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# **New Technology Investment Strategy**

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**Track 3: New Renewables**

**Session 2: Crosscutting Technologies**

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# Learning Objectives

- ▶ Understand the changes taking place in technology and that it does not just apply to PV, solar thermal or wind systems
- ▶ Be aware of how new products are often "disruptive technologies" that may work better than more conventional systems
- ▶ Understand how some of these may also be applicable to the built environment.
- ▶ CCEF New technology investment strategy, analysis approach and resulting investment priorities
- ▶ Projected time to market roadmap for new technologies
- ▶ New technology commercialization tenets not to be overlooked

# Connecticut Clean Energy Fund



CONNECTICUT  
CLEAN ENERGY FUND

**THE POWER TO  
MAKE A DIFFERENCE**

**CLEAN ENERGY BENEFITS ALL OF US**

- Stabilizes energy costs
- Builds energy independence
- Generates local jobs
- Creates a healthy environment
- Combats global warming
- Leaves our children a better world

**BENEFITS**



- ▶ **Foster the growth, development and commercialization of renewable energy sources in Connecticut**
- ▶ **Created in 1998, launched in 2000**
- ▶ **Funded by a surcharge on electric utility bills ~\$25M/year**
- ▶ **Some additional funding from sale of Renewable Energy Credits, ARRA funding, foundation grants**

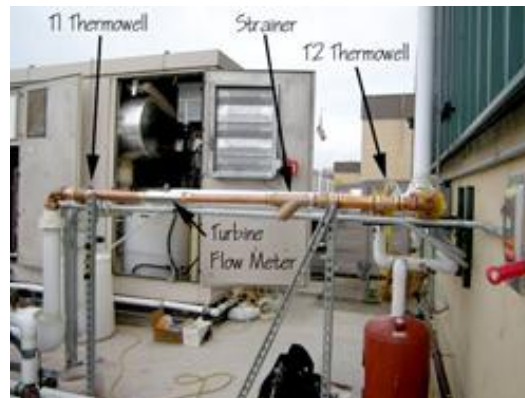
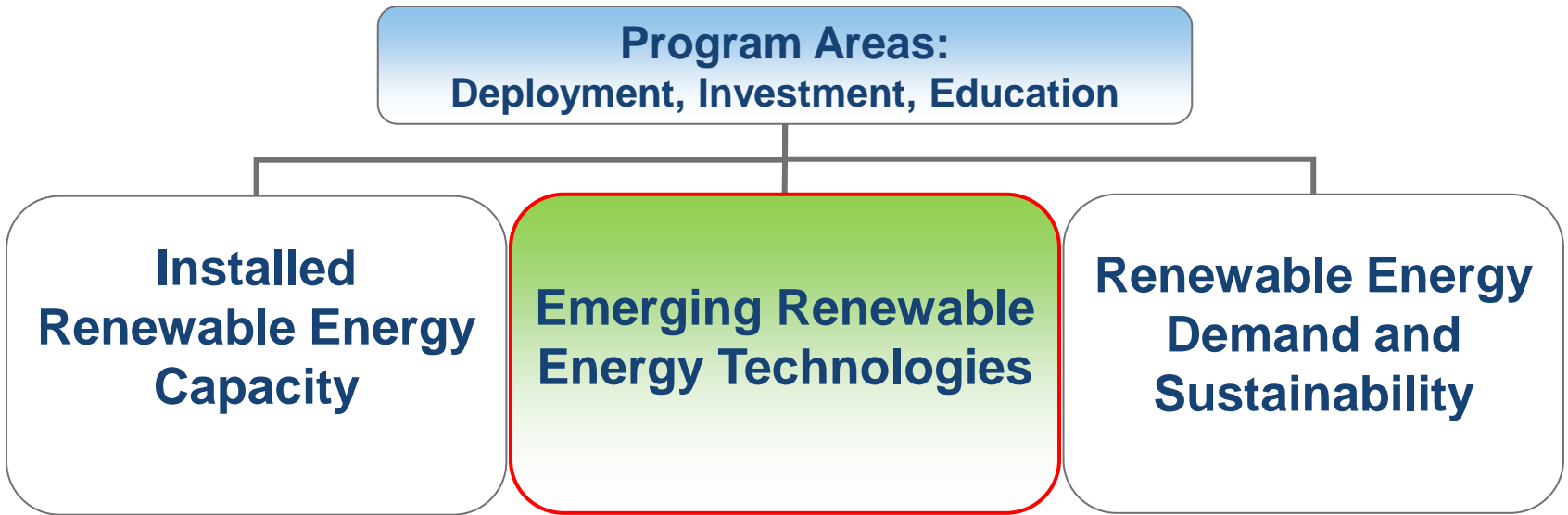
# CT Clean Energy Economy Today

(Mar 2009)

- ▶ **Core clean energy industry clusters include:**
  - ▶ Energy efficiency and energy management
  - ▶ Fuel cell R&D, manufacturing and installation
  - ▶ Solar-PV installation
  - ▶ Emerging: solar thermal, geothermal, biomass, biofuels, small hydro
- ▶ **Top 10 employers account for about half the jobs and revenues:**
  - ▶ UTC, FCE, Sensor Switch, Schuco USA, US Insulation Corp, Trane, Alliance Energy Solutions, EMCOR, Home Depot, Wal-Mart
- ▶ **Over 300 large and small companies and institutions**
  - ▶ \$782 MM in revenues
  - ▶ 11,800 jobs (direct and indirect; 0.7% of workforce)



# CCEF Program Areas



# Emerging Technologies Programs

## Alpha Program

Funds promising early stage technologies

DEBT

## Op Demo Program

Funds technologies on threshold of commercial application

DEBT

## Clean Tech Fund

Funds companies with promising technologies/products

EQUITY

Strategic Assessments and Resource Analyses

Technology Assessments

# New Technology Investment Strategy

## Overarching Goals

- ▶ **Accelerate the incubation and commercialization of technologies that will become the future engine of CT's clean energy industry**
  - ▶ Economic development and job creation
  - ▶ Cost reduction/ improve scalability
  - ▶ Energy security and diversity
  - ▶ Establish a self-sustaining early stage fund
  - ▶ Environmental impact

2010



2015



2020



2025



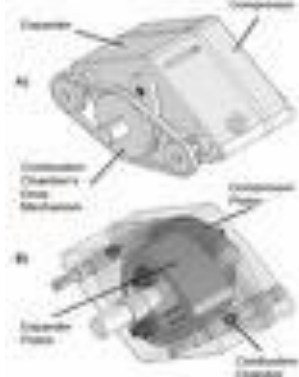
# New Technology Investment Strategy

## Questions we asked . . . . .

**Meter, meter, on the wall**  
How smart-grid technology works

1. A smart meter has a data connection to the utility, allowing the delivery of real-time information about load and pricing. Consumers can instantly see how much power they are using and what it is costing them. The availability of this information opens up many new possibilities.
2. Using the information from the smart meter, a smart appliance such as an air conditioner or washing machine can be programmed to switch off when demand is high, and on when demand is low. In some cases utilities can send commands directly to smart appliances in order to manage load at peak times.
3. Smart meters make it easier to incorporate intermittent, distributed sources of energy (such as solar panels or backyard wind turbines) into the electricity supply. They also enable households to sell excess power back to the grid.
4. A smart grid makes it possible to co-ordinate the charging of large numbers of electric cars. This is best done at night, when electricity demand is at its lowest level and there is excess capacity. Plugged-in cars could also act as an enormous energy-storage system, feeding power back into the grid if needed.

— Data link



# New Technology Investment Strategy

## Evaluation and Selection Criteria

<b>Business Attractiveness</b>	<ul style="list-style-type: none"><li>• Market potential</li><li>• Profitability potential</li><li>• Time to market</li><li>• Potential for strategic partnering</li></ul>
<b>CT Strategic Fit</b>	<ul style="list-style-type: none"><li>• Job creation potential</li><li>• Human and intellectual resources</li><li>• Industrial and infrastructure resources</li><li>• Infrastructure and natural resources</li></ul>
<b>Technology</b>	<ul style="list-style-type: none"><li>• Technology readiness level</li></ul>

# New Technology Investment Strategy

## Resulting Priority Investment Areas

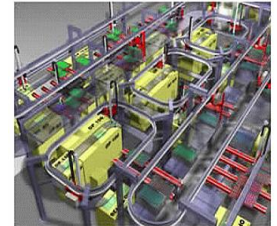
### High Efficiency Building Systems



### Distributed Clean Energy Systems



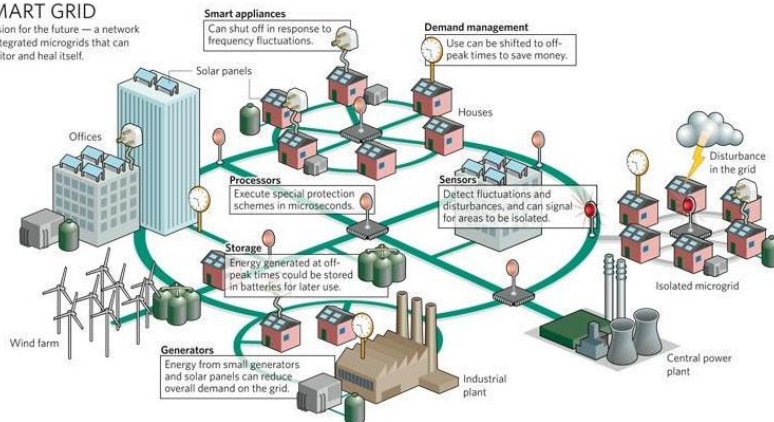
### Industrial Energy Efficiency



### Utility Power Generation & Management

#### SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.



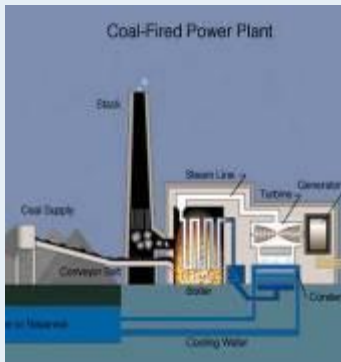
### Renewable Fuels Production



# Why is energy efficiency and energy management so important?

## Simple Cycle Generation

~ 67% loss



~193W

electricity

~ 64W

## Transmission & Distribution

~ 6% loss



electricity

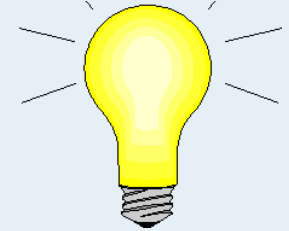
~ 60W

## End Use Utilization

~ 88% loss

7W (light)

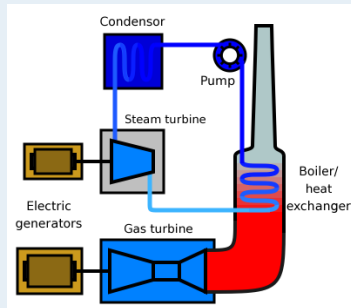
53W (additional heat)



# Why is energy efficiency and energy management so important?

## Combined Cycle Generation

~ 45% loss



~29W

electricity

~ 16W

## Transmission & Distribution

(with new, lower loss transformers)

~ 5.8% loss



electricity

~ 15W

## End Use Utilization

~ 52% loss

7W (light)

8W (additional heat)



# Why is energy efficiency and energy management so important?

- ▶ Today's low hanging fruit; strong economic incentive driven by high energy costs
- ▶ Enables more expensive renewable technologies to become affordable through load reduction, especially in state that is not resource rich
- ▶ Provides the information necessary to measure, manage, commission and improve energy systems
- ▶ High job creation potential – labor intensive, jobs can't be outsourced
- ▶ Leverages region's knowledge workers and IT strengths
- ▶ *The cleanest electron (therm, etc.) is the electron that isn't produced . . . . .*

# Time to market roadmap

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- ▶ **Near term – pull the symphony together; tune instruments**
    - ▶ Today's known technologies
    - ▶ Incremental design improvements and business model innovation
    - ▶ Focus is on energy efficiency and energy management
  - ▶ **Mid term – conduct a symphony; not a cacophony**
    - ▶ Cost reduction/ commoditization of today's renewables
    - ▶ Systems integration/ commissioning of renewables with efficiency and management
  - ▶ **Long term - bring in the virtuosos**
    - ▶ Next generation, breakthrough technologies become commercially viable: energy storage/batteries, sunlight to fuels, etc.
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# High efficiency building technologies reduce residential and commercial energy usage

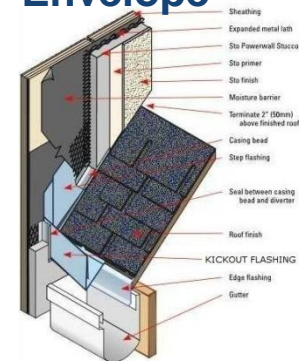
## Heating, Ventilation and Cooling



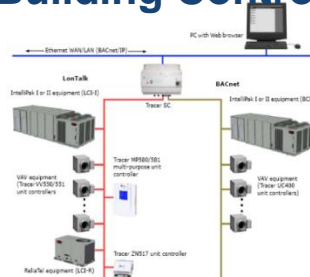
## Lighting



## Building Envelope



## Building Controls



Carrier, EMCOR, Schuco, Sensor Switch, Trane, and GE

# Renewable and high efficiency, non-renewable power generation systems

Waste Heat Recovery



Combined, Cooling, Heating and Power



Solar PV Systems



Fuel Cell Systems



Geothermal Heat Pumps



Solar Thermal

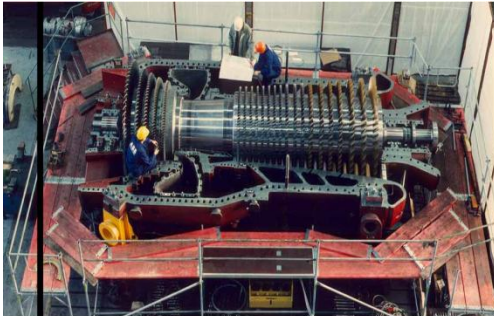


Pratt Power Systems, Fuel Cell Energy, UTC Power, GE, and Schuco

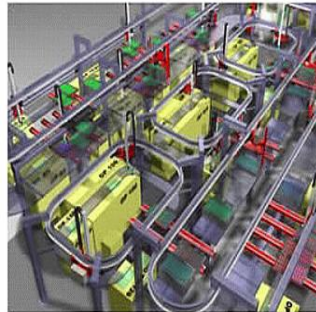
Source: Navigant Consulting ([www.ctcleanenergy.com/Navigant](http://www.ctcleanenergy.com/Navigant))

# Complete energy solutions, automation, predictive maintenance to improve industrial efficiency

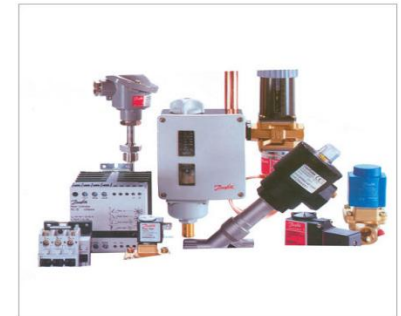
**Industrial CHP**



**Automation**



**Controls**



**Hamilton Sundstrand, Pratt Power, Carrier, and GE**

# Optimize performance of the electric grid by combining power generation with demand side management

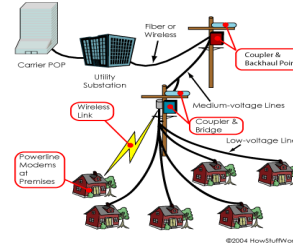
## Advanced Meters



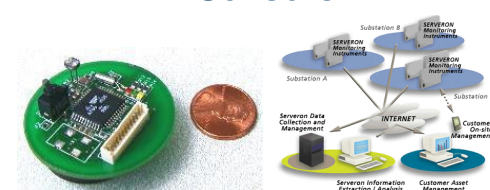
## Demand Response



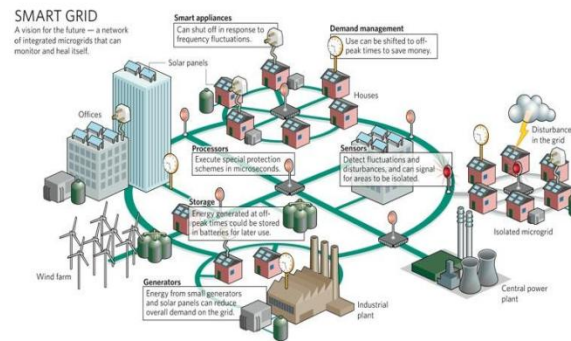
## Communications



## Sensors



## Smart Grid



Northeast Utilities in partnership with GE and others

# Biofuels and hydrogen production technologies used for stationary power or transportation

**Integrated Biorefineries**



**Algal Biofuels**

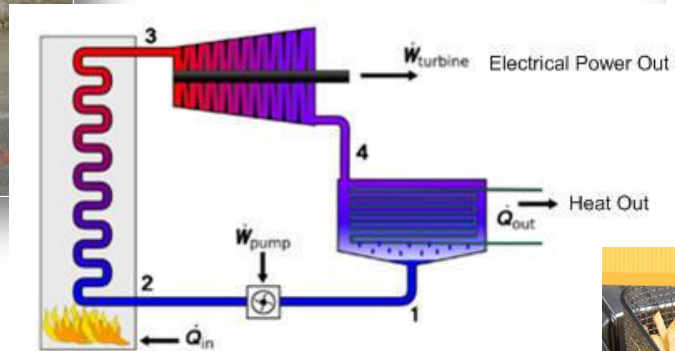
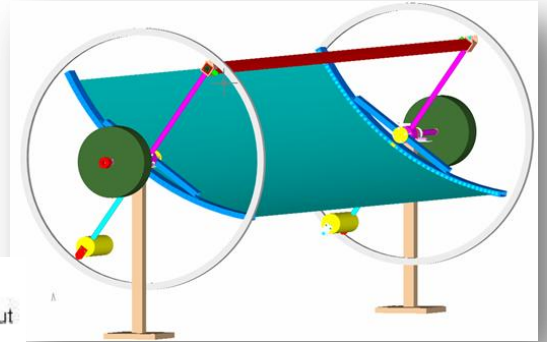


**Hydrogen Production**



Proton Energy Systems, Fuel Cell Energy, Avalence, Monsanto, and Agrifuels, among others. Recent investment activities by BP, Exxon, Shell, Conoco Phillips and others indicate an opportunity for strategic partnering

# Recently funded projects and prospects



1. Low Pressure Cool Liquid
2. High Pressure Liquid/Vapor
3. High Pressure Hot Gas
4. Low Pressure Hot Gas



# Leveraging

- ▶ Infinity Fuel Cells Smart Modular Regenerative Fuel Cell
  - ▶ \$500k -----→ > \$8 million
- ▶ FCE Electrochemical Hydrogen Generation System
  - ▶ \$600k -----→ >\$30 Million
- ▶ Avalence high pressure H2 production/storage
  - ▶ \$500k -----→ leveraged \$13 Million ARRA Clean Cities funds



## Tenets not to be overlooked

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- ▶ **Focus on solutions to commercial problems, not cool technologies in search of problems to solve.**
  - ▶ **No value prop, no dough.**
  - ▶ **Focus on building financially sustainable businesses.**
  - ▶ **Be smart and ever mindful that good intentions can pave the way to unintended outcomes.**
  - ▶ **Change is hard . . . . . embrace it.**
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# QUESTIONS WELCOME

Visit us online at: [www.ctcleanenergy.com](http://www.ctcleanenergy.com)

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