FuelCell Energy, Inc.
3 Great Pasture Road
Danbury, Ct 06813
• Baseline products cost-competitive with government subsidy at locations with very high cost-of-electricity

• Company sponsored R&D focusing on marginal gains to make the DFC products cost-competitive in regions with high cost-of-electricity
Needs large scale market penetration to enjoy the fruits of this transformational technology

Needs drastic reduction in cost-of-electricity to achieve large scale deployment

Requires high risk research to achieve the required COE reduction (increase power density, enhance life and lower cost)

- Increase stack power from 350 net kW to 500 net kW
- Enhance stack service life from 5-yr to 10-yr
- Additional 20% cost reduction by design and volume production
• **Baseline design life 5-yr**

• **Life (5-yr) limiting factors**
  - NiO dissolution from cathode and deposition in the matrix
  - Electrolyte loss from matrix causing gas leakage and cell internal resistance increase

• **Desired life 10-yr for wide spread commercial success**
Performance Improvement Opportunity

- Stack output has increased by a factor of three over last twelve years

- **Current stack output is 350 kW net AC**

- Another 40% increase is achievable
  - New cathode development will be required to achieve the desired goal
• **Stack module cost is ~two-third of the plant cost**

• **Low hanging opportunities:**
  - Streamlining of cell assembly process allowing automatic cell assembly
    - Develop human touch free assembly line concept
    - Develop automated components joining techniques.
    - Demonstrate cell components assembly without human touch
  - Matrix manufacturing process improvement to allow higher yield
The History of DFC

Products Cost Reduction

- DFC300 MA
- DFC3000 B3
- DFC1500 B5
- DFC1500 M10 Module

1st Commercial Shipments
Multi Units Buys

Field Trials

- DFC3000 B1 & DFC1500 B1 M10 Module
- 300kW Stack
- DFC3000MA B2.5 C300 Module
- DFC1500MA
- DFC3000 B2 DFC1500 B4
- Launch Global Sourcing

Calendar Year

2003 2004 2005 2006 2007 2008 2009

Relative Production Cost $/kW

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

DFC/T
C1400 350kW Stack

MO3244
Normalized Direct Fuel Cell MW Module Cost Reduction Progress

Normalized Direct Fuel Cell MW Module Cost Reduction Progress

Estimated Relative $/kw Stack Module Cost

Normalized Direct Fuel Cell MW Module Cost Reduction Progress

Relative $/kw Stack Module Cost

- 0.10
- 0.20
- 0.30
- 0.40
- 0.50
- 0.60
- 0.70
- 0.80
- 0.90
- 1.00

2003 2004 2005 2006 2007 2008 2009

2009 Estimated

- Cell Components, 52%
- Stack Technology (Power Uprate), 33%
- Non-Repeating Components, Final Assembly, Conditioning, 15%
DFC Cost-of-Electricity Reduction by 40% Performance and 100% Life Improvements

DFC COE based on installed cost for DFC3000 product. Capital costs amortized over 15 years, fuel cost at $7.5/MMBtu
Cost of Electricity Breakdown

Baseline DFC COE (unsubsidized)

Advanced research enables 25% reduction in COE

Fuel Cost

40% power + 10% cost

O&M

Heat sold
Impact of Target Improvements: Opens Up Unsubsidized Markets

-8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18

Current DFC3000, ADG fuel with SGIP
Current DFC3000, natural gas fuel with SGIP
Current DFC3000, natural gas fuel no capital cost incentives
42% Performance Improvement
100% Life Improvement

Cost of Generated Electricity Cents / kWh
Annualized DFC Capital Cost
Annualized Gas Cleanup Capital Cost
Fuel
O&M and Restack
Heat Recovery Value
RECs, CO2 Credits
ITC
SGIP
Net COE
CT150 Wholesale Power Feed-in Rate
CA Commercial Power Retail Price
US Average Commercial Power Retail Price

Ultra-Clean, Efficient, Reliable Power
Wide spread adaptation of the DFC will result from drastic COE (~3-4 cents/kWh) reduction and will lead to immeasurable national benefits. Simply 0.2% capture of the total capacity will lead to:

- Reduces GHG emissions by ~20 million tons of CO₂ per year) to combat climate change
- Saves fuel (~50 million barrels of oil equivalent per year) improving energy security
- Ensures US leadership in the energy technology field
- Creates~300,000 new green technology jobs
- Generates billions of dollars (~$10 billion) in foreign sales
Appendix
## Estimation of Impacts

### Assumptions

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>Rest of the World</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Installed Capacity in 2006</strong>, MW</td>
<td>964,000</td>
<td>3,048,000</td>
<td>4,012,000</td>
</tr>
<tr>
<td><strong>Replacement Market, 3% per year</strong></td>
<td>28920</td>
<td>91,440</td>
<td>120,360</td>
</tr>
<tr>
<td><strong>Growth Market, 1.0% USA</strong>¹ and 2.2% rest of the world²</td>
<td>9,640</td>
<td>67,056</td>
<td>76,696</td>
</tr>
<tr>
<td><strong>Total New Installations, MW</strong></td>
<td>40,000</td>
<td>160,000</td>
<td>200,000</td>
</tr>
<tr>
<td><strong>Yearly DFC Capture starting 2015, 5% of US market and 3% of World Replacement Market, MW</strong></td>
<td>2,000</td>
<td>4,800</td>
<td>6,800</td>
</tr>
<tr>
<td>% penetration of the Total</td>
<td>0.21</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>Fuel Cell Sale, $X10^6 ($1800 per kW)</strong></td>
<td>3,600</td>
<td>8,640</td>
<td>12,240</td>
</tr>
<tr>
<td><strong>Fuel Cell Stack Replacement + Maintenance (15%), $10^6</strong></td>
<td>540</td>
<td>1,296</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total business, $10^6</strong></td>
<td>4,000</td>
<td>10,000</td>
<td>14,000</td>
</tr>
<tr>
<td>**Job (direct+Indirect) creation, # (23 jobs per $10^6)**³</td>
<td>100,000</td>
<td>200,000</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>Total Fuel Cell Power Per Year (@ 90% Capacity factor), MW-hr</strong></td>
<td>15,770,000</td>
<td>37,840,000</td>
<td>53,610,000</td>
</tr>
<tr>
<td><strong>CO₂ Emissions Avoided, million tons per year</strong></td>
<td>5</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td><strong>SOx Emissions Avoided</strong></td>
<td>0.06</td>
<td>0.14</td>
<td>0.19</td>
</tr>
<tr>
<td><strong>Nox Avoided</strong></td>
<td>0.02</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>PM₉₀</strong></td>
<td>0.0019</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Fuel Savings, million barrels/yr oil equivalent</strong></td>
<td>10</td>
<td>30</td>
<td>50</td>
</tr>
</tbody>
</table>

¹. Energy Information Administration International Energy Annual 2006
². EIA Press release, April 14, 2004, "World net electricity consumption nearly doubles over the projection period, from 13,290 billion kilowatthours in 2001 to 23,072 billion kilowatthours in 2025" (estimated to be 2.2%)
³. Projected by Chris Bentley of FCE