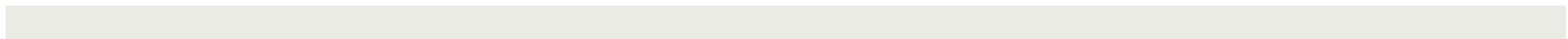
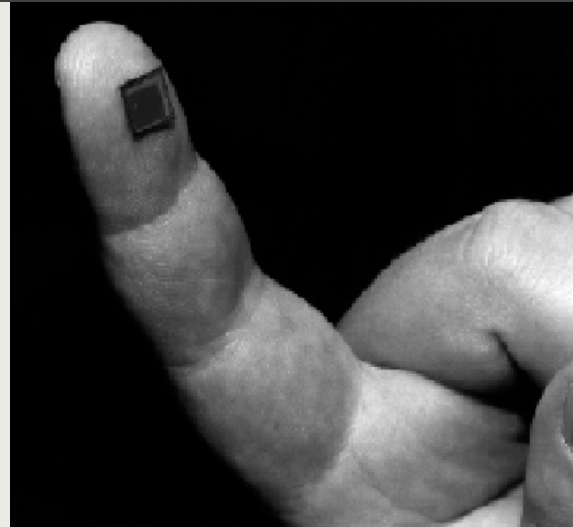

PicoSystem[®] Self-Powered, Wireless Sensor Platform

Dave Bend, Ankush Garg, Kurosh Hashemi, Mark Hurwich, Taylor Keep



- Introduction
- Commercialization
- Appendix

*“The US sensor market
is worth \$10.3B
per year”*

Wired vs. Wireless

The majority of sensor data is still painfully wired. Wireless Sensor Networks (WSNs) provide a huge opportunity to displace current technology

Wired
Sensor Network



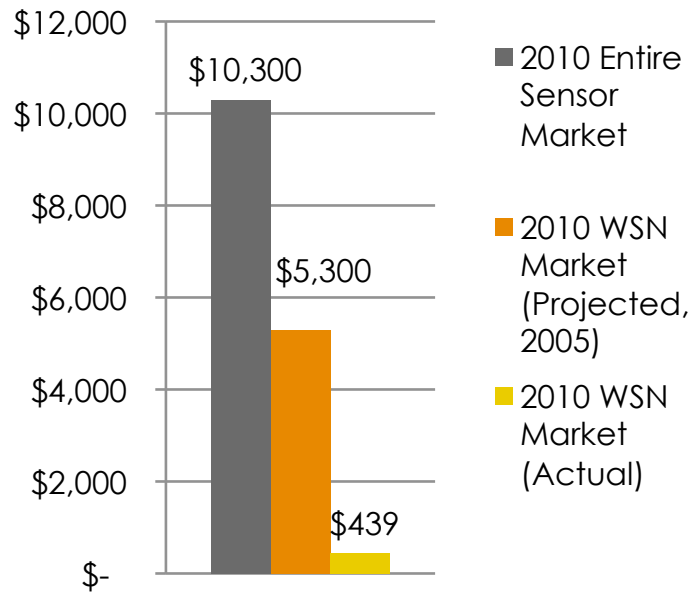
Wireless
Sensor Network



Harnessing the Power of Wireless

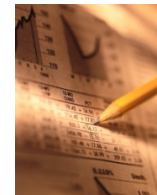
Expectations for WSN have been very high, however WSNs have yet to replace wired alternatives at mass scale

The WSN market has high potential that has yet to be realized



Source: ON World

What has slowed WSNs growth? Cost savings have yet to disrupt the marketplace

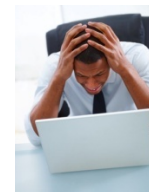


Cost savings

Additionally, end users reveal three key concerns



Reliability



Ease of Use



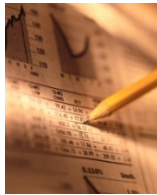
Battery Life

Source: ON World

Sensing More with Less

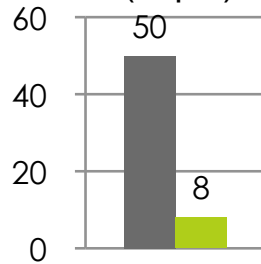
The Piconode significantly improves upon existing technology. It uses a novel radio that dramatically reduces power, size, and...

Lowest costs by 6X compared to WSN alternatives

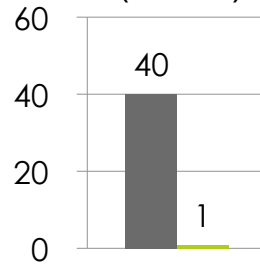


Cost savings

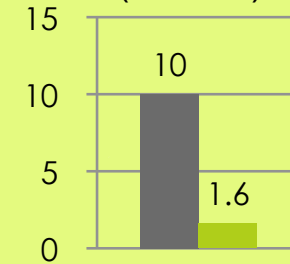
6.25X Less Power
(in μw)



40X Smaller
(in cm^2)



6X Cheaper
(in US \$)

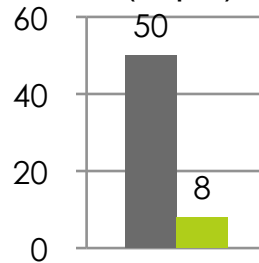


Extends battery lifetime by 4X

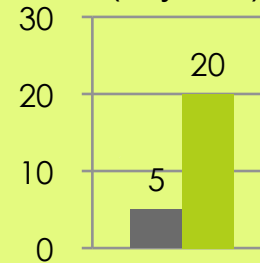


Battery Life

6.25X Less Power
(in μw)



4X Battery Life
(in years)



Introducing the Piconode



Development of the Piconode began at UC Berkeley 20 years ago and has shown dramatic progress over time

Research Institutions Involved

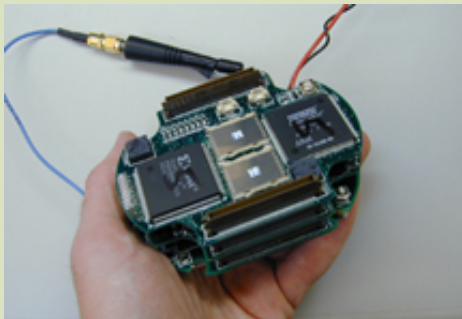


Project Lead

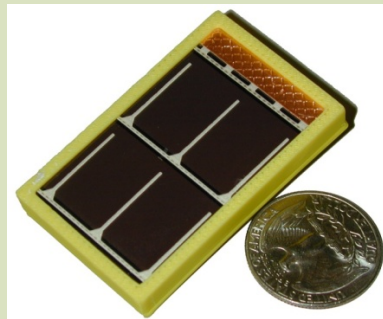


Jan Rabaey

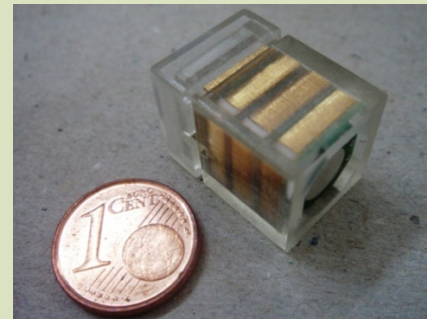
Piconode Size Improvements



2000



2003



2005

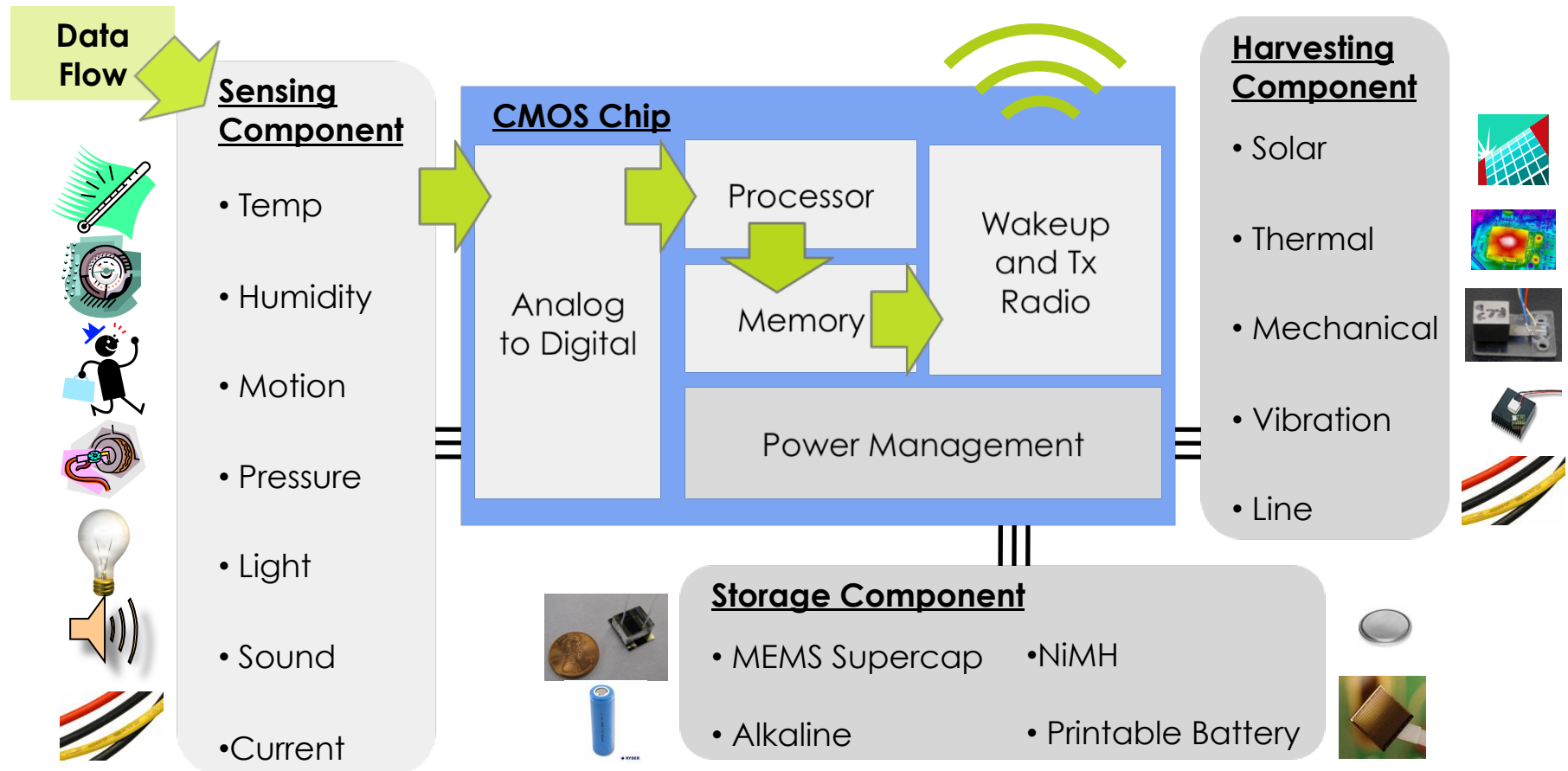


2011

The Piconode Platform



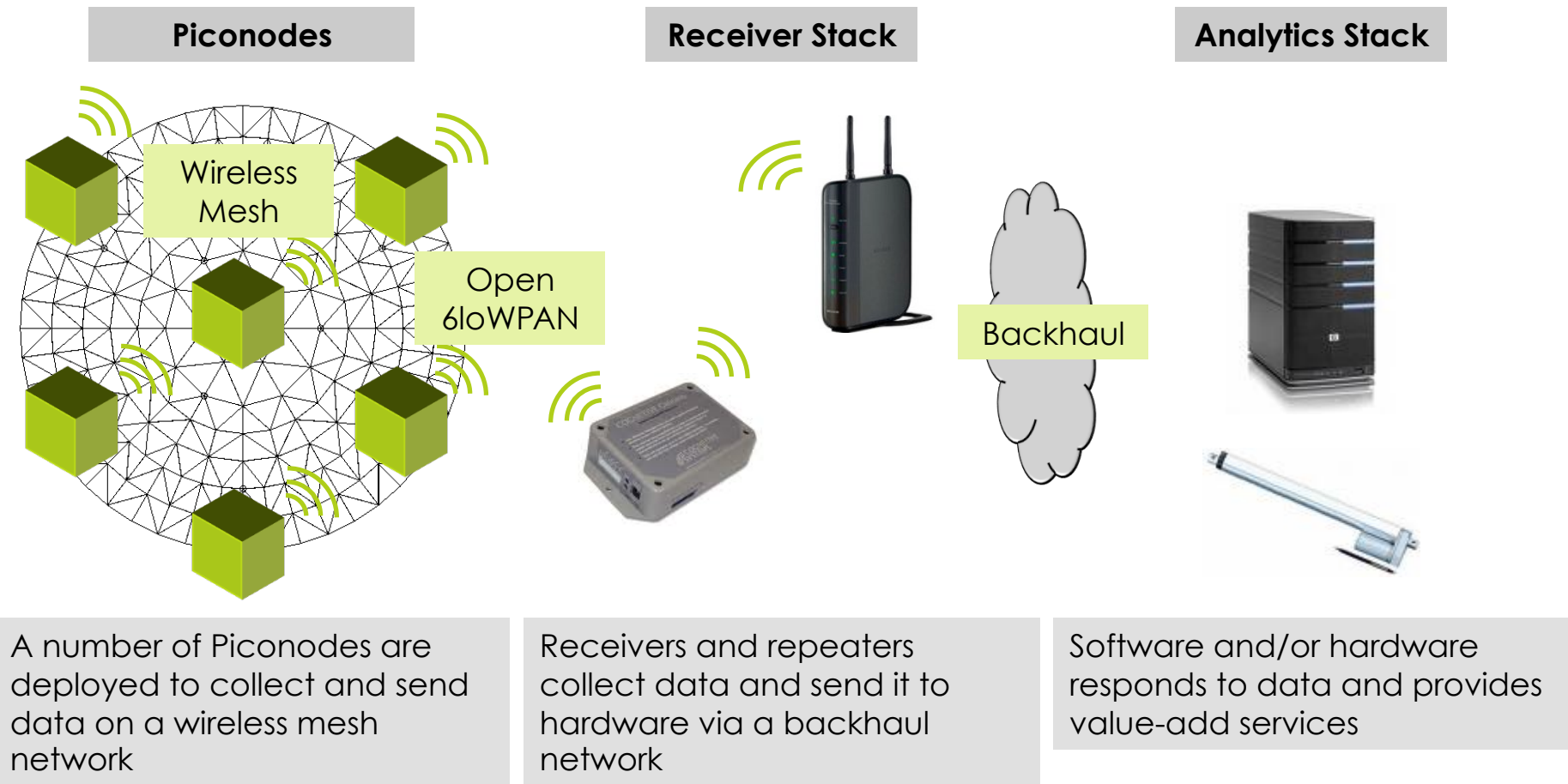
The Piconode is constructed on a CMOS platform that includes BWRC's ultra low power radio. Components are interchangeable depending on application needs



The Integrated PicoSystem



The PicoSystem integrates the Piconode, a Receiver Stack, and an Analytics stack



- Introduction
- Commercialization
- Appendix

Bringing This Technology to Market



The PicoSystem presents three opportunities for commercialization

1

Established corporations integrate as-is technology into offerings

Sensors



Data Aggregators



2

Team builds new business around extended technology IP



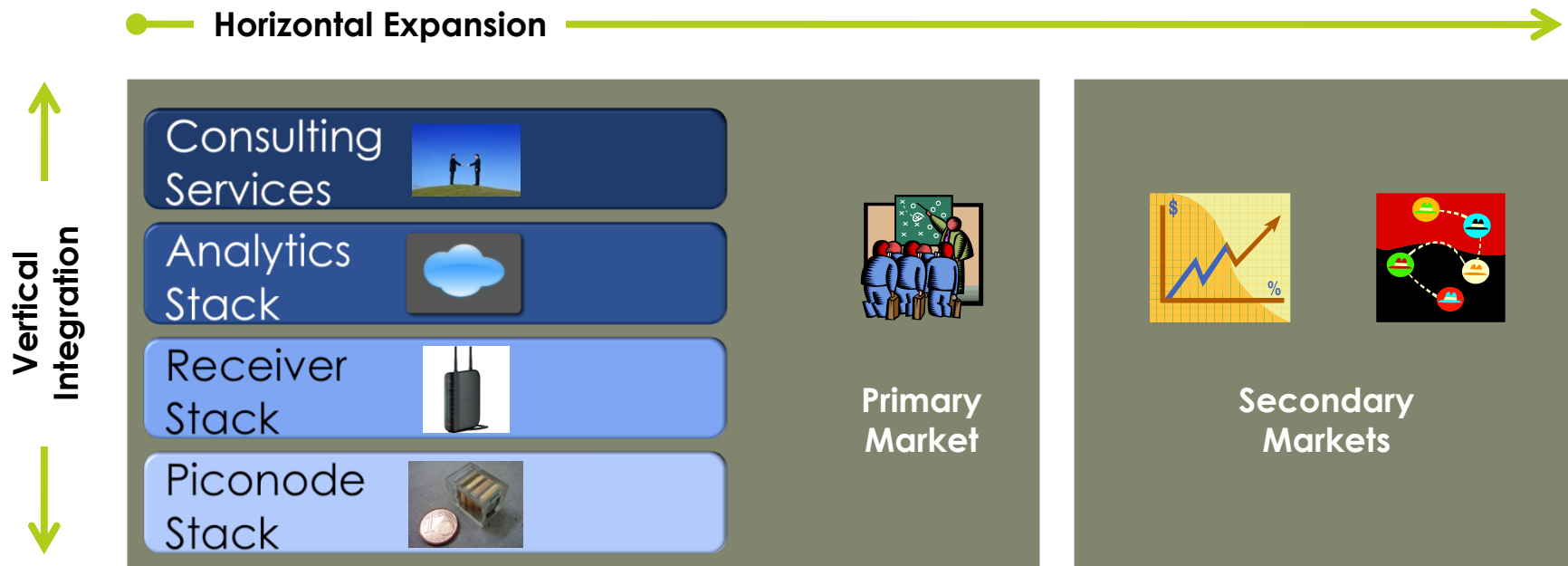
3

Team builds new business around vertically integrated offering



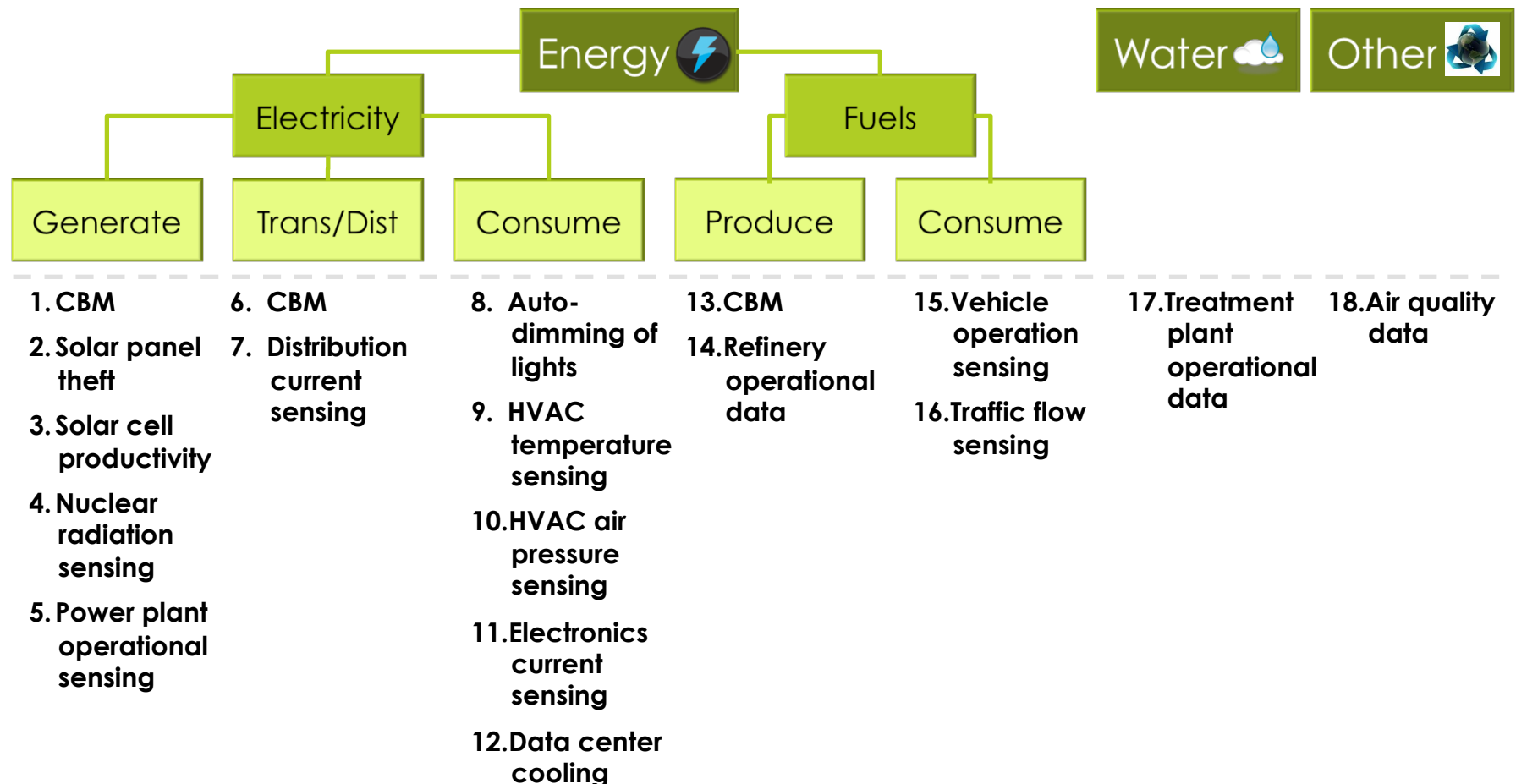
Go-To-Market Strategy

The PicoSystem enters a beachhead market within a vertically integrated company and expands horizontally into new markets over time



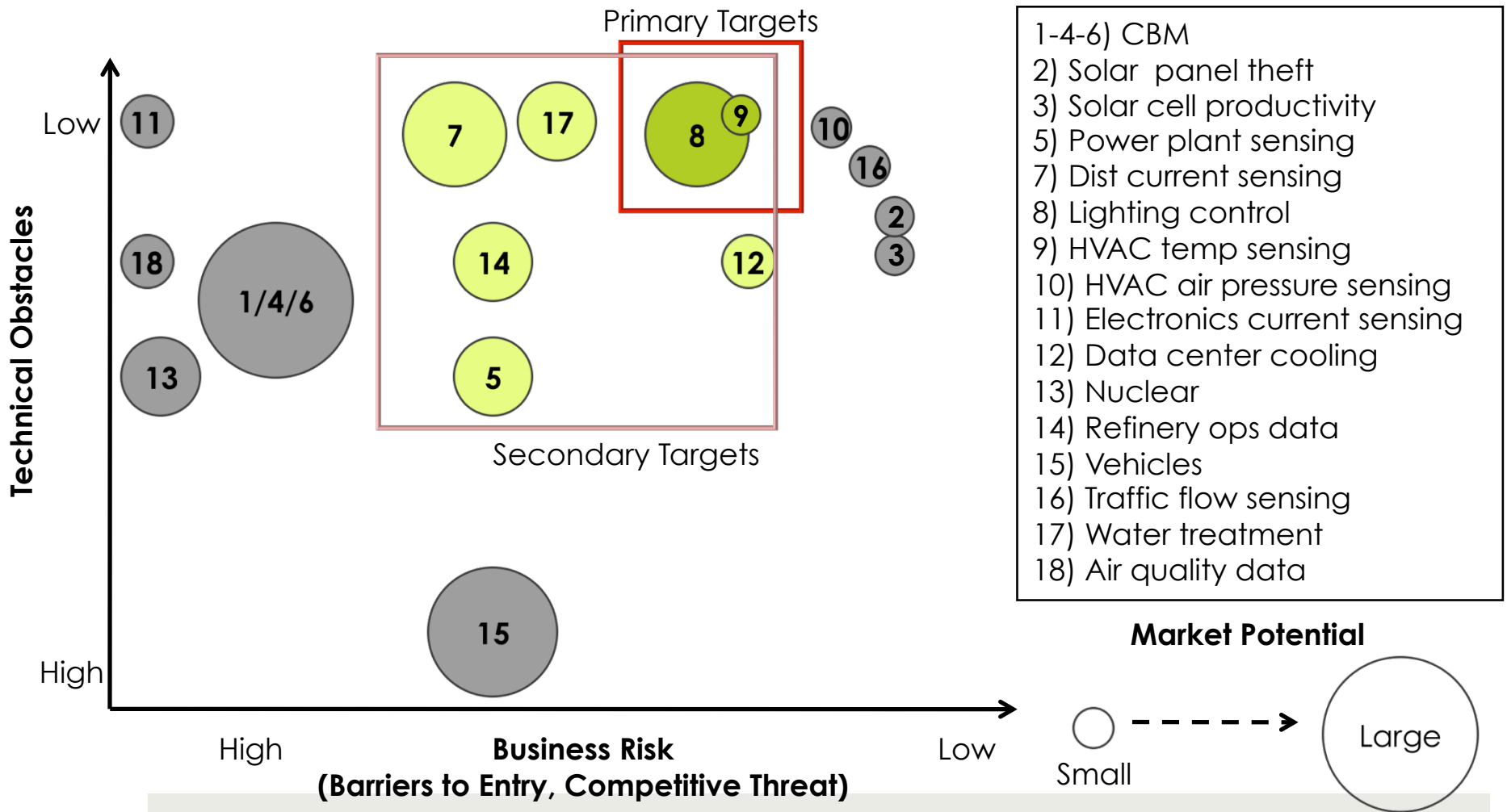
Application Focus

The PicoSystem can be used in numerous applications. To manage scope, the team limited its deep-dive analysis to Cleantech, where 18 applications were identified



Application Focus

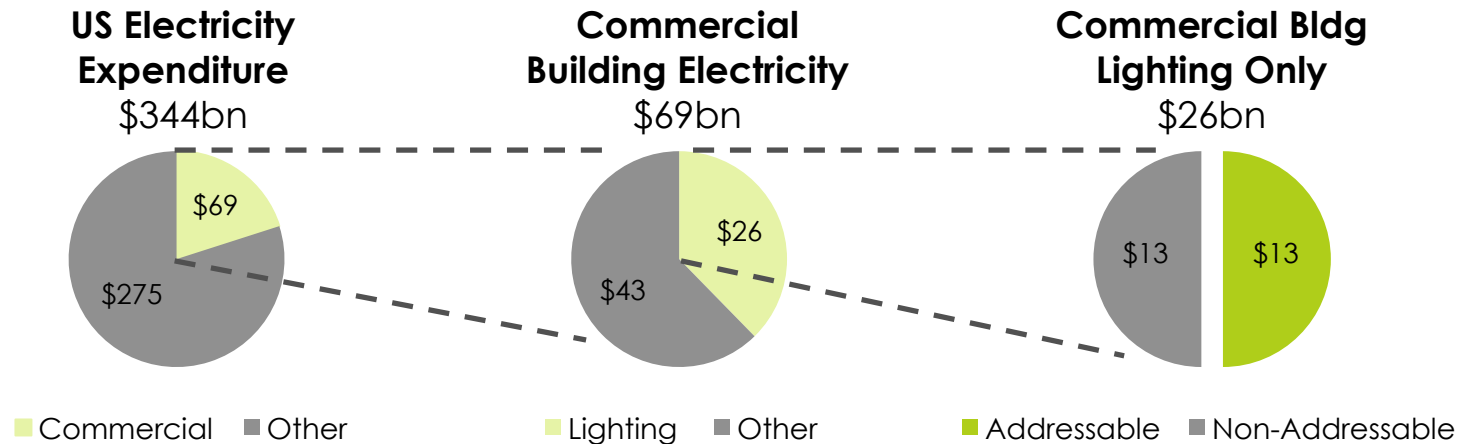
Of the 18 applications, we recommend focusing first on the lighting control market and subsequently the HVAC local temp sensing market



Lighting Control Market



Occupancy and auto-dimming controls are a \$13B market...



Sales opportunities would exist within retrofits and new buildings through:

General contractors and subcontractors



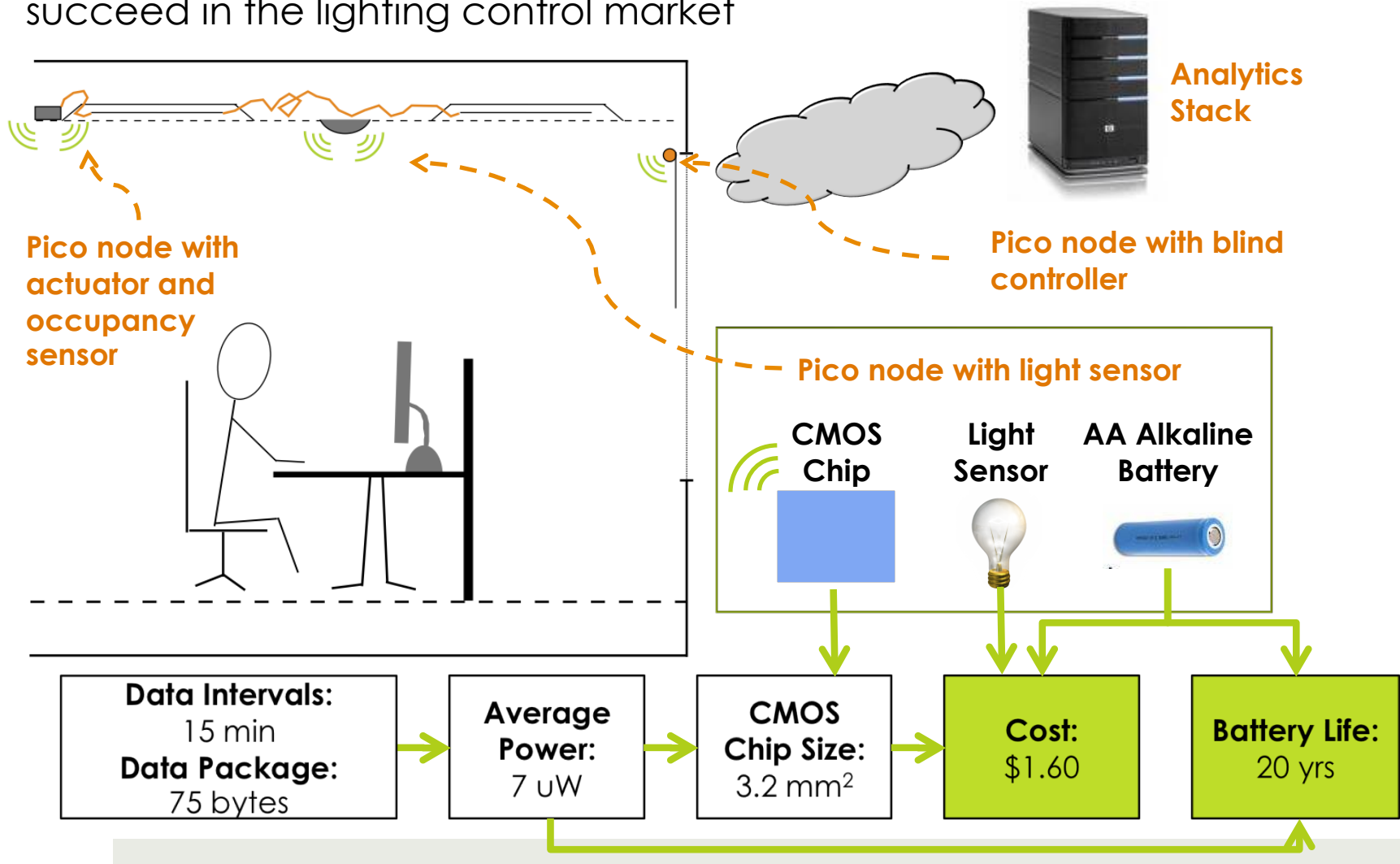
Design consultants



The PicoSystem: Lighting Control



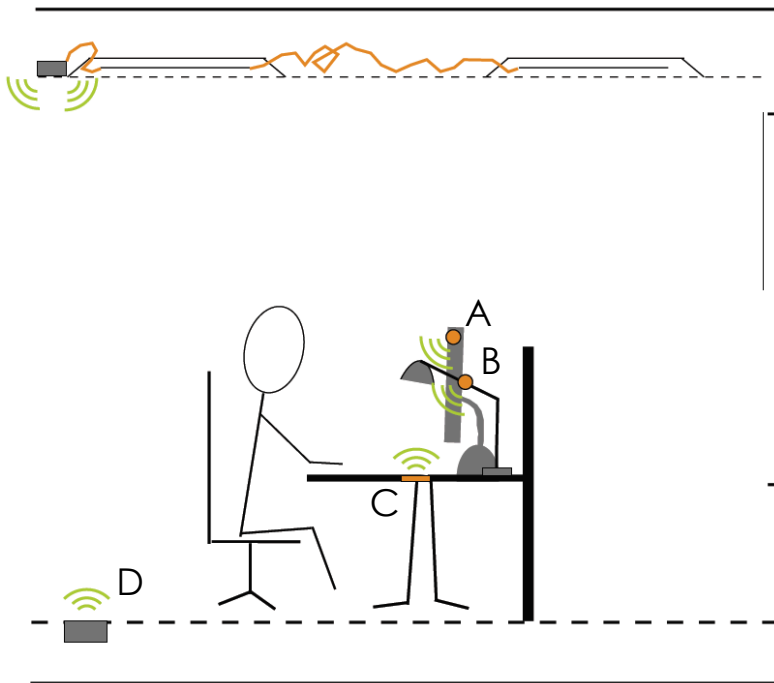
The PicoSystem couples lower cost equipment with innovative analytics to succeed in the lighting control market



The PicoSystem: Lighting Control



The Piconode's small size and low cost bring novel configurations and applications within reach



A. Monitor Integration



B. Task Lighting



The right light



C. Office Furniture



D. HVAC diffusers



Analytics use occupancy, desk light level, temperature, and ID tags to optimize the worker environment

Enhances lighting, HVAC, maintenance, and **productivity**

- Introduction
- Commercialization
- Appendix

The team recommends five actions to progress the PicoSystem's viability in the marketplace

- 1. Use wireless mesh**
- 2. Offer licensing exclusivity**
- 3. Test and improve performance in harsh conditions**
- 4. Keep range stable as voltage decreases**
- 5. Build out the integrated PicoSystem**

Building a Vertically Integrated Company



To succeed, the business will need to advance the technology, hire leadership, build partnerships, and overcome financing hurdles

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6+
UCB Prototype Completion	Active					
Company Formation	Active					
Initial Staffing Build Application/Software Partnerships Develop Hardware/Software	Active					
Beachhead Development	Active	Active				
Hardware/Software Specialization Market Product Begin Selling/Post Sales Support	Active	Active				
New Technology Development		Active	Active	Active	Active	Active
Build R&D/Marketing Staff Implement IP Strategy		Active	Active	Active	Active	Active
New Tech Commercialization			Active	Active	Active	Active
Market New Technologies Begin Selling/Post Sales Support Enter Into Production Partnerships			Active	Active	Active	Active
IPO/Company Sale						Active

Initially, the company will depend on vertical integration as a barrier to competitive threats. Over time, the company will develop patentable technology

