FOUNDATION
CAPITAL

Foundation Capital EiR1 at ORNL

Presentation to EERE

May 2010

Narrow EiR IP filter employed

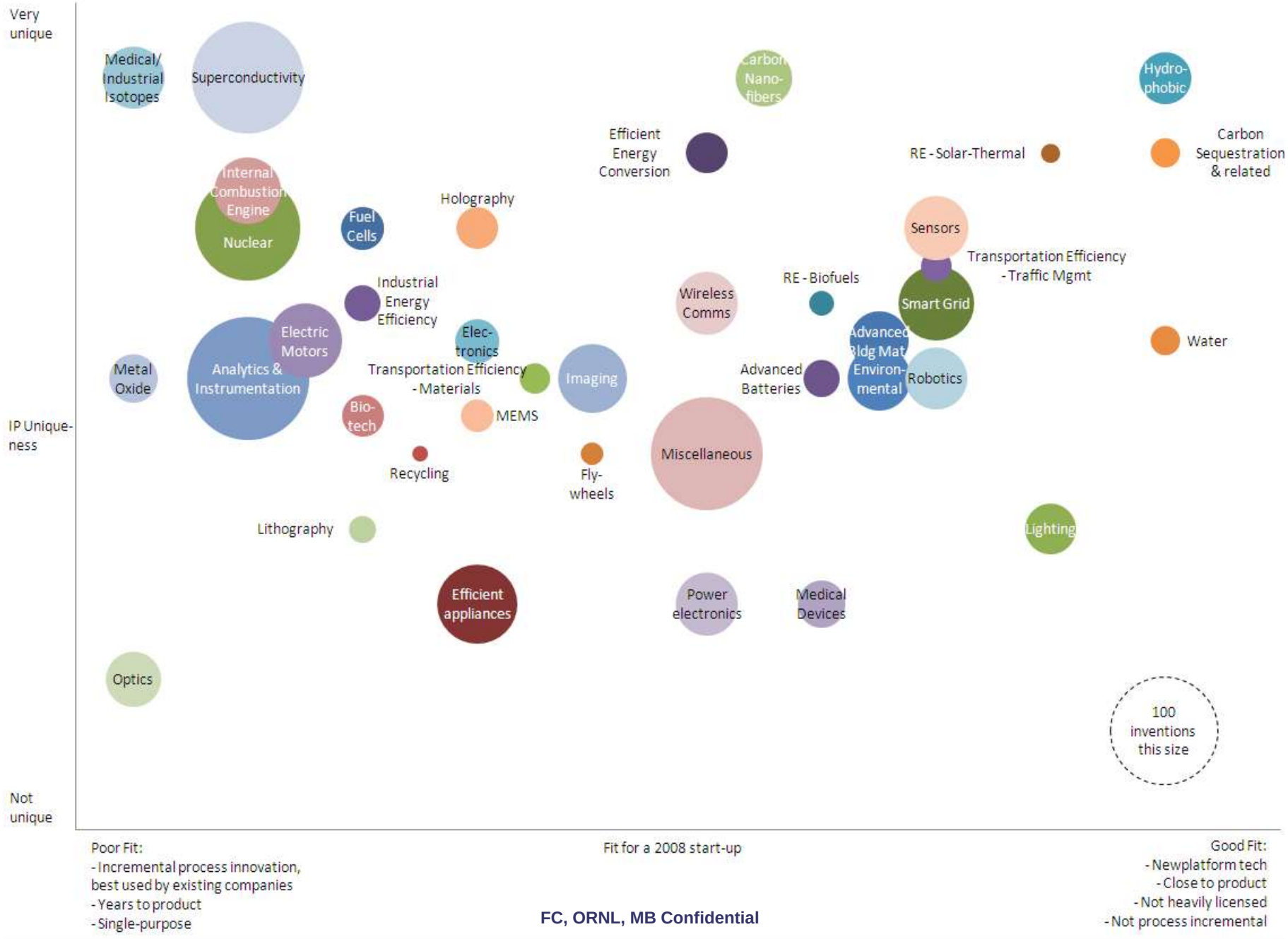
FOUNDATION CAPITAL

- Find a technology that
  - Promises a 5-10x improvement over status quo
    - Not incremental
  - Is covered by unique, defensible, broad IP portfolio
    - No license patchwork
  - Addresses a $B market opportunity
  - Has platform characteristics
    - Once core product developed, should be leverageable into several applications with small additional R&D resources
  - Fit for private funding within 12 months of EiR program start
    - Ready to generate early revenue 24 months after private funding kicks in

Distribution of 1,500 reviewed ORNL IP

Out of 3,000 Total Disclosures Filed Over 25 yrs

FOUNDATION CAPITAL



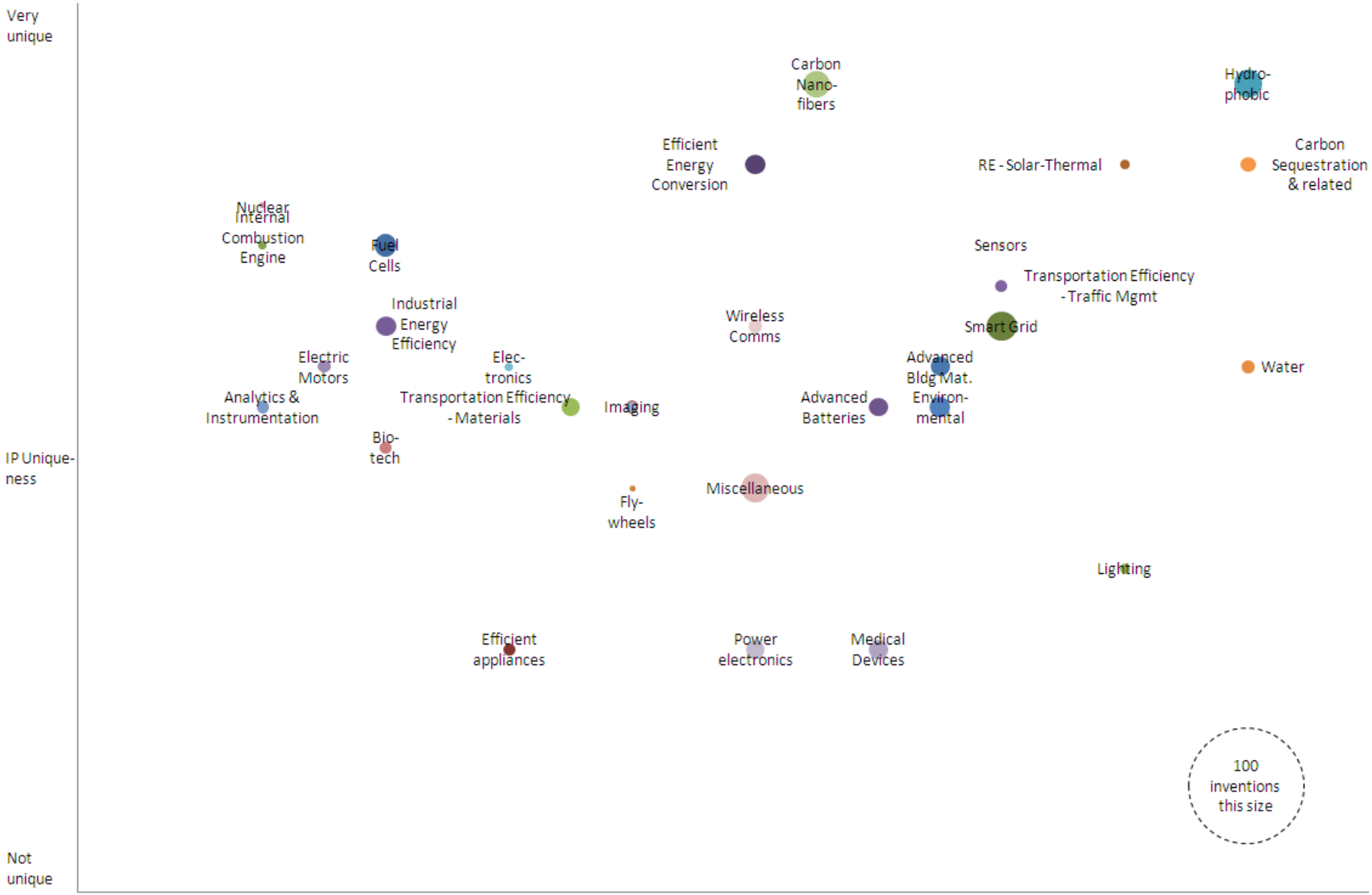
Many ORNL techs not a natural fit for start-up

FOUNDATION CAPITAL

- ORNL has strong IP in specialized techs
  - Hydrogen Economy & Fuel Cells – too far out
  - Superconductivity – too far out & heavily licensed
  - Industrial Isotopes
  - Incremental innovations to industrial processes
    - Nuclear, steel, metal oxides
  - Analytics and instrumentation
- Most of these cannot serve as the foundation of a new start-up

Approx 250 inventions reviewed further

FOUNDATION CAPITAL



1st order prioritization filters

FOUNDATION CAPITAL

1. Maturity (see next slide)
2. Market sizeable ($500M +, order of magnitude)
3. Investment $ required to profitability (order of magnitude)
4. Strong IP (core technology, not process)
5. Platform nature
6. Substantial customer benefits
7. Substantial competitive advantage
8. Inventor support
9. Cleantech/energy relevant

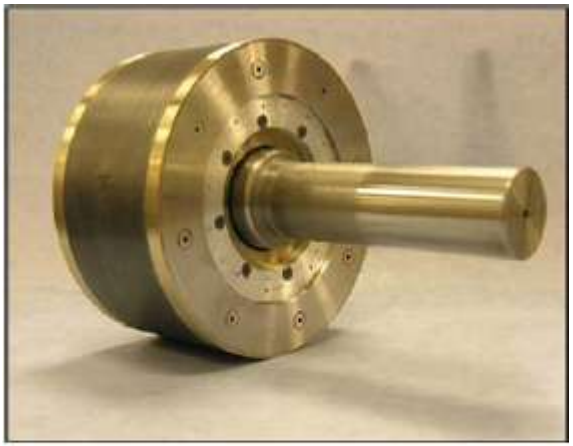
Compact, high efficiency electric motors: Advantage too small (?)

FOUNDATION CAPITAL

Summary assessment	Advantage too small
Technology	Novel electric motor design
Problem	Hybrids need high efficiency, compact electric motors
Market size 2009	TBD
Market size 2013	TBD
Market CAGR	TBD
Cost advantage over current	20% less material cost
Performance adv. over current	20% smaller, lighter, 40% efficiency gain, lower battery power required
Likely margin @ market price	TBD
R&D time needed	Prototype available now
technology risk	None
R&D investment	TBD
IP Status	Multiple patents granted
Manufacturing investment	TBD
# competitors	Many (to be confirmed)
Advantage over comp.	Lighter, smaller product
# of alternatives	TBD
Advantage over alt.	TBD
# of customers	TBD
Adjacent markets/platform?	TBD
HR, other assets required	None
Value chain issues	TBD

Business Opportunity:

Manufacturer compact, high efficiency electric motors for hybrids, etc.



Prototype permanent magnet motor with brushless field excitation coil operates at 16,000 RPM

Magnetic Processing: Investigate

FOUNDATION CAPITAL

Summary assessment	Investigate
Technology	10T+ magnetic processing of steels, alloys, other materials
Problem	Heat treament costly, does not reach desired properties
Market size 2009	TBD
Market size 2013	TBD
Market CAGR	TBD
Cost advantage over current	Energy, time savings
Performance adv. over current	20-50% weight reduction,80% life extension, eliminate some costly alloys & chemistries
Likely margin @ market price	TBD
R&D time needed	2 years
technology risk	low
R&D investment	$5M FC est. (incl. magnets)
IP Status	8 patents filed
Manufacturing investment	TBD
# competitors	TBD – magnet manufacturers
Advantage over comp.	Cheaper, faster than heat tr.
# of alternatives	Heat, pressure treatment
Advantage over alt.	Cheaper, faster, safer
# of customers	Est. 000s
Adjacent markets/platform?	Effect on other materials tbd
HR, other assets required	Superconducting magnets **Eager but professorial Inv.**
Value chain issues	Must make own magnets?

Business Opportunity:

Manufacturer of magnetic processing equipment

Possibly manufacturer of magnetically processed materials

Magnetic Processing Laboratory Facility

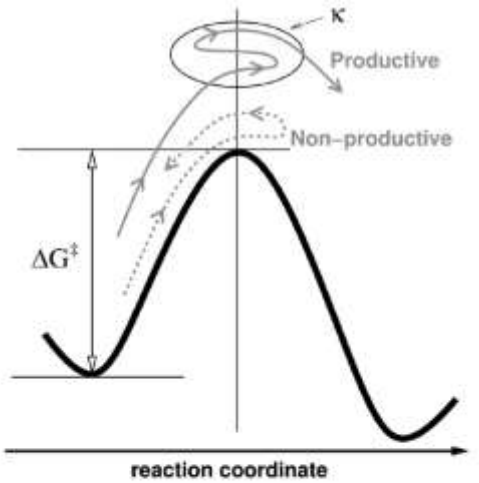
Optimized Enzymes: Investigate

FOUNDATION CAPITAL

Summary assessment	Investigate
Technology	Manipulate enzyme internal motion to optimize enzyme reaction rates
Problem	Enzymes not optimized for desired industrial uses
Market size 2009	$10B (all enzymes)
Market size 2013	$15B est.
Market CAGR	TBD
Cost advantage over current	TBD
Performance adv. over current	10-1000x improved reaction rates
Likely margin @ market price	TBD
R&D time needed	6 months
technology risk	Medium-high
R&D investment	$60k (+TCDF) to prototype; $500k per enzyme after
IP Status	Several patents filed
Manufacturing investment	TBD
# competitors	Codexis, others TBD
Advantage over comp.	TBD
# of alternatives	Stick with current methods
Advantage over alt.	Faster, cheaper, better
# of customers	Many
Adjacent markets/platform?	All enzymes are targets
HR, other assets required	Non-specific
Value chain issues	Need to manufacture?

Business Opportunity:

Custom enzyme designer, optimizer and licensor (preferred) or manufacturer.



$$k_{TST} = \left(\frac{k_B T}{h}\right)\exp\left(\frac{-\Delta G^{\ddagger}}{k_B T}\right)$$

$$k = \kappa k_{TST}$$

Figure 5
Schematic illustration of free energy profile for an enzymatic reaction. Protein dynamics can influence reaction rates in two possible ways: by altering height of the activation free energy barrier ($\Delta G^{\ddagger}$) and transmission coefficient (κ). k_B is the Boltzmann's constant, T is the temperature, h is the Planck's constant and k_{TST} represents the transition state theory reaction rate.

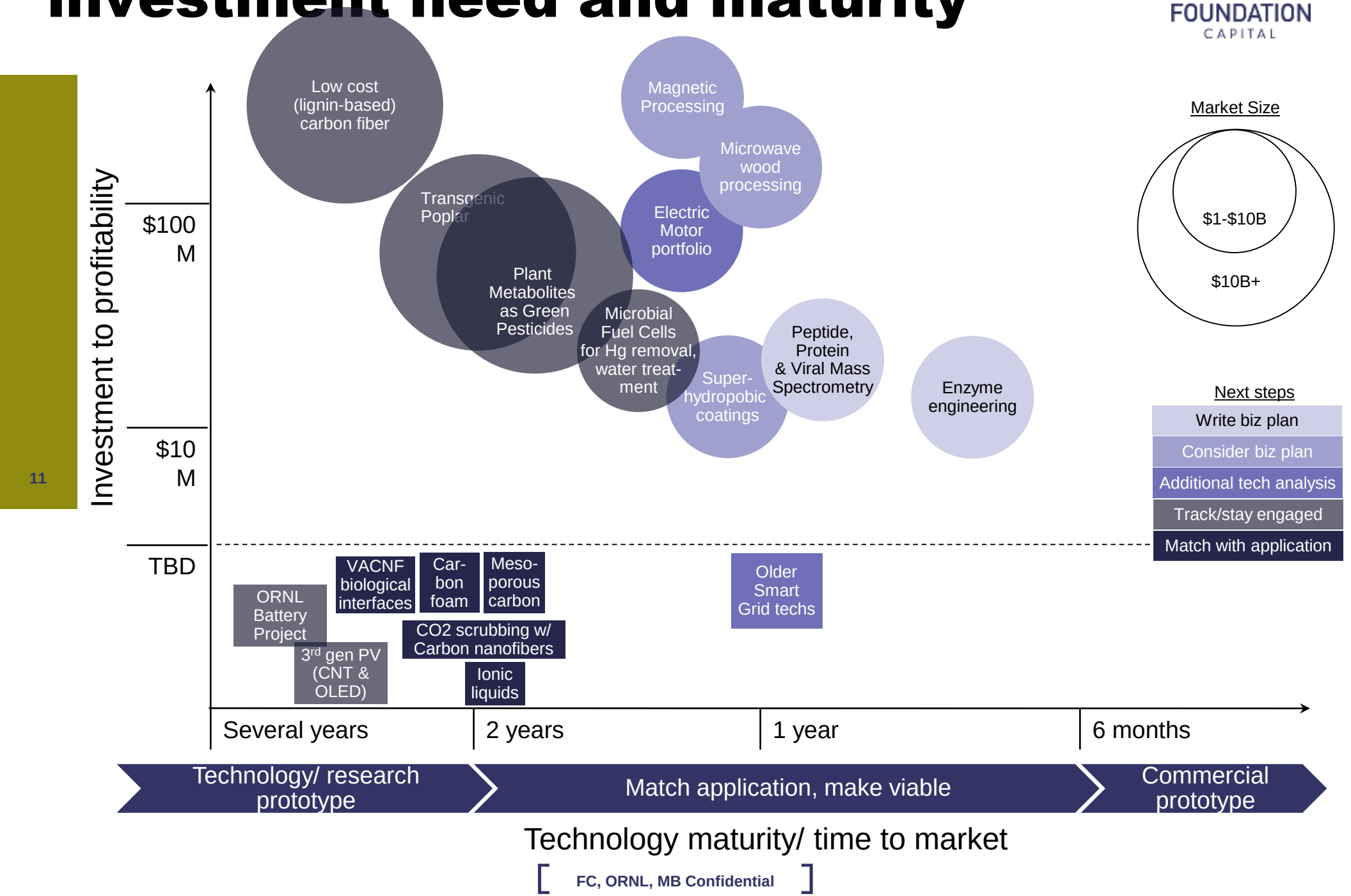
Key filter: Technology maturity

FOUNDATION CAPITAL

Two key steps to hit VC investment sweet spot: 1. Match tech to application 2. Mature matched tech to create commercial prototype

Typical duration:	5-10 yrs	1-3 yrs	0-10 yrs	6 mo – 2 yrs	6 mo – 2 yrs
	Basic research	Technology/ research prototype	Match to application, make viable	Commercial prototype	Gen 1 product/ service
	• Exploratory or application targeted scientific research • Ex – how to make micro-porous, high conductivity material? Irres-pective of appli-cation	• Proof of concept • Bench scale • Ex – ORNL: Graphitized carbon nanofiber	• Match research prototype w real application such that in 1-5 years • Economics *probably* make tech viable • Industry dyna-mics *probably* support intro of new tech	• For at least 1 sizeable market segment: • Sufficient scale • Ok feature set • Acceptable cost "in sight"	• 1st customer(s) identified, sold

ORNL technologies by market size, investment need and maturity



Filters found hardest to pass

FOUNDATION CAPITAL

1. Fit for private funding within 12 months of EiR program start
2. Promises a 5-10x improvement over status quo
3. Has platform characteristics
4. Addresses a $B market opportunity
5. Is covered by unique, defensible, broad IP portfolio

Other observations

FOUNDATION CAPITAL

- ORNL commercialization department
  - Well organized if not fully “data automated”
  - CMs have finger on pulse of the lab – knew pretty well which inventions might be a fit
  - Easy to work with
  - Clearly motivated to make licensing deals happen
- ORNL scientists
  - Easy to talk to
  - Safety oriented – “I want to start a company … once my retirement benefits have fully vested”
  - Better at talking to DoE officials than entrepreneurs
- ORNL overall
  - “Entrepreneurial leave”, some other support in place
  - However, no strong entrepreneurial culture/ecosystem

Mike Paulus, ORNL Tech Transfer & Former Entrepreneur, Making Progress

5/2015 Update

FOUNDATION

- Took Entrepreneur Leave From ORNL in 2000, Co was later acquired by Siemens
- Returned to Oak Ridge in 2010
- New tech transfer efforts include Spark! conference, webinars, etc.
- Licensing revenue has increased from $1.4M in 2009 to $3M in 2014
  - Suggesting sales of licensed products around $60M/yr
  - Still small compared to $1.65B annual ORNL budget

Sources: http://www.ornl.gov/ornl/news/news-releases/2014/ornl-technology-transfer-continues-strong-upward-trend