Connecticut Fuel Cell Programs - From Demonstration to Deployment

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Connecticut Clean Energy Fund
Connecticut Clean Energy Fund (CCEF)

- Legislation 1998 / Launch 2000
- Administered by Connecticut Innovations (CI)
- Surcharge on electric bills → ~$20 million per year
- 50¢ per household per month
CCEF Highlights

As of 06/30/07:

Projects Funded/Committed $ 75.4 Million
Program Allocations $ 65.2 Million
Vision, Mission, and Approach

- **Vision** – Connecticut will be a leader in having a sustainable balance of energy production, economic growth, and environmental impact.

- **Mission** – The Connecticut Clean Energy Fund develops, invests in, and promotes clean sustainable energy sources for the benefit of Connecticut ratepayers.

- **CCEF Approach** - To develop and implement programs that are innovative and responsive to the market place.
Strategic Framework

CCEF Goals

1. Create a **supply** of clean energy (installed capacity)

2. Foster the growth, development and commercialization of **clean energy technologies**

3. Stimulate **demand** of clean energy by increasing public awareness
Clean Energy Technologies

Fuel Cells
Solar
Biomass
Hydro

Landfill Gas
Wave
Wind
3-Year Strategic Plan

Goals/Objectives

Goal 1
Supply

Goal 2
Technology

Goal 3
Demand

Programs

Project 100
Onsite DG

Company Development
Demonstration
Industry Infrastructure
Clean Energy Communities
Public Awareness
Education

Targets

100 MW
5 MW

Baseline Improvement
10 Projects
Baseline Improvement
0.5%
Demonstration Programs

Program Goal 2 —Support the early-stage development of the clean energy industry in Connecticut by significantly improving the infrastructure and demonstrating the viability of innovative clean energy technologies.
Operational Demonstration

- **Rationale** – CCEF is charged under Connecticut law to foster the growth, development and commercialization of clean renewable energy technologies and related enterprises.

- **Program Goal 2** – CCEF will support the early-stage development of the clean energy industry in Connecticut by significantly improving the infrastructure and demonstrating the viability of innovative clean energy technologies.

- Commercial demonstration qualifies technology for installed capacity programs (P100 and Onsite DG)
Innovation Spectrum
Operational Demo - Bridging the Valley of Death

References
Bridging the Valley of Death: Transitioning from Public to Private Sector Financing NREL (Chart by David Berg)
Project Due Diligence

Review process includes:

- Technology Analysis (Innovation/Uniqueness/Value Added)
- Market and Competition analysis,
- Cost Effectiveness
- Company & Management Experience
- Host site readiness (regulatory/legal)
Financing Vehicle

- Non-Recourse Loan
  - Up to $750,000

- Payback based on level of Commercial Success
  - 3 year commercialization window
  - 5 years for fuel cells

- 25% cash cost share
Operational Demo Projects

- **Operational Demonstration Program** – provides funds for pre-commercial stage clean energy projects that rely on the innovative use or application of renewable energy generation technologies - $4.0 million allocated

**Result:**

- Electrochemical hydrogen separator enhances productivity of FCE DFC fuel cells

- Gencell Molten Carbonate demonstration to access the mid-size (25 to 100kW) high temperature fuel cell

- Ztek solid oxide fuel cell demonstrate heating cooling and power generation.
Operational Demo Projects (con’d)

- Operational Demonstration Program – provides funds for pre-commercial stage clean energy projects that rely on the innovative use or application of renewable energy generation technologies - $4.0 million allocated

Result:
- Several Proton Energy regenerative fuel cell and hydrogen generation system
- Infinity Fuel Cell Smart modular regenerative fuel cell that self generates Hydrogen from wind or PV for remote deployment of small fuel cell system.
Program Goal 1

Connecticut ratepayers will have access to a diverse supply of installed clean energy resources through the implementation of Project 100 (100 MW) and on-site distributed generation (5 MW).
Supply Programs

- Project 100
- Onsite Renewable DG Program
- Commercially available technology
Project 100

- **Program Requirement:**
  Select no less than 100 MW of Class I grid-side renewable energy projects through a competitive RFP process

- **Result:**
  **Round 1:** 34 MW forwarded to utilities – 19 MW withdrew, 15 MW Power Purchase Agreement signed 5/07

  **Round 2:** 31 Proposals/331 MW received – 11 Proposals/159.4 MW forwarded to utilities
  **including 68 MW Fuel Cells**
Project 100 Evaluation Criteria

Financial Viability
- Financial expectations and assumptions
- Financing experience and creditworthiness
- Financial structure
- Status of attracting capital
- Firmness of cost data

Technical Feasibility
- Team experience
- Permitting status and public acceptance
- Site control
- Design status and technical viability
- Fuel/resource plan
- Commercial available technology

CT Ratepayer Costs and Benefits
- Contract price
- CCEF investment amount
- CT economic development potential
- CT T&D impact
- CT energy price suppression
- Diversity
Onsite Renewable DG Program

Onsite Renewable DG Program – designed to stimulate the demand for behind-the-meter installations of clean energy at CI&I buildings in the state – $32.3 M Allocated

Result:

39 Solar PV completed/in process – 4 MW; 8 fuel cells, 2.7 MW
On-site Renewable DG Projects

Yale University’s Environmental Sciences Center (New Haven)

Fairfield Water Pollution Control Authority (Fairfield)

Pepperidge Farm (Bloomfield)
On-site Renewable Distributed Generation Program

- Enable renewable energy installations at **industrial, institutional and all commercial sites**
- Grants to “buy down” the cost of renewable energy generating devices
- Up to $4 million per grant
- Host site in CL&P or UI service territory
On-site Renewable Distributed Generation Program - the Process

- Applications accepted on rolling basis
- Staff reviews projects against screening criteria
- CCEF project modeling and grant assessment
- Applicant agrees to award amount
- Projects Committee and Advisory Board
On-site Renewable Distributed Generation Program

Project Funding Amounts

- Max funding → $4,000,000
- Funding Caps
  
<table>
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<th>Technology</th>
<th>Solar</th>
<th>Fuel Cells</th>
<th>Small Wind</th>
<th>Small Biomass</th>
<th>Landfill Gas</th>
<th>Hydro</th>
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<td>15 yrs</td>
<td>10 yrs</td>
<td>10 yrs</td>
<td>TBD</td>
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- Specific grant amount determined after CCEF completes project modeling

*Fuel Cells over 1 MW;$3.20/W
Summary

Growing in Scale: What’s Needed to Make this Happen...

- All 5 Major Players working in concert:
  - Federal R&D, Biofuel Subsidies, Tax Credits, Loan Guarantees
  - State-Based Clean Energy Funding, Project Management, Education Programs
  - Private Venture Capital, Private Equity and Project Finance
  - Industry & University Innovation - looking to new markets/products
  - Educated/Aware Consumers
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