Accelerating Adoption of Energy Innovation: Building Bridges to the Marketplace

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Challenge: Connecting Innovation to the Marketplace Requires Building the Energy Innovation Pipeline

Discover

Basic & Applied Science

Technology Application

Develop

Start-Up & Product Prototype Testing

Deploy

Company Scale-up & Clustering

Build Critical Mass of Research in Strategic Theme
Generate Intellectual Property
Fund & Perform Proof of Concept
Procure Pre-Seed Funding/Pursue Licensing
Convert Licenses to Start-ups with Seed Funding
Procure Venture Funding & Mature the Enterprise
Not Just One Problem:
Key Inputs Need to be Enhanced at Each Stage

- **Innovation Management**
  - How activities are organized to support a pipeline.

- **Human Resources**
  - How talent is guided and rewarded to feed innovation.

- **Governance**
  - How institutional policies enable and reward action.

- **Finance**
  - Securing capital for each stage of innovation activity.

- **Physical Infrastructure**
  - The right facilities for the dynamics of each stage of innovation.
**Factor 1: Innovation Management—Build Bridges to the Marketplace**

<table>
<thead>
<tr>
<th>Pipeline Inputs by Stage</th>
<th>Discovery Basic to applied research</th>
<th>Development Technology to product</th>
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<tbody>
<tr>
<td>Focus:</td>
<td>IP “mining” to package related innovations.</td>
<td>Establish R&amp;D institutes to support commercialization.</td>
<td>Build buyer-supplier exchanges.</td>
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<tr>
<td>Structure and Organization of Innovation Activities</td>
<td>Industry affiliates programs to learn business needs.</td>
<td>Offer services for prototyping and pilot testing.</td>
<td>Assist early-stage firms in obtaining contracts with larger customers.</td>
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<tr>
<td></td>
<td>Pre-competitive R&amp;D consortia to attract industry participation.</td>
<td>Broker R&amp;D partnerships, services and suppliers.</td>
<td>Use networks to build marketing and distribution capacity.</td>
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<td>Provide access to global market data.</td>
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Factor 2: Governance—Practices to Better Mine and Harness Innovation

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<td>Focus: Regulatory and Administrative Policies</td>
<td>✓ Provide equity participation to faculty that generate business ideas, but remain on staff.</td>
<td>✓ Scale up of OTT licensing to in-state start-ups.</td>
<td>✓ Use procurement to assist early stage firms to survive.</td>
</tr>
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<td>✓ Expand offices of technology transfer to scale-up patent generation productivity (or outsource).</td>
<td>✓ Positive policies on faculty role in working with start-ups.</td>
<td>✓ OTT capacity adequate to assist start-ups.</td>
<td>✓ Align permit processes.</td>
</tr>
<tr>
<td>✓ Incentives for angel network (risk reduction or capital).</td>
<td>✓ Ensure state policies do not create cost disadvantages.</td>
<td>✓ Ensure companies to utilize university facilities.</td>
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Focus:
- Regulatory and Administrative Policies

Pipeline Inputs by Stage:
- Discovery: Basic to applied research
- Development: Technology to product
- Deployment: Company start to cluster growth and market adoption
## Factor 3: Human Resources—Rewarding and Retaining Talent with the “Right Stuff”

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### Focus: Motivation Retention and Attraction of Talent

- Career path options for faculty who serve industry science needs.
- Incentives and promotional rewards for innovation & patent productivity.
- Endowed chairs for faculty that build research centers.
- Career rewards for faculty active in commercialization.
- Business planning & technology management training.
- Team building: Match founder with experienced “jungle guide” from marketplace.
- Develop curriculum to meet industry needs early.
- Assist new firms in recruiting workforce.
- Establish just-in-time training at community colleges.
## Factor 4: Finance—Ensuring Capital for the Gestation of and Birth of Ideas

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<td><strong>Focus:</strong></td>
<td>State funds to leverage federal research bids and build a critical mass. Pre-seed capital for advance new ideas and proof of concept.</td>
<td>Establish seed fund capacity. Build and manage Angel networks. Leverage institutional investments in venture funds to increase capital. Use procurement to stimulate demand for innovation.</td>
<td>Form “deal generators” to generate and improve quality and volume of investment candidates. Manage consistent quality venture forums with local risk partners. Ensure availability of commercial financing.</td>
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<tr>
<td><strong>Capital from Research thru Enterprise Growth</strong></td>
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### Factor 5: Physical Infrastructure—Building Next Generation Micro-Economies

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<td>Facilities from Research Labs to Tech Parks to Innovation Zones</td>
<td>✓ Specialized research labs to attract faculty. ✓ “Collaboratories” for industry and university projects. ✓ Shared groups of instruments and labs with GLP capability.</td>
<td>✓ Establish incubator complex linked to expertise network. ✓ Offer pilot test and prototype facilities. ✓ Build lease facilities (wet lab/dry labs).</td>
<td>✓ Create partnerships to aggregate demand and broker deliver ✓ Use innovation zones to provide regional incentive packages. ✓ Develop multi-function technology parks as new micro-economies (within zones).</td>
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**Focus:**

- Facilities from Research Labs to Tech Parks to Innovation Zones

**Pipeline Inputs by Stage:**

- Discovery Basic to applied research
- Development Technology to product
- Deployment Company start to cluster growth and market adoption
Strategic Interventions: Partnerships for Each Stage of the Pipeline

Discover
- Pre-Competitive Energy R&D Initiatives
  - Fund Research, Mine IP and Build Bridges to Industry

Develop
- Energy Innovation Seed Capital Funds
  - Seed Capital to Identify, Prepare, Screen and Start Deals
- Forward Linkages Energy Venture Capital Fund
  - Funds to Grow, Roll-up Orphan Deals and Build Market Case

Deploy
- Regional Climate Prosperity Initiatives
  - Partnerships to Scale-up Demand and Market Adoption
Discovery—Beyond Basic Research: Pre-Competitive Energy Technology Initiatives

- Conduct research to define priority pre-competitive themes.
- Identify university or lab anchors and create centers or nodes in target regions to leverage capabilities.
- Build partnership of complementary sponsors using value-chain logic.

Output:
- Intellectual Property
- Leading Researchers
- Industry Partners
- Seed Cap Prospects
Development—Beyond Incubators: Create a Deal Generator-Seed Fund to Feed the Innovation Pipeline

- Build relationships with research universities.
- Identify energy research spin-offs.
- Screen candidates and select best fit with energy market objectives.
- Directly and indirectly provide virtual incubation to enhance development.
- Move into venture portfolio, license out or sell.
Development Corporation: A Fund to Harvest Seed Graduates and Build Value-Chain

Deals selected and managed to match forward linkage opportunities in marketplace and in strategically targeted regions.
Deployment—Regional Market Aggregation: Partner to Scale-up Adoption of Energy Innovation

Opportunity: Climate Prosperity Partnerships—”Energy Star 2.0”
- Work with regional partners to examine carbon footprints—overall and industry or institution specific to define energy challenges.
- Articulate and aggregate demand for solutions whose marginal cost can be reduced by scale of market demand.
- Create climate prosperity partnerships to mediate matching between providers and users—within user groups or across the broader region—from wholesale sale packaging to energy zones and consortia.
Building Market Bridges: Exploratory Cases

- **Connecticut Fuel Cell Cluster Initiative**
  - A Partnership for Value-Chain Development

- **BC Power Technology Cluster**
  - A Case of Industry Evolution

- **South Carolina Hydrogen & Fuel Cell Strategy**
  - A Portfolio of Regional Innovation Partnerships

- **Ontario Bio-products Innovation Network**
  - A Convergence Center Partnership
Connecticut is Building a Fuel Cell Cluster

Goal: Energy development to reduce dependency and GHG

Approach
- **Private**: Leverage historic industry strengths in fuel cell technology.
- **Public**: Align economic inputs—innovation, workforce, capital, and governance (policies and programs for fuel cells and “hydrogen road map”).

Structure: A Fuel Cell Coalition managed by a non-profit (CCAT) growing cluster value-chain membership and collaborative action.
Focus: Build the Fuel Cell Value Chain

- Suppliers
  - Basic FC Materials
  - FC Component Manufacture
  - FC Stack Assembly
  - FC System Assembly
  - Sales & Distribution
  - Recycling

- Integrators
  - R&D
  - Catalyst
  - MEA
  - Flowfield plates
  - Seals
  - Testing equipment

- Distributors
  - Power conditioning
  - Controls
  - Piping and valves
  - Air delivery system
  - Fuel processor
  - Fuel storage
  - Testing equipment

- End-Users
  - R&D
  - Diagnostics equipment
  - Replacement parts
  - Refurbished parts

- Support
  - Aluminum
  - Steel
  - Platinum
  - Carbon/Graphite
  - Plastics
  - Membrane

- Service & Maintenance
  - Diagnostic equipment
  - Replacement parts
  - Refurbished parts

- Recycling
  - Collecting depots
  - Dismantling facilities
  - Resell infrastructure
BC Power Technology Alliance: Focus on Leveraging Assets

An Energy Cluster: Key Drivers
- Fuel Cells: Ballard and Questair, fuel cell technology firms.
- Gas Engines: Westport
- Electric Hybrids: Azure and Rail Power
- Power Electronics: Xantrex and Power Measurement.
- Green Buildings: Busby, Perkins & Will; Keen Engineering.

Focusing on Smart Energy Solutions
- Sustainable urban practices (including off-grid).
- Smart transportation: Systems for personal and public transit vehicles.
- Smart grid: transmission and distribution management.
- Large sale green power production systems

Collaborating with R&D, Finance and Public Partners under BCTIA
- National Labs: NRC Institute for Fuel Cell Innovation at UBC.
- Institute for Integrated Energy Systems, University of Victoria.
- Simon Fraser University (PEM fuel cells).
- UBC Clean Energy Research Center & Sustainable Dev. Research Initiative.
- PowerTech Labs, BC Hydro for energy R&D, testing, consulting.
- Vison Scitec, energy tech consulting and R&D.
- BC Hydro: Advocating performance based components procurement.
- 2010 Sustainable Olympics: Demonstrations of H2 Highway, Smart Buildings.
- Major venture firms from BC are investors.
South Carolina: Building Next Generation Energy Initiatives Regionally to Compete Globally

Upstate Region
- End user applications
- Transportation applications
- Materials sciences
- Chemical engineering
- Fuel cells

Aiken Region
- Production
- Storage materials
- Distribution
- Chemical sciences
- Nuclear engineering

Midlands Region
- Fuel cells
- Production
- Storage materials
- Transportation applications
- Nuclear engineering
## The Three South Carolina Regions and Their Strategic H2 & Fuel Cell Directions

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<th>Region</th>
<th>Aiken</th>
<th>Midlands</th>
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<td><strong>Regional Theme</strong></td>
<td>Hydrogen production, storage, and distribution</td>
<td>Fuel cell and related support technologies</td>
<td>Hydrogen production, the hydrogen transition, auto-related technologies, energy efficiency, and selected demonstrations</td>
</tr>
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</table>
| **Actions**     | - Introduce Thermochemical Hydrogen Production Processes through a Pilot Plant Initiative  
                    - Create a Pre-Competitive Industrial Hydrogen Storage Partnership  
                    - Establish a Fully Functional Hydrogen Distribution Test Facility  
                    - Create a Pre-Competitive Hydrogen Technology Alliance | - Expand the Hydrogen and Fuel Cell Industry Center of Excellence  
                    - Establish a Uniform System for Technology Validation Initiatives and Demonstrations  
                    - Organize a Fuel Cell Production-Automation Partnership  
                    - Establish a Set of Energy Parks/Zones | - Establish New Energy End-User Application (NEUA) Assessment Center  
                    - Stimulate Entrepreneurship through ClemsonICAR  
                    - Organize Demonstration Projects Matched with the Development Needs of the Upstate  
                    - Explore Partnership with SRNL |
Ontario: Invest, Organize Research, Connect & Integrate to Build the Bio-Products Value Chain

Ontario Convergence Centers

Agriculture

Co-Gen & Fertilizers

Bio-Fibers for Insulation & Composites

Commodities to Processing for Feedstock

Chemicals

Bio-Fuels
Bio-ethanol
Bio-diesel

Bio-Plastics & Paints
Plasticizers & Phenolic Resins

Automotives & Components

Ontario: Invest, Organize Research, Connect & Integrate to Build the Bio-Products Value Chain

ICF International
Conclusion: What is Missing in the GCC Energy Dialogue? Two Critical Elements

- How to Aggregate Market Demand
  - Innovations, even when they reach the enterprise stage may languish due to slow market up-take due to prices and established competition.

- How to Scale-Up Delivery
  - Enabling markets to adopt innovation more rapidly may require achieving economies of scale and delivering solutions at a broad market level.
Goal: Avoid the Chasm? Build a Bridge

Early Adoption
Start-up
Market Bridge
Market Latency “Chasm”
Innovation Adoption Time Line
Market Acceptance
It is Time to Think About How to Build Bridges to the Market in New Ways...

- **Focus on the Region**
  - Take action to secure your future by collaborating to create and implement a new regional climate prosperity strategy.

- **Build Energy Innovation within Clusters**
  - Recognize how vital carbon reduction, energy efficiency and innovation are to each industry’s value-chain and performance.

- **Build Energy Innovation among Institutions**
  - Build these principles into operations of public and private institutions—transit, education, health, waste management, administration.

- **Accelerate Clean Tech & Energy Innovation Cluster Development to Supply**
  - Foster renewable energy, energy efficiency, carbon reduction cluster growth to meet regional needs and export to global markets.

- **Collaborate to Aggregate Demand & Enhance Choices**
  - Future performance may depend on your region working together to aggregate market needs and collaborating on accelerating adoption of climate prosperity solutions.
Three Converging Paths to Innovation
Different Users Needs Their Own Market Bridge

To Accelerate Adoption of Energy Innovation

- **Industry Clusters**
  - The “drivers” of your regional economy—producers, suppliers and their key institutions.

- **Institutions**
  - Schools, health care, public facilities, waste and transportation, and energy.

- **Community**
  - Commercial and residential buildings, developments, neighborhoods, districts and supporting infrastructure.
Goal: Achieve Sustainable Prosperity

- **Focus on a Triple Bottom-Line**
  - **Progress Toward Climate Change Goals:** Accelerated adoption of carbon reducing and green value-chain best practices and innovations.
  - **Enhanced Economic Competitiveness:** Reduce “economic leakages” and increased productivity through reducing expenditures on non-local energy and use of local inputs.
  - **Increased Opportunity:** New economic diversity and employment potential from growth of clean technology and green industries.

- **Set the Stage for Accelerated Change**
  - Convene the marketplace of stakeholders to begin collaborative strategy and action
The ICF Approach to Market Bridges: Build Your Climate Prosperity Strategy

Phase 1: Mobilize
- Ready and engage metro-region climate prosperity stakeholders.

Phase 2: Analyze
- Regional, industry and institutional carbon footprints and energy position.
- Assess likely carbon policy impacts.
- Assess clean tech and carbon reduction cluster capacity and readiness to deliver.

Phase 3: Catalyze
- Convene marketplace for each cluster and major institutions around climate prosperity challenges and develop cluster-and-institution specific actions.

Phase 4: Realize
- Integrate individual cluster and institutional energy and carbon strategies and cross-cutting actions into a metro-region climate prosperity vision, strategy and implementation partnership.

Phase 5: Actualize
- Launch and track metro-region climate prosperity implementation partnership to support and renew the collaborative strategy.
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