If You Develop It…Will We Buy It?  Better Buildings Technology Shark Tank

Wednesday, May 17, 2017
2:00-3:15 pm
Panelists

- Chris Gladden, Glint Photonics
- Ralph Muehleisen, Argonne National Lab
- Scott Fackler, Xergy Inc.
- Marina Sofos, Department of Energy (moderator)
Chris Gladden

Glint Photonics
Daylight Concentrator: A New Angle on Sunlight

Chris Gladden, PhD
Director of Engineering
Glint Photonics, Inc

May 17, 2017
Human Performance is Enhanced by Daylight

By adding high quality daylight to buildings:

• Retail sales increase 31%-49% ¹
• Students progress 20%-26% faster in reading and math ²
• Office worker productivity increases by 13% ³
• Occupants can maintain healthy circadian rhythm, have increased cognitive performance, and decreased stress levels ⁴,⁵

But…many building interiors have insufficient daylight

The Glint Daylight Concentrator is a revolutionary new product that can bring natural daylight deep into the interior of buildings

¹. Heschong Mahone Group (1999). Skylighting and Retail Sales: An Investigation into the Relationship Between Daylighting and Human Performance
². Heschong Mahone Group (1999). Daylighting in Schools An Investigation into the Relationship Between Daylighting and Human Performance
Human Costs Dominate Building Expenses

- Human factors offer the biggest cost saving opportunity in buildings
- Total O&M + fixed costs: < $15/ft²
- Typical office worker: >$250/ft²
- Average office utility costs are ~$2.35/ft²

Increasing worker productivity by 10% could save 10 times more that the total cumulative utility costs.

Our customers are building owners, lighting designers, and companies that want to bring more daylight into their buildings.
Market Opportunity

- 93% of the $6B daylighting market is currently skylights for commercial and institutional buildings

- California commercial buildings
  - 600,000 buildings with 6 billion square feet
  - 120,000 buildings per year perform alterations to improve energy efficiency

- Initial market: Commercial buildings in CA performing window glazing replacement or new construction (~12,000 buildings)

- First products sold in 2019
- Addressable market of 300,000 units per year in CA ($100M market)
- National market of >3 million units per year
- Large European daylighting market strongly supported by regulations
Glint Daylight Concentrator

- Thin, flat, stationary collector panel mounted on roof or building façade
- Highly concentrated sunlight is delivered into hollow reflective light pipes, 2” x 12” in cross section
- Hollow light-guides can be routed through walls and plenums as desired, up to 30 meters from collector
- Gathers sunlight at angles >60°, providing >8 hours of daylight delivery per day
The Glint Daylight Concentrator provides significant cost and performance advantages over incumbent technology.

- More light delivered through a smaller roof penetration
- Reduced installation cost
- Increased routing flexibility
- Greater annual energy savings

**Cost and Performance Advantage**

<table>
<thead>
<tr>
<th>Daylighting system</th>
<th>Routing capability</th>
<th>Roof penetration area (sq ft)</th>
<th>Peak lumens</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skylight in drywall shaft</td>
<td>None</td>
<td>8.00</td>
<td>30,000</td>
<td>$2,500</td>
</tr>
<tr>
<td>Tubular daylighting device</td>
<td>Limited</td>
<td>1.10</td>
<td>8,000</td>
<td>$300</td>
</tr>
<tr>
<td>Concentrator with fiber optics</td>
<td>Flexible</td>
<td>0.05</td>
<td>4,000</td>
<td>$10,000</td>
</tr>
<tr>
<td><strong>Glint daylighting device</strong></td>
<td><strong>Flexible</strong></td>
<td><strong>0.17</strong></td>
<td><strong>13,000</strong></td>
<td><strong>$400</strong></td>
</tr>
</tbody>
</table>
Rapid Scaling of Prototypes

- Glint found in 2010 to pursue novel solar concentrators
- ARPA-E funding supported development from 2012-2016
- BTO BENEFIT funding will support development from 2016-2019
- Rapidly scaling prototypes to prepare for 2018 pilot installation

2016 – Gen 1 Panel
20 in²

2017 – Gen 2 Panel
170 in²

Technology featured in Scientific American, MIT Tech Review, CleanTechnica, TechSpot, Gizmodo and more.
Panel Demonstration
Panel Internal Optics
Team

Dr. Peter Kozodoy
Founder & CEO

• Over twenty years of experience in research and development of devices based on advanced materials
• Successfully commercialized products at two startup companies:
  • LEDs for energy-efficient lighting at WiTech (acquired by Cree, Inc.)
  • Tunable lasers for telecommunications systems at Agility Communications (acquired by JDS Uniphase).

Dr. Chris Gladden
Director of Engineering

• PhD research in advanced materials for non-imaging optical systems
• Extensive experience in optical system design, optical modeling, process development, fabrication, and optical testing
• Successfully developed models at NREL for commercialization of renewable energy technology
Next Steps

• Seeking pilot demonstration sites and partners
  • Ideal location would allow for high profile demonstration of technology in a commercial or office space
  • Prefer façade mount, but roof mount also possible
  • Retrofit with window replacement or new construction
  • High solar resource location
  • Looking to identify pilot installation location by end of year
  • Installation could begin in late 2018
  • Commercial product launch planned for 2019

• Goals for pilot study
  • Measure improvements in light quality
  • Quantify (if possible) human factor improvements
  • Quantify energy savings
  • Get occupant feedback
Ralph Muehleisen

Argonne National Lab
Periscope

An affordable, secure, revenue grade, electrical submeter. Finally.

Dr. Ralph T. Muehleisen
Principal Building Scientist, Argonne National Laboratory
rmuehleisen@anl.gov
Periscope

An affordable, secure, revenue grade, electrical submeter. Finally.

Periscope is an electrical submeter that is accurate enough for revenue grade metering, flexible enough for monitoring any building circuit, and will have installed costs of $20 phase.
The Problem

- Existing Revenue Grade Meters are too Expensive
- Affordable Meters are too Inaccurate, Proprietary, and Insecure
The Solution:

Periscope

Periscope is a new electrical submeter that is

- Revenue Grade Accuracy
- Low capital and install costs
- Standards compliant metrology with high security
The Periscope Team

Ted Bohn, PI
Principal Electrical Engineer
- 30+ years of experience in electrical system R&D
- 10+ years of experience developing electric metering standards

Ralph Muehleisen
Principal Building Scientist
- 25+ years of experience in sensors R&D
- 20+ years of experience in buildings related R&D

2G Engineering
Board Prototyping Partner
- AS9100-certified design firm specializing in custom electrical and mechanical system design

Amzur Technologies
Software Design Partner
- Developers of OpenDEM, an open source, distributed, energy management system
The Market

The primary market is those users who need REVENUE GRADE submetering a small, but needy, portion of a 2.8B worldwide market.
Competition

Big Players

Honeywell

LEVITON

Digital Energy

Schneider Electric

Startups

Z³ Controls

WHISKERLABS

CIRCUIT METER

BYRAM LABS

AN ENERGY TECHNOLOGY COMPANY
Progress To Date

- Converted EV metering circuit to AC and DC building monitoring
- Developed packaging for fast install by electrical contractors
- Testing devices at Argonne for longevity and accuracy along side revenue grade reference metering
Our Ask

- Looking for company, big or small, who wants to license our technology and bring it to market.
Periscope
A low cost, secure, revenue grade, electrical submeter. Finally.

Thank you.
Any questions?

Ralph T. Muehleisen, rmuehleisen@anl.gov
How do we do it?

Low cost, high performance SoC + flexible current sensor options

Standard electrical packaging, OLED Display, and QR code ID for fast install

Multiple standard network options
Market Opportunity

Large worldwide market growth driven by many things including:

- Cost Containment
- Accountability
- Billing Management
- Code changes
- Deeper energy management and interest in “big data”
- Utility M&V

![Market Size Chart](chart.png)

Investment opportunity: Energy Efficiency, Nanotech

Ion Exchange Membranes

Xergy, Inc.
Executive Summary
April 2017
At Xergy, We Dare to Imagine!

Meat staying fresh and lasting inside your refrigerator for many weeks!

Washing your hands or clothes with no soap or detergent!

Having a heat pump that makes no noise, without harmful refrigerants, and saves you 20% on your utility costs!!
Unit/Revenue Forecasts – Micro Climate Control – 1st Launch Commercial Product Line

Listed below, that start with our proprietary ion exchange membranes (far left), embedded in sub-assemblies, and then assembled into final products for home appliance integration.

<table>
<thead>
<tr>
<th>Launch revenue forecast</th>
<th>2017F</th>
<th>2018F</th>
<th>2019F</th>
<th>2020F</th>
<th>2021F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units (in thousand of units sold to Haier)</td>
<td>500</td>
<td>1,000</td>
<td>2,150</td>
<td>4,920</td>
<td>10,250</td>
</tr>
<tr>
<td>Revenues (in $ millions)</td>
<td>$4.0</td>
<td>$7.9</td>
<td>$15.4</td>
<td>$40.6</td>
<td>$72.3</td>
</tr>
</tbody>
</table>

We can control both Humidity and Oxygen inside appliances, and we believe these Units could eventually be in every refrigerator in the world.
Core Technology: Ion Exchange Membranes

Controlling the movement of ions and molecules through nanoscale channels offers revolutionary pathways for development of new home, energy, industrial, medical, and sensing products. This technology is new, transformational, disruptive, and very profitable.

- **The Problem:**
  - Ion Exchange Media are inherently weak. XERGY reinforces them to make composites membranes that are stronger.
  - XERGY knows how to package them into useful devices, creating great products for critical applications.

- **The Solution:** Ion Exchange Media - Two Key Properties
  - Can transport Ions under electric field (cations, anions). Recently received three ARPA (Anionic Membrane) awards.
  - Can transport polar molecules (pervaporation). Difference in concentration, temperature, pressure.

- **Validation:**
  - Winner of the 2011 GE Ecomagination Award, for development of electrochemical compressors for HVAC applications based on advanced ion exchange membranes.
  - Winner of about $8,000,000 of R&D grants from DOE, BTO office, and ARPA-E.
Commercial Products

**Xion Exchange Membranes**
- Xergy developed a pilot production line to manufacture advanced composite ion exchange membranes.
- Range of new ion exchange membranes both cationic and anionic for other applications.

**Micro-climate Control Systems**
- Can be used in a variety of applications, most notably, home appliances.
- They are perfect for cigar, tea or cannabis storage boxes, musical instrument storage containers, gun or firearms storage containers, museum displays and safe or valuable storage containers.

**Electrochemical Compressors**
- Noiseless, scalable, modular and highly efficient without the use of CFC's.
- Xergy is the world leader in electrochemical compressors and heat pumps.
- Comprehensive patent portfolio to support its market presence.

**Electrochemical Ozone Generators**
- Electrochemical method to generate ozone within water to create ozonated water.
- Used for water treatment and disinfection systems.
Value Proposition

XERGY can customize for applications including different chemistries and supports. No other company can do this because they are married to one chemistry.

- 10 times thinner means 10 times lower cost
- Thinness means lower resistance, higher performance.
- Compositing provides mechanical reinforcement for otherwise weak materials.
- Lower cost plus higher performance = Value Creation

Hundreds of product opportunities.
Management

Bamdad Bahar, Founder, and Chief Executive Officer.

• President and General Manager Teledyne Energy Systems (fuel cells)
• Business Leader at W.L. Gore & Associates (GORE-TEX®).

William Parmelee, Ph.D. Director of R&D.

• Senior Researcher in New Product Development with Invista SARL
• Ph.D. in Mechanical Organic Chemistry, University of Michigan.

Zhefei Li, Ph.D. Membrane Development Leader.

• Post doctoral work at Ohio University, IUPUI, Iowa State University and Missouri University
• Ph.D. Materials Science and Engineering, Missouri University of Science and Technology.

Steven Naugler, Senior Electrochemist Engineering Leader

• 30 years as a Process Technology Engineer with Rohm and Haas
• BME, Mechanical Engineering, University of Delaware.
Xergy, Inc. – Summary

Established company with highly-credentialed senior management team

- Founded in 2010 and headquartered in Harrington, DE
- $8,000,000 of investment and grant commitments.
- Winner GE Ecomagination award.

Commercially-proven technology, capital light business plan.

- Product prototyping, assembly and testing ion-exchange membrane technology
- Several Billion dollar scale applications.

Joint Development Agreement with Haier Group (GE Appliances).

- Negotiating a JDA with Haier Group, which acquired GE Appliances in 2015.
- Agreements anticipated to cover initial purchase of sub-assemblies
- Joint venture to manufacture sub-assemblies in China

ASK: $5,000,000 Series A financing to establish commercial production
ASK: Strategic Partners that would like to help us test units in the field.
Thank You

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