



OptiSense LLC

Optical Sensors for the Hydrogen Industry

Caltech/MIT Enterprise Forum

California Institute of Technology

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The Key Problem

- **Hydrogen**
 - **Widely used (over 3 trillion cu. ft. produced annually)**
 - **Highly Flammable (4 – 74 % in air)**
 - **Difficult to Contain (leaks easily)**
 - **Hard to Detect**
 - **Selective sensors expensive and/or difficult to operate**
 - **Inexpensive sensors non-selective and/or create additional hazards (spark, hot surface, etc.)**
 - **No good solution currently available**
 - **Yet, this gas is poised to be the energy carrier of the future!!!**
- **Market Need**
 - **Inexpensive hydrogen and oxygen sensors**

Our Solution

- **Optical Detection**



Hydrogen
Sensing
Element

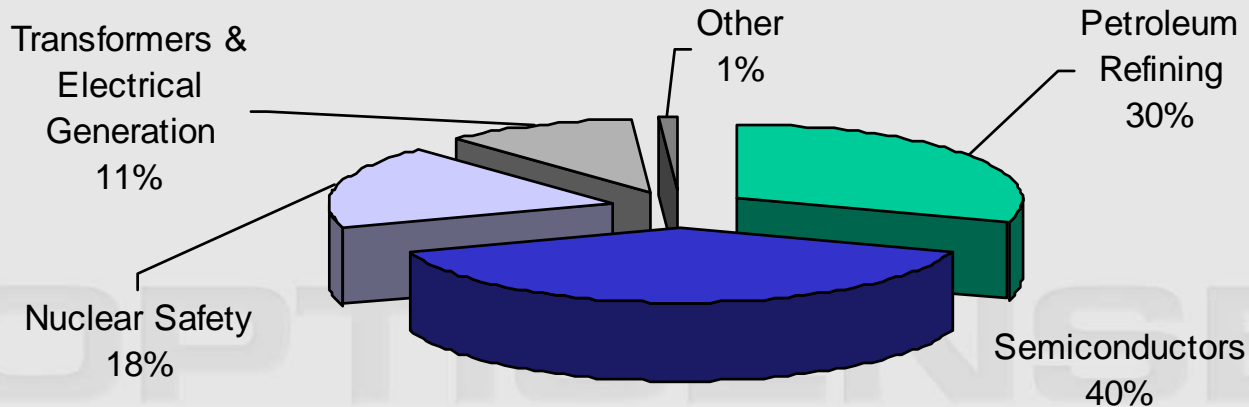
Oxygen
Sensing
Element

Combined
hydrogen/oxygen
sensor prototype

- Now made affordable by investments of the telecom industry
 - Extensively explored
 - Tremendous challenges
- Proprietary and patented manufacturing process key to our advantage

Markets

- **Key is industrial gases and safety**
 - **Customers and markets (Source: DCH Tech., 2001)**



- **Total market estimated at \$115 Million today - \$150 million by 2005**
 - Over 10 percent annual growth rate through 2010
 - Does not include industrial gases
 - Potential to be largest single market
 - One industrial gas customer has identified a single internal process with need for 4,000 units if cost is less than \$10,000 each (in the U.S. alone!)

Markets

- **Additional Niche markets**
 - U.S. military → weapons systems
 - NASA/Boeing → aerospace applications, launch vehicles
 - Highly specialized applications
 - High margin, low volume
 - Key to further advancing and challenging the technology
- **Future Markets**
 - Hydrogen infrastructure/Hydrogen economy
 - Fuel cells (industrial, commercial, residential safety)
 - e.g., hydrogen refueling will require combined hydrogen/oxygen sensor

Competitive Advantages

- **Low-tech mfg process Off-the-shelf ancillary components**
 - Technology clearly superior for many applications
 - Intrinsic low cost even at smaller volumes
 - Material cost today ~ \$80.00 per unit
- **Comparison with competition**
 - Selective sensors at > \$1,000 per unit
 - Non-selective sensor at > \$400 per unit
 - Costs expected to drop with volume, but we believe we have the edge
- **Future competition expected**
 - Honeywell
 - H2Scan
 - Fuel Cell Safety Systems, etc.

Program to Date

- **Successful demo of early fiberoptic units with NASA/Boeing**
- **Alpha prototypes for customers**
 - **Planned for early 2003 – first unit shown at 2002 Fuel Cell Symposium**
 - **Introduced to U.S. and Japanese Markets in late 2002/early 2003 - Europe being explored**
- **Next generation system now under development with grant from NASA**



Development Plan

- **Reengineering of sensor elements**
 - **No longer a laboratory experiment!**
 - **Basic manufacturing and QA/QC principles**
- **Outsourcing of electronics (signal processing) and packaging**
- **Teaming with Existing Distributors**
 - **Packaging, market knowledge**
- **First commercial prototype ready 6 months from funding**
 - **First product release within 12 months**

Marketing and Sales Plan

- **Focus on existing industrial market**
- **Team with existing distributors**
 - **Focus on those with existing distribution channels**
 - **Business discussions**
 - Major sensor supplier
 - Industrial gas companies
 - Petroleum refiners
 - Automobile producers, fuel cell developers
- **Fuel cells too uncertain a basis for short term marketing and sales projections**
 - **However, a big brass ring in the out years**
 - **May provide a framework for exit strategy!**

Key Personnel

- **Aaron Cohen – President**
 - 30 year business veteran, Chairman of National Testing Systems, Inc.
- **Jerald Cole – Chief Technology Officer**
 - 22 years product/process development and management of focused product oriented teams
- **Elias Azrak – Chief Financial Officer**
 - Investment banker, former treasurer of Fortune 500 Entertainment Conglomerate.
- **Other**
 - Personnel from parent company, plus outside experts ready to join once funding is in place

Financial Summary

- **\$6.5 million invested in technology**
 - **Government Grant Funding**
- **\$240,000 private investment in 2002**
 - **Alpha prototype development**
- **Seeking to raise \$3 million**
 - **Initial financing of \$500,000 in 2003**
 - **Develop commercial product**
 - **Hire needed additional staff**
 - **Secondary financing of \$2.5 Million in 2004**
- **Sales and Profit Projections**

	\$Millions				
Year	2004	2005	2006	2007	2008
Sales	0.4	4.5	12	20	28
Profit (loss)	(0.7)	(1.3)	3	6.5	11

Lessons Learned (1)

- **Seed investment from private investor**
 - Used to finance project leading to alpha prototypes
 - Subcontracted effort to parent company
 - Prepared R&D plan and monitored progress
- **Result:**
 - Mindset, priorities inappropriate for product development, sense of urgency lacking
- **Lesson:**
 - Extract key technical personnel from parent company, sever former management ties

Lessons Learned (2)

- **OptiSense Management efforts focused on customers, market development**
 - Trade shows, technical conferences
 - Market studies
 - Networking
- **Result:**
 - Good customers relationships, but no product
- **Lesson:**
 - Balance focus between technology development, strategic relationships