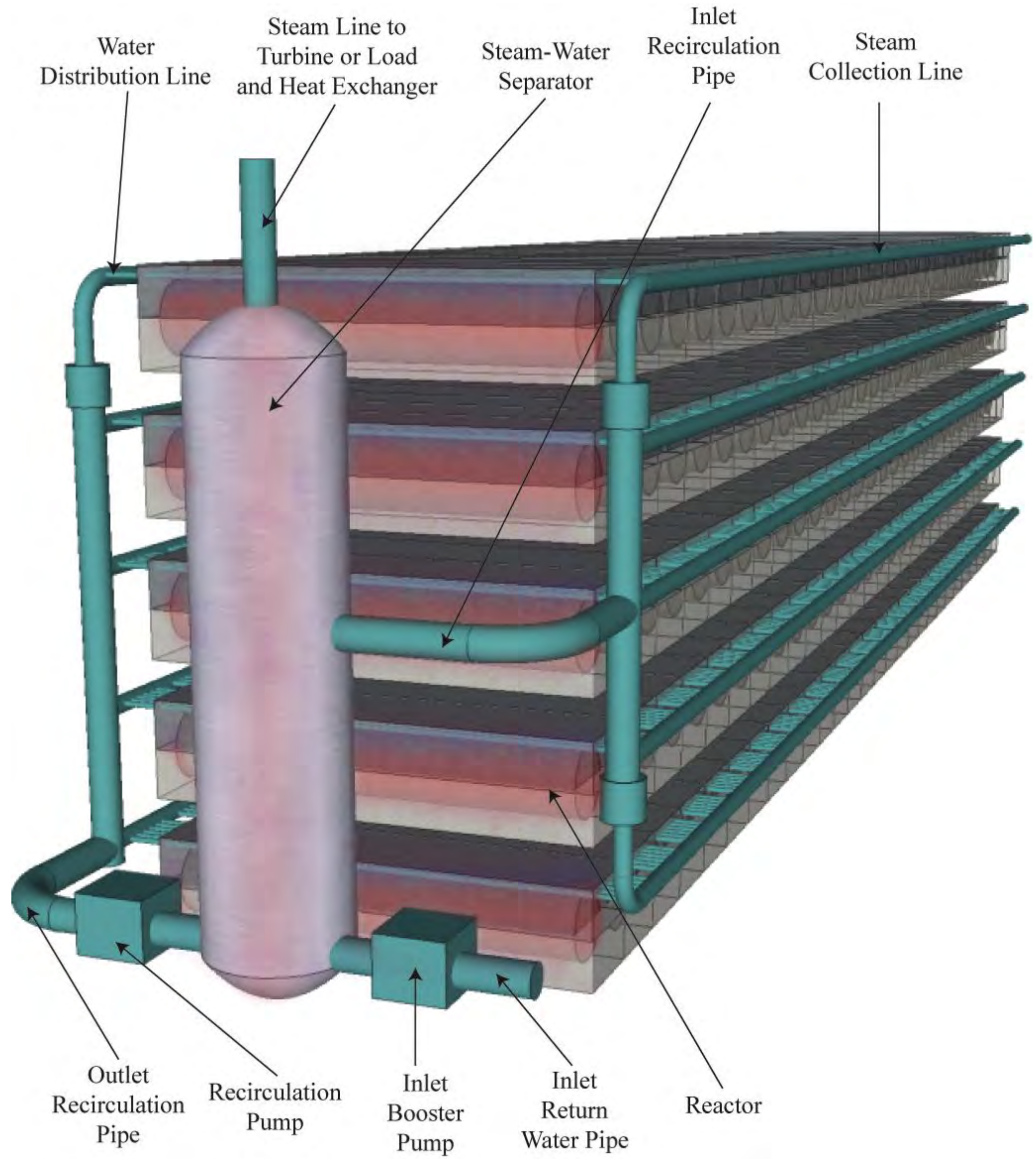
# BlackLight Power Continuous Thermal Power System

A schematic drawing of a multi-tube reaction system comprising alternate layers of insulation, reactor cells, and heat exchanger to maintain continuous power via a cell heat gradient.



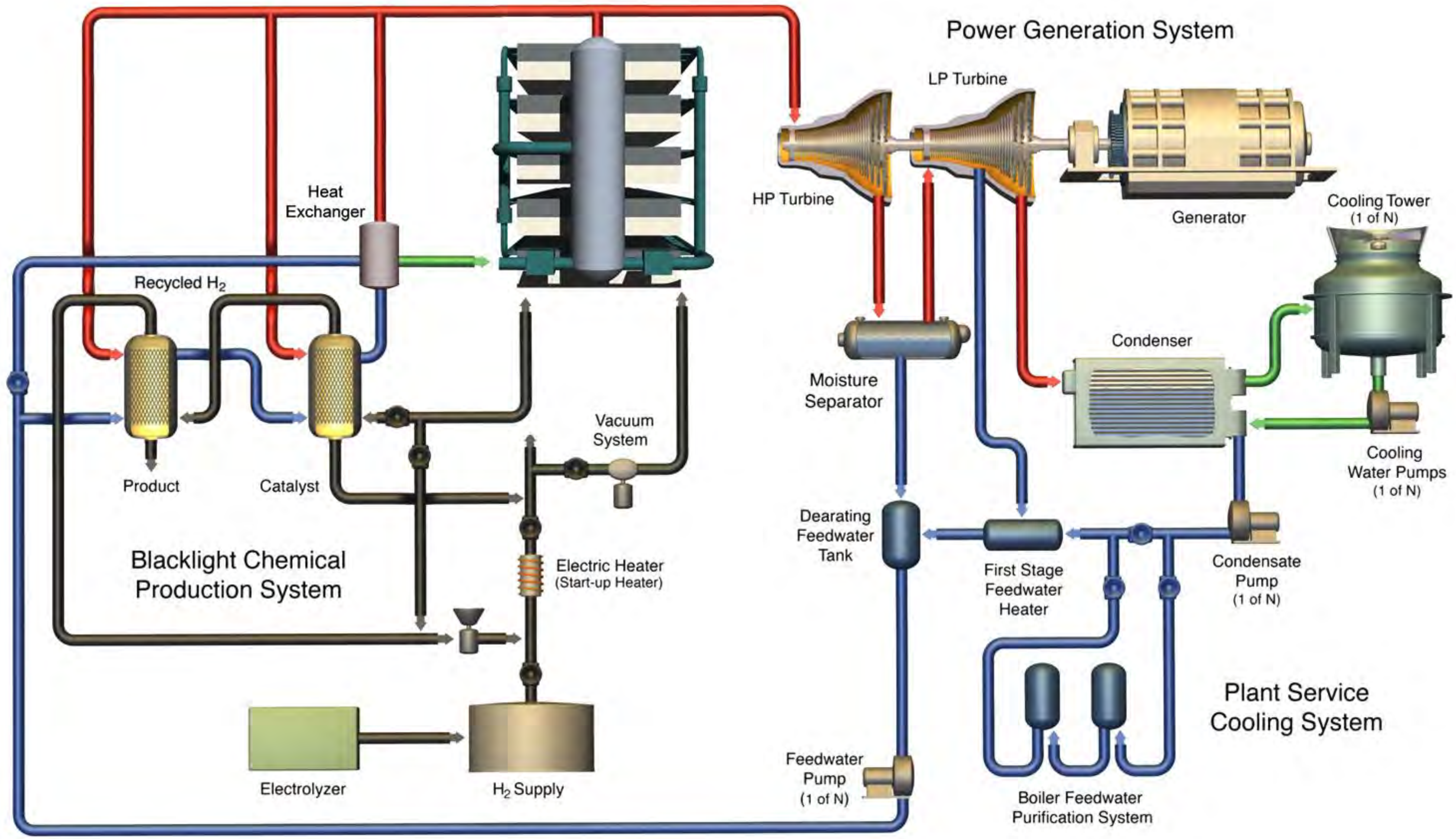
# BlackLight Power Continuous Thermal Power System

The boiler system comprises the multi-tube reaction system, shown right, and a coolant (saturated water) flow regulating system. The reaction system heats the saturated water and generates steam. The flow regulating system collects the flow of saturated water, separates the steam and water, recirculates the separated water through the boiler tubes, and outputs and channels the steam into a main steam line.



# Blacklight Power Continuous Thermal Power System

Steam is generated in the boiler system and output from the steam-water separator to the main steam line. A steam turbine receives the steam from boiling water, and electricity is generated with a generator. The steam is condensed and pumped back to the boiler system.



# Potential Markets

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**Initial market focus:**

- Commercial space and industrial process heating
- Central power generation
- Co-generation
- Micro-distributed power

**Other likely commercial applications include:**

- Motive Power
- Laser
- Lighting
- Specialty Chemicals

# Revenue Model

- BlackLight's model for thermal power using solid fuels is focused on licensing power producers to utilize the BlackLight Process as a fuel/heat source replacement
- The Company is pursuing a broad licensing approach across the power industry
  - To date, it has entered into contracts with seven utilities firms for up to 8,250 MW of power
    - Collectively these firms own, purchase, or manage electric power production of approximately 7,600 MW and service nearly 1 million customers
    - Maximum potential revenue under these contracts alone is approximately $500 million per year
- BLP plans to license EPC firms and OEMs on a sales-royalty basis
- In addition to recurring royalty payments, as the technology becomes more mainstream, potential for significant upfront fees

# DOD Contractor License

The Company has licensed a defense contractor, Applied Research Associates (ARA), to use BLP's solid fuel technology for:

(i) pursing and/or performing Qualified Government Contracts,

(ii) conducting Independent Research for the purpose of pursuing and/or performing Qualified Government Contracts, and

(iii) conducting due diligence and validation testing.

Under the license agreement, ARA can perform revenue bearing government contracts for the DOD with 10% of the gross contract revenue paid as a royalty to BLP.

# DOD Contractor License cont'd

In addition, ARA will assign all intellectual property (IP) it develops under DOD contracts to BLP and in turn, BLP will provide an exclusive license to ARA for government contract applications of the IP.

ARA has successfully achieved solid fuels validation through sponsored validation programs at two Universities.

ARA intends to pursue contracts with DOD departments and agencies for development of BLP's Solid Fuel technology for a broad range of military applications including energy and propulsion.

# The Market Potential

BLACKLIGHT POWER

*(Dollars in millions, except per kWh)*

| **Licensing Fees to BLP** | | **Single Plant** | | **United States** (1) |
|---|---|---|---|---|
| Total Delivered Energy (kW) | | 1,000,000 | | |
| Hours in a Year | | 8,766 | | |
| Total Annual Delivered Energy (kWh) | | 8.8 billion | | 21.0 trillion |
| BLP Licensing Fee per kWh | $ | 0.01 | $ | 0.01 |
| Annual Potential Fee to BLP | $ | 88 | $ | 210,415 million |
| Capacity Utilization | | 75.0% | | |
| Fee to BLP @ 75% Capacity | $ | 66 | | |

Source: EIA

(1) For illustrative purposes, assumes total delivered energy is derived from electrical power plants using the BlackLight Process.

# IP Overview

- The Company aggressively files and obtains patents relating to the BlackLight Process, application of the Process and the resulting hydrino products
- Numerous patent applications have been filed worldwide
  - 60 issued patents provide coverage in many major energy markets (4 in the U.S.)
  - >100 pending applications (important applications in U.S.)
  - World-wide applications related to the solid fuels process were filed on April 24, 2008 and July 30, 2009.
  - An application regarding engineered thermal-to-electric systems and CIHT was filed on March 18, 2010. Patents regarding CIHT were filed on March 17, 2011, the application on CIHT entitled "$H_2O$-Based Electrochemical Hydrogen-Catalyst Power System" was filed on March 30, 2012, and the application "CIHT Power System" was filed on May 21, 2013.
  - World-wide applications on the breakthrough energetic plasma producing SunCell were filed on January 10, 2014 as the application entitled "Power Generation Systems and Methods Regarding Same."  Additional patents have subsequently been filed worldwide.
- Management believes these applications, if ultimately issued as patents, will provide broad protection over the Company's proprietary process
- BLP's IP counsel is Finnegan, Henderson, Farabow, Garret & Dunner, LLP

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# Thank you!

**For more information please visit us at www.blacklightpower.com**