

November 8, 2007 Keith Frame, Associate Director

Connecticut Clean Energy Fund

Connecticut Activities to Promote Emerging Renewable/Clean Technologies



Connecticut Programs to Promote Emerging Renewable Technologies

1. CCEF – Connecticut Clean Energy Fund \$30M

- Project 100
- Onsite DG program
- Operational Demo
- CT Clean Energy Options

2. CEEF -Connecticut Energy Efficiency Fund \$90M

- Energy Conservation Programs
- Demand Response Program
- Energy efficiency Partnership +\$60m
- 3. OPM- State Energy Office
 - New energy Technology Program +\$50k/\$10k



Strategic Framework

CCEF Goals

- 1. Create a supply of clean energy (installed capacity)
- 2. <u>Foster the growth, development and</u> <u>commercialization of clean energy technologies</u>
- 3. Stimulate demand of clean energy by increasing public awareness









Supply Programs

Project 100

Onsite Renewable DG Program

Small Solar PV Rebate Program



Clean Energy Technologies







Landfill Gas



Solar



Wave



Biomass





Hydro



Wind



Project 100

Project 100 – Legislation that requires the state's electric distribution companies to enter into minimum 10-year contracts for no less than 100 MW of Class I renewable energy capacity--\$39.5 M Allocated

Result:

Round 1-34 MW forwarded to utilities

Round 2 – 31 Proposals/331 MW Received





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

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:

27 Solar PV completed/in process – 1.3 MW; 6 fuel cells, 1.3 MW







On-site Renewable Distributed Generation Program

Project Funding Amounts

- Max funding → \$4,000,000
- Funding Caps

Technology	Solar	Fuel Cells	Small Wind	Small Biomass	Landfill Gas	Hydro
Funding cap	\$5/W	\$4.70/W	\$3.60/W	\$3.30/W	\$3.20/W	TBD
Evaluation timeframe	20 yrs	10 yrs	15 yrs	10 yrs	10 yrs	TBD

Specific grant amount determined after CCEF completes project modeling



Demand Side Programs Public Education & Awareness

Connecticut Clean Energy Communities

Program – aid to Connecticut municipalities to assist in the support and purchase of clean energy

Results (as of February 2007):

- □ 41 towns have joined 20% by 2010 Campaign
- □ 20 towns have qualified as Clean Energy Communities
- 12,000 signups for CTCleanEnergyOptions equivalent to 94,500 MWh's of demand or 31.5 MW of wind
- □ 8 towns installed or in process of installing earned solar systems
- □ 90 kilowatts of free solar systems earned
- Received 2006 Green Power Pilot Award from the EPA and DOE



Emerging Technologies



Program Goal 2 –Support the earlystage development of the clean energy industry in Connecticut by significantly improving the infrastructure and demonstrating the viability of innovative clean energy technologies.



Connecticut's Emerging Technology Initiatives

- Yankee Ingenuity Applied Research \$750k/year
- \$3M Equity Investments in Renewable Tech Companies \$500k/investment
- \$4M Operational Demonstration Program -\$750k/project
- \$3.5M Endowment to Create CGFCC
- \$2M/year Sustainable Energy Eminent Faculty
- Facilitate Business Plan development through Connecticut Innovations Pre-Seed Fund \$100k/project
- \$50k Office Of Policy and Management Energy Technology Grant - \$10k/project



Connecticut's Infrastructure Initiatives

Renewable Resource Assessments

- Wind Maps of New England
- Biomass Resource assessments and Technology Characterization studies
- Small wind demonstration program
- Fuel Cell Performance Monitoring Program
- Energy Technology Education initiatives
 - Pilot Post High School Renewable Energy curriculum





Connecticut Clean Energy Fund DOD/GAO Guidelines To Gauge **Technology Maturity**

Technology Readiness Level

- 1. Basic principles observed and reported
- 2. Technology concept and/or application formulated
- 3. Analytical and experimental critical function and/or characteristic proof of concept
- 4. Component validation in a laboratory environment
- 5. Component validation in a relevant environment
- 6. System/subsystem model or prototype demonstration in a relevant environment
- 7. System prototype demonstration in an operational environment
- 8. Actual system completed and "field qualified" through test and demonstration
- 9. Actual system "field proven" through successful operations



	Description
•	Lowest level of technology readiness. Scientific research begins to be translated into applied R&D. Examples include literature studies.
•	Invention begins based on observation of basic principles. Application is speculative with no proof or detailed analysis.
•	Active R&D is initiated, including analytical and lab studies to validate predictions of separate elements of technology. Examples include components not yet integrated or representative.
•	Basic technological components are integrated to establish the pieces that will work together (low fidelity). Examples are lab hardware.
•	The basic technology components are integrated with reasonably realistic supporting elements to allow testing in simulated environments. Examples include "high fidelity" integrated lab components.
•	Representative model or prototype system that has been tested in a relevant environment. Examples include testing in a "high fidelity" lab environment or in simulated operational environment.
•	Prototype near or at planned operational system. Requires demonstration of an actual system in an operational environment.
•	Technology has been proven in its final form and under expected conditions, representing the end of true system development. Examples include test and evaluation to meet system design specs.
•	Actual application of the technology in its final form and under true mission or field conditions. Represents the end of system fine tuning.

(1) Best Practices: Better Management of Technology Management Can Improve System Outcomes (GAO/NSIAD-99-162, 1999)





References

Connecticut Clean Energy Fund

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



Project Due Diligence

Evaluation 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 LoanUp to \$750,000

Payback based on level of "Commercial Success"

- a 3 year commercialization window
- □ 5 years for fuel cells
- 25% cash cost share





Technology Development Programs

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:

- 9 Demonstrations comprising 412 kW; Fueled by hydrogen (5), natural gas (2), wood chips (1), and Water (2)
 - Yankee Ingenuity Program \$1.5 million allocated

Result:

4 Applied Research Projects Underway





Connecticut Clean Energy Fund

VISIT US ONLINE <u>www.ctcleanenergy.com</u> www.ctinnovations.com

200 Corporate Place Rocky Hill, CT (860)563-0015



BACK UP SLIDES



Residential Solar Systems

Cumulative Residential PV Systems Approved





C & I Projects

Cumulative Commercial & Industrial Projects

