Bridging the Valley of Death

Addressing the scarcity of seed and scale-up capital for next generation clean energy technologies.

Clean Energy States Alliance call, 18 December 2009

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Clean Energy Group (CEG) and New Energy Finance (NEF) were commissioned by the Annenberg Foundation to assess current gaps in clean energy financing, and solicit recommendations to address them.

Between June-August 2009, CEG and NEF conducted interviews with 60 sector thought leaders in 10 countries.

Participants included venture capitalists, project developers, attorneys, insurers, private equity players, commercial bankers and others.

A summary of proposed responses is presented here in draft form and has been circulated to survey participants for further comment.
The Valley of Death
Two valleys of death, not one

The old valley – commercialization to scale-up
• As old as time
• Intractable
• A problem, regardless of project finance environment
• Government support always needed

The new valley – lab to start-up
• Disappeared briefly but now back with a vengeance
• Benefitted from recent boomlet in clean energy VC investment
• Exposed again now that early stage capital has disappeared
• Probably needs government support
• Poses important questions about role of VC
### The valleys

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research &amp; Development</td>
<td>Demonstration / Proof of Concept</td>
<td>Deployment / Pilot Facility</td>
<td>Diffusion / Commercialization</td>
<td>Commercial Maturity</td>
</tr>
<tr>
<td>Generate idea and begin to generate intellectual property</td>
<td>Design and test prototype</td>
<td>Prove technical validity in the field</td>
<td>Prove manufacture process can be scaled economically</td>
<td>Proven technology is sold and distributed</td>
</tr>
<tr>
<td>Improve intellectual property</td>
<td>Market technology</td>
<td>Prove technology is viable at scale</td>
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**Valley of death - Technological**

**Valley of death - Commercialization**

**Gaps**

**Series A**

**Series B**

**Series C**

**Later Rounds**

**Public Markets**
Global new investment in clean energy, 2004 – 2009

- **2004**: $35bn (68% Growth)
- **2005**: $60bn
- **2006**: $93bn (59% Growth)
- **2007**: $148bn (5% Growth)
- **2008**: $155bn
- **2009**: $130bn (17 - 23% drop)

**Note:** Adjusts for reinvested equity. Total value includes estimates for undisclosed deals.

Source: New Energy Finance
Global VC/PE investment by type:
2007 – 2009 (annualised)

PE Expansion capital
- 2007: $42m/74, $53m/113
- 2008: $21m/109
- 2009: $19m/35

VC Further Rounds
- 2007: $16m/51, $19m/71
- 2008: $19m/35
- 2009: $20m/36

VC Series C
- 2007: $20m/36, $33m/25
- 2008: $14m/65
- 2009: $18m/58

VC Series B
- 2007: $12m/38
- 2008: $18m/58
- 2009: $12m/38

VC Series A/Seed
- 2007: $5m/178
- 2008: $5m/126
- 2009: $5m/72

Note: Chart labels show average deal size / total number of deals. Figures for 2009 have been annualised through to the year-end.

Source: New Energy Finance
Count of VC & PE exits by route:
Q1 2006 – Q3 2009

Source: New Energy Finance
Feed-in Tariffs

Structure

- Factors in avoided cost externalities
- Cap-and-trade punishes emitters; feed-in tariffs (FiTs) reward clean producers
- High fixed-price offered for every MWh of clean power produced
- Implemented widely in Germany and Spain
- In place or under development in Oregon, Hawaii, Vermont, Sacramento (SMUD), Gainesville, and California
- Federal action highly unlikely
# Feed-in Tariffs

## Advantages
- Eliminates time and uncertainty of negotiating individual PPAs
  - Shortens development cycle and facilitates financing
- Reliable cash flows
- Economic development

## Drawbacks
- Inefficient and inflexible
  - Bubbly and inefficient technologies supported
  - Developers overpaid at times
- Does little to encourage use of cutting edge equipment
  - Tried and true favoured over the more ambitious
- Challenge/possibility: a FiT that fits next generation technologies
Government as a First Adopter

Structure

- Use government’s buying power to promote clean technologies

Global examples:

- China – Central government to add more than 60,000 lower carbon vehicles by 2012
- Brazil – Electrobras guarantees 20-year clean energy PPAs totaling 3.3GW and resells power to distributors
- UK – Crown Estate to purchase first 7.5MW Clipper turbine when complete in 2-3 years

US:

- Federal agencies to up efficiency, cut oil use, and leverage purchasing power to promote low-carbon energy technologies
- Billions in stimulus for federal improvements, plus state and local grants
- Pentagon as first adopter of solar PV for use off-grid; algae-based jet fuel tested in Air Force jets
Government as a First Adopter

<table>
<thead>
<tr>
<th>Advantages</th>
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<tbody>
<tr>
<td>✅ Economies of scale</td>
</tr>
<tr>
<td>✅ Ability to soak up excess capacity at times of low private sector demand</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
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</thead>
<tbody>
<tr>
<td>✅ New technologies not specifically targeted</td>
</tr>
<tr>
<td>✅ Limited risk appetites (i.e. a military bases)</td>
</tr>
<tr>
<td>✅ US federal PPAs currently capped at 10 years</td>
</tr>
<tr>
<td>✅ Challenge/possibility:</td>
</tr>
<tr>
<td>☞ Making government an effective first adopter of next generation technologies via PPAs, mandates, or some other policy</td>
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Efficacy Insurance

Structure

- Insurance that protects against underperforming technology
- Pays out at a rate that brings underperforming equipment up to original specifications
- Provides liquidated damages up to the value covered by the policy
- Totally unavailable today for new clean energy technologies, but used in the past to support new, relatively untested devices
  - Hartford Steam Boiler for new locomotive steam engines in 1850s
  - Nuclear power
- Potential structure: pooled capital to underwrite policies. Developers pay a premium and transfer the performance risk to the new insurance pool
Efficacy Insurance

Advantages
- Technology risk removed allowing typical project finance institutions to lend/invest
- Potentially simple financing structure: debt + equity, with appropriate insurance sprinkled on top

Drawbacks
- Private insurers highly unlikely to move on their own to create such a product
- Challenge/possibility:
  - Insurance industry is highly regulated - could regulators compel insurance firms to participate?
  - Public funds could be added to the pool to reduce private insurer exposure
Streamline Testing and Standards

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<tr>
<td>✅ Complying with current standards can slow technology deployment, especially when seeking to get onto the grid</td>
</tr>
<tr>
<td>✅ The National Institute of Standards and Technology could work with private standard-setting organization (UL and others) to develop expedited processes for new energy technologies</td>
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<td>✅ Facilitated certification or third party testing to verify novel technology could enhance financing prospects, make investors more comfortable with associated risks</td>
</tr>
<tr>
<td>✅ Warranties to provide comfort for commercial lenders.</td>
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<tr>
<td>✅ None, though it is far from a full solution</td>
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</table>
Delegated Investor Program

Structure

- A delegated commercialization finance authority could be created to assess and assume technology risks with government support, similar to the work of DoE 1703 program in the U.S.
- This authority could distribute some of the decision-making responsibility via the diffusion of capital to existing qualified private sector institutions, empowered to make decisions on a deal by deal basis.
- Banks, other investment mangers or experienced public sector agencies could do the actual processing of applications.

Advantages

- The approach should speed the capital allocation process – multiple delegated investors working with the technical assistance of a central commercialization risk assessment entity could deploy capital more quickly than a federal agency working in isolation.

Drawbacks

- Risks must be apportioned appropriately, which could prove challenging given the limited pool of investors with adequate technical expertise to address the commercialization finance issues.
Ken Locklin
Clean Energy Group

Ethan Zindler
New Energy Finance
+1 703 486 5667
www.newenergyfinance.com
www.newcarbonfinance.com
ethan.zindler@newenergyfinance.com

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