NYC cleanheat

Solar Thermal for Large Multifamily Buildings in NYC

September 19th, 2013

Introduction and Agenda

Solar thermal is a proven technology that utilizes solar energy to heat water for use in space heating and hot water systems in buildings

Agenda

- Introduction to Clean Heat
- Why is solar thermal a good idea for Clean Heat buildings?
- How does solar thermal work?
- Ideal candidates for solar thermal
- Tax credits and incentives
- Case Studies
- Getting started
- Q&A

Speakers

- Lara Croushore, NYC Economic Development Corporation
- Laura Humphrey, NYC Clean Heat
- Alison Kling, City University of New York (CUNY)

PlaNYC: A Greener Greater New York

Air Quality

Achieve the cleanest air of any big U.S. city

Energy

Reduce energy consumption and make our energy systems cleaner and more reliable

Climate Change

Reduce our greenhouse gas emissions by more than 30%

Public Health and Air Quality

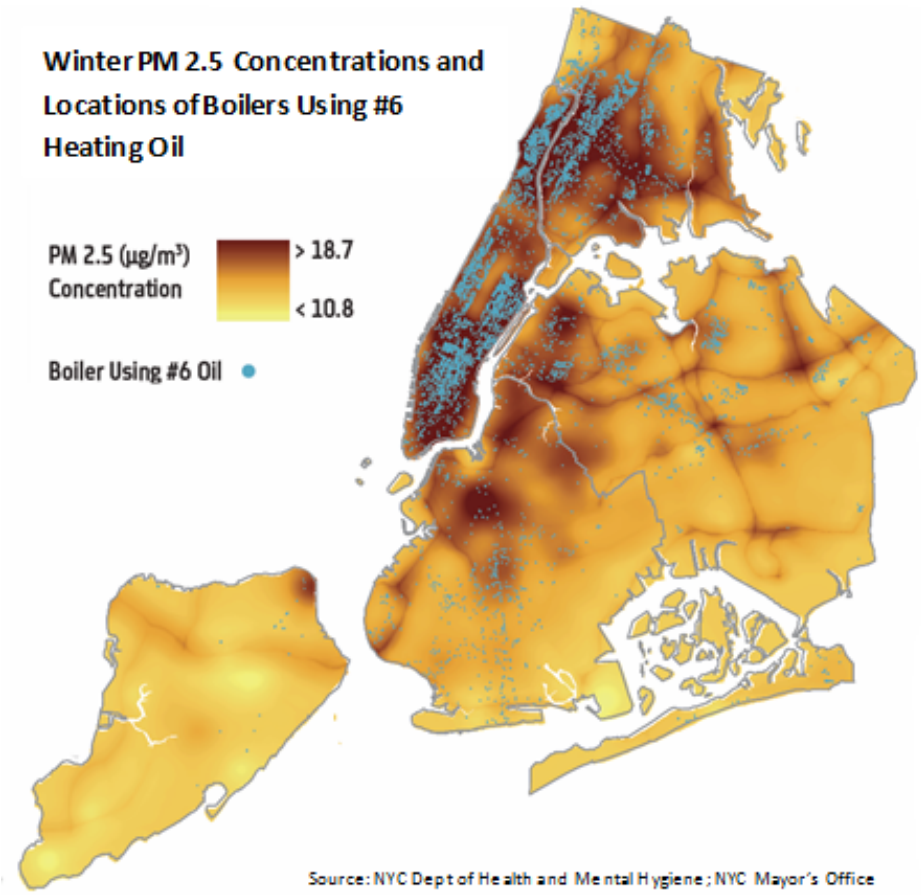
Eliminating No. 6 and 4 heavy heating oil is one of the highest impact strategies we can undertake to make New York City's air quality the cleanest of any major U.S. City

Quantifying the Influence of Heavy Oil

- In 2008-09 the Department of Health conducted the NYC Community Air Survey at 150 monitoring sites citywide
- Fine particulate matter (PM 2.5) levels were 30% higher, on average, in parts of the City with the highest densities of heavy oil use compared to the lowest densities

Annual Health Impacts from PM 2.5

- Over 3,000 deaths
- 2,000 hospitalizations for lung and heart conditions
- 6,000 ER visits for asthma in children and adults



Heating Oil Regulations

In April of 2011, DEP finalized regulations that will eliminate heavy oil use in two phases to balance near-term health benefits with cost minimization for buildings

Phase 1

- As of July 1, 2012, DEP no longer approves Certificates of Operation for No. 6 oil
- As these permits must be renewed every three years, No. 6 oil will be completely eliminated by 2015

Phase 2

- All buildings must convert to cleanest fuels by 2030 or when replacing boiler/burner – whichever happens sooner

NYC Clean Heat: Free Resources for Buildings

Technical Assistance

- NYC Clean Heat staff is available to guide buildings through the conversion process
- NYC Clean Heat is working closely with the utilities and industry leaders to help buildings save money and convert to the cleanest fuels

Financial Assistance

- NYC Clean Heat connects fuel switching projects to financing platforms to assist with construction costs.

Website

- Visit **nyc.gov/cleanheat** to learn more about health impacts of heavy oil, clean conversion options, the conversion process, when your building must convert, and more

Contact us

info@nyccleanheat.org

Call **311** and ask for NYC Clean Heat

Available Heating Fuels

NYC Clean Heat is fuel neutral program.

Buildings have the option of switching to a number of cleaner burning fuels.

Cleaner Burning Fuels

- Ultra-low sulfur No. 2 fuel oil (ULS 2)
- Biodiesel blends (B5, B20, etc.)
- Natural Gas
- Steam
- Other alternatives (geothermal, co-generation, etc.)

Heavy Fuel Oil

- No. 6
- No. 4

Solar Hot Water in Clean Heat Buildings

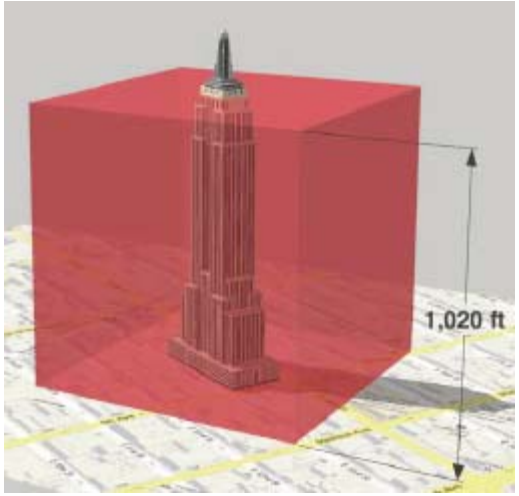
Solar hot water (SHW) creates many advantages and benefits specific to buildings converting off of heavy heating oils

Lower your energy costs

- Keep a portion of your energy costs flat by incorporating renewables
- Increase the efficiency of your heating system
- Multifamily buildings can cash in on state and federal tax credits and incentives
- Maximize your Clean Heat investment
  - Do your heating system alterations at the same time
  - Take advantage of the Clean Heat ULS 2 Conversion Specialist program to lower your fuel costs
  - Utilize Clean Heat financing

Improve air quality for your building and your neighbors

- One pound of PM 2.5 can saturate a volume of air larger than the Empire State building!



- The average building eligible for NYC Clean Heat emits 222 lbs of PM 2.5 each year.

Solar Hot Water in Clean Heat Buildings

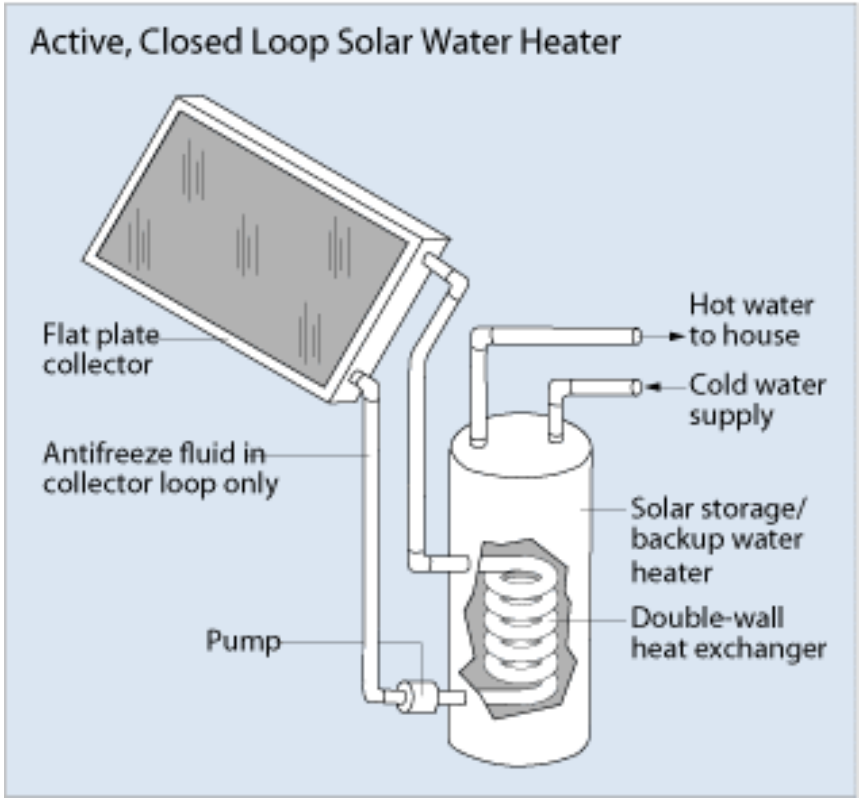
Installing solar hot water can create efficiencies throughout your heating system

- **Solar thermal can be used to offset hot water load**
  - Clean Heat buildings are 40,000 sqft or larger, which means that SHW works in different applications than smaller buildings
  - Hot water can comprise up 75% of a building's year round heating needs
  - In NYC, systems are generally designed to cover 20-80% of the hot water energy need
- **Maximize efficiency by separating space heat and hot water systems**
  - Space heating system can be downsized and shut off for months at a time
  - New hot water system derives most of its energy from solar, not oil

How Does Solar Thermal Work?

Solar: It's not just for electricity!

- **Solar thermal systems (SHW) serve a number of heating applications**
  - Hot water, space heating, process heat, or pool heating
- **Water or glycol heated by direct solar radiation and circulated to heat exchangers**
- **SHW is more efficient at converting solar energy into usable energy than photovoltaic technology**
- **SHW has also been deployed to serve cooling loads, but technology is more complex and less developed in the U.S.**



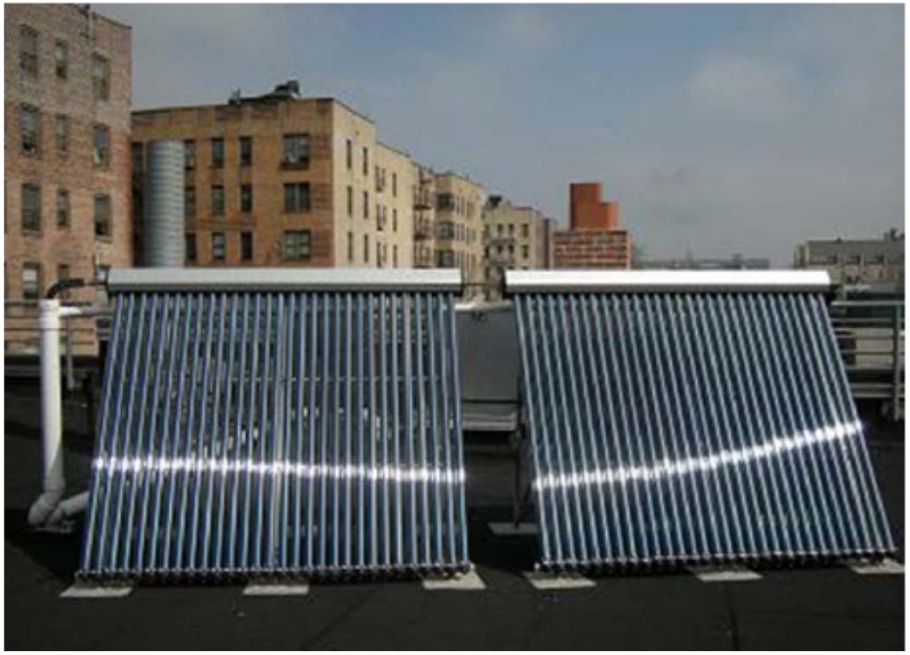
Source: energy.gov

How Does Solar Thermal Work?

- Flat plate and tube collectors are the most common systems installed in NYC
- Tanks and remaining system components can be located on roof or basement depending on building specs

Flat plate

Tube collector



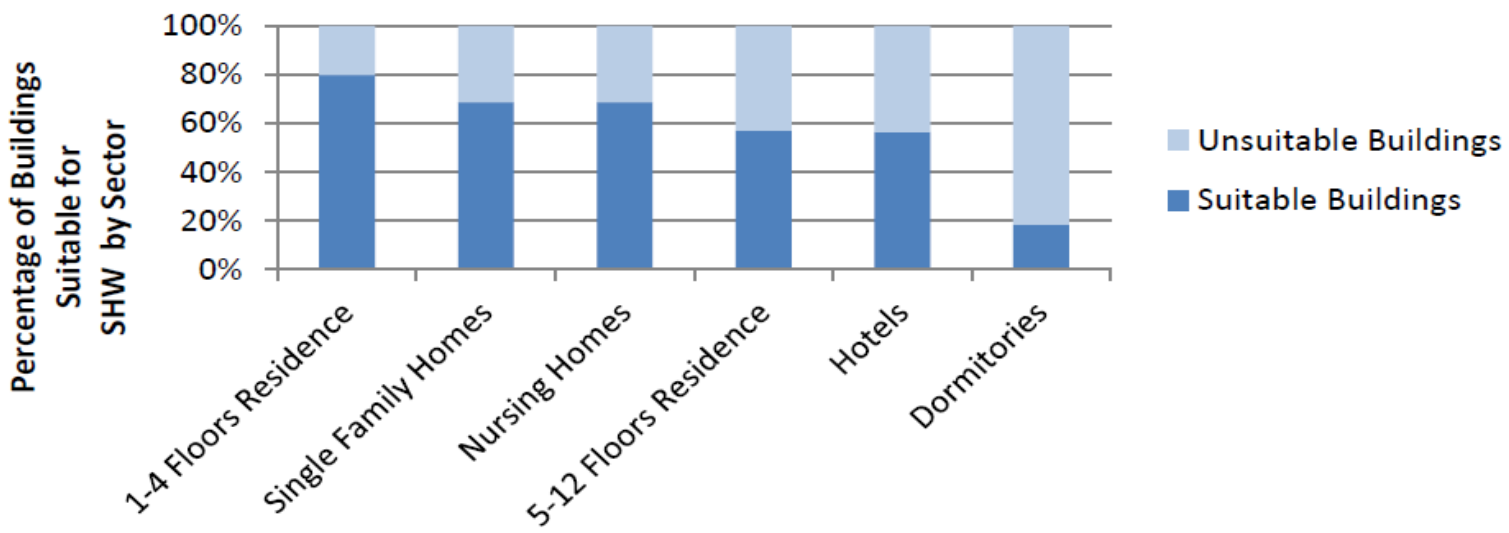
Source: CUNY Solar Thermal Road Map

Ideal Candidates in NYC

Solar thermal economic and technical success depends on a few key building usage characteristics

Consistent, high, hot water loads

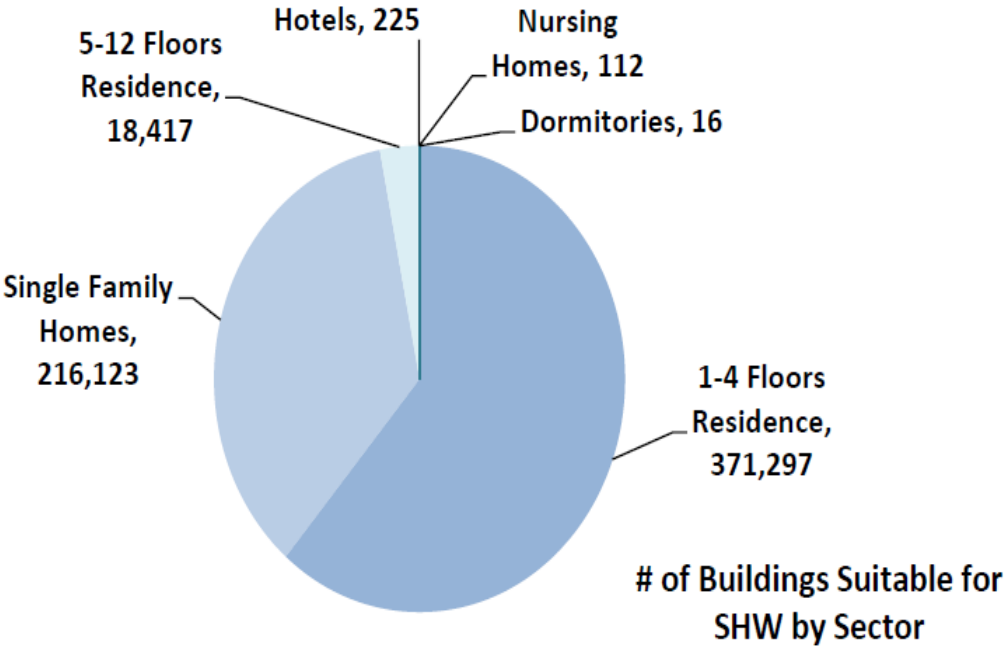
- Multifamily buildings, residences, hotels, dorms, hospitals, laundries, car washes, nursing homes, food processing facilities, swimming pools
- Lower installation costs are associated with larger buildings



Ideal Candidates in NYC

Solar thermal economic and technical success also depends on a few key structural characteristics

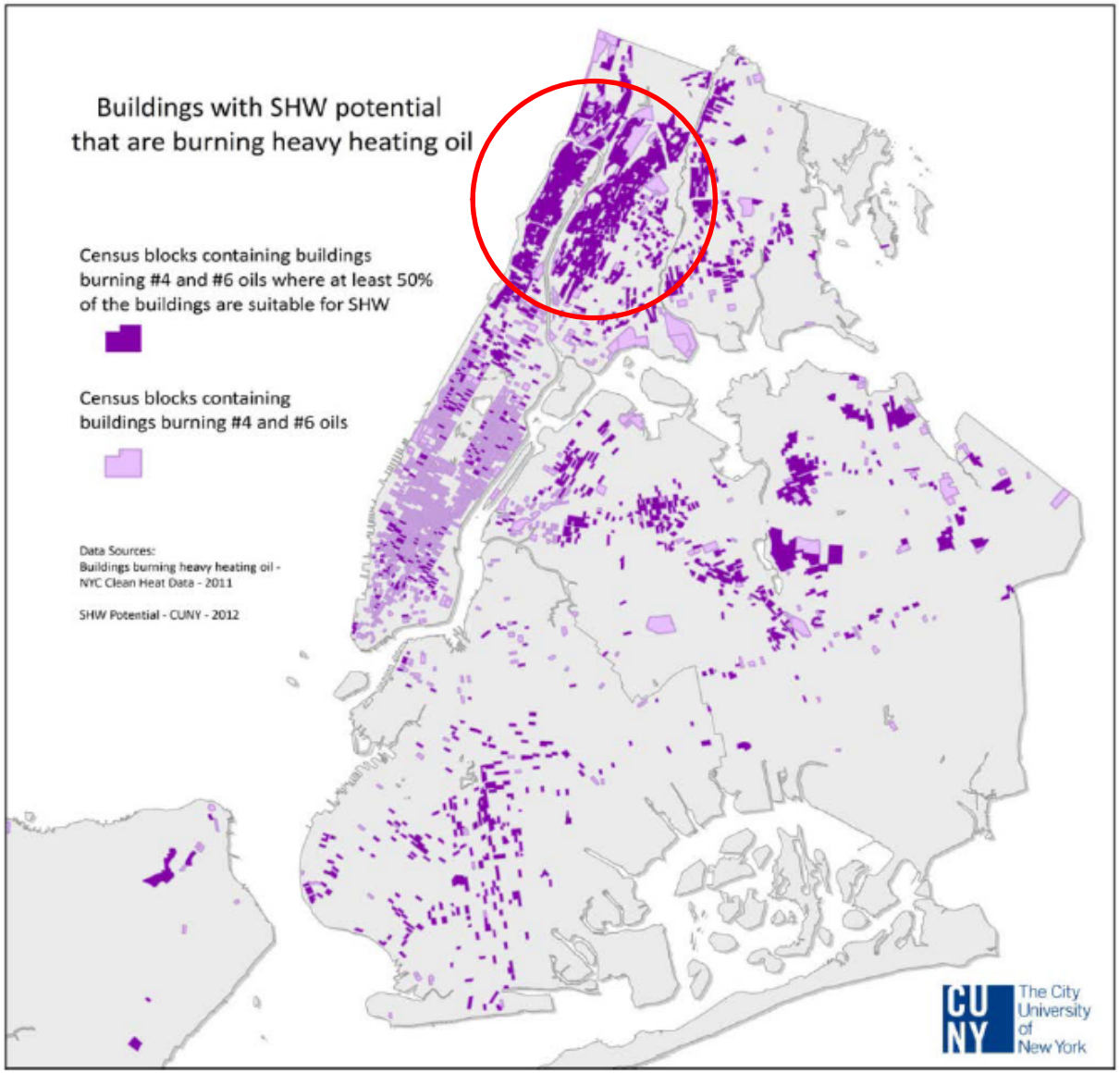
- **1-12 story buildings**
- **Short piping runs**
- **Large/unobstructed roof spaces**
- **Easy accessibility to basement space for storage tanks**
- **South-facing roof space best for panel placement**
- **Primary hot water needs are met by fuel oil or electricity**
  - SHW tends to have longer payback periods in natural gas buildings at current prices



Source: CUNY, 2013

Ideal Candidates in NYC

There is significant overlap between Clean Heat buildings and areas with good SHW potential



Solar Thermal Incentives

A combination of federal and state tax credits can cover up to 55% of the total cost for a residential or multifamily installation

- **Federal Residential Renewable Energy Tax Credit**
  - Up to 30% of cost of system
- **New York State Solar Tax Credit**
  - Up to 25% of cost of system, capped at $5,000
- **New York State Energy Research and Development Authority (NYSERDA) rebate***
  - Electric heating systems
  - $1.50/kwh displaced, capped at $4,000
- **Project financing available through NYC Clean Heat**

Sample Installed Costs:

Multifamily System: $134,000

Federal Tax Credit: ($40,200)

NYS Tax Credit ($5,000)

Total Installed Cost Net Incentives:

$88,800

*Note: NYSERDA recently recommended "fuel neutrality" in its solar thermal program.

Source: CUNY

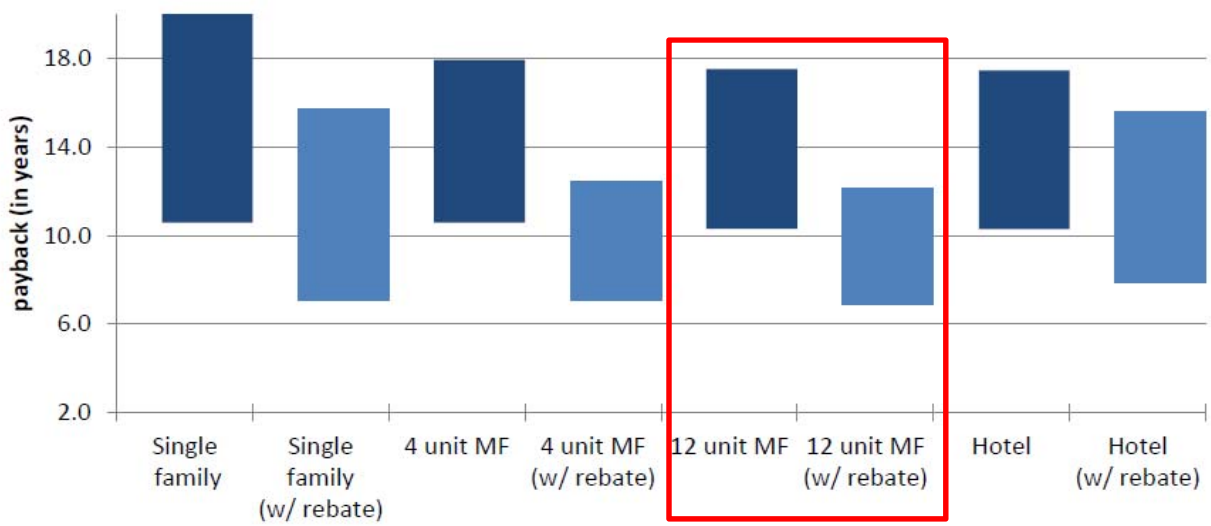
Paybacks

Buildings currently using fuel oil for heat can achieve projects with competitive paybacks

Payback periods can be in the 10-17 year range if all tax credits can be leveraged

Typical Payback Ranges for SHW in Fuel Oil Buildings

Dark Blue: Payback under current incentive landscape



Source: CUNY

Case Study: Solar Thermal Pilot Program

NYC Economic Development Corporation (NYCEDC) launched this pilot to better understand the financial, technical and regulatory barriers limiting SHW deployment

In 2009, NYCEDC announced the Solar Thermal Pilot Program to:

- Determine the feasibility and potential for solar thermal in NYC
- Identify barriers to implementation
- Develop standards and best practices for a sustainable and robust marketplace

The program provided financial assistance to City-based building owners interested in installing solar thermal systems

- Participants received grants of 30% of installation costs, capped at $50K

Four systems were installed under the program, each equipped with performance monitoring equipment

Primary applications were to supplement domestic hot water supply; however, a system to provide industrial process heat was also evaluated

Case Study: Solar Thermal Pilot Program

- Multi-family/commercial
- 5 story; 30 units; 20 flat plate collectors; $129,000

- Convent, 10-14 residents
- 5 story; 8 flat plate collectors; $28,600

- Multi-family/commercial
- 6 story; 88 units; 44 evac. tube collectors; $249,000

- Community center
- 2 story; 24 flat plate collectors; $168,000

Photo: NYCEDC

Case Study: Solar Thermal Pilot Program

NYCEDC evaluated performance and analyzed constraints for an industry whitepaper

Financial

- On average, pilot program participants are saving 23% on their energy bills
- Under pilot program, average payback period is ~5-6 years (with incentives) and ~12-14 years (without incentives)

Technical

- Solar therms produced under pilot program supplied 31% of the participants' demand for hot water
- Greatest potential for low buildings (10 stories or less) with high, consistent demand for hot water, sufficient roof space and unobstructed southern-facing exposure.

Regulatory

- Pilot program participants reported high "soft costs": 30% residential, 10% commercial

Case Study: St. Mary's Recreation Center

Department of Citywide Administrative Services (DCAS) installed an evacuated tube drain-back solar thermal system to supply indoor pool and domestic hot water needs

Results:

- The system will allow the Center staff to shut down the building's main boilers during summer while continuing to use it as back-up on cloudy days when the solar thermal system isn't meeting the building's demand for hot water.
- System is expected to save the City $28K/year in avoided natural gas costs.

Photo: DCAS

Case Study: St. Mary's Recreation Center

Department of Citywide Administrative Services (DCAS) installed an evacuated tube drain-back solar thermal system to supply indoor pool and domestic hot water needs

Lessons Learned:

- Seek out experienced contractors
- Ensure proposed roof is structurally sound to take the added weight of a Solar Thermal System
- Drain-back system was found to be preferable for light commercial applications when hot water demand has wide variation
- In addition, drain-back system requires less maintenance compared to the steam-back system.

Photo: City of New York Parks and Recreation

Getting Started

Practical Steps for Implementing Solar Thermal

Process

1. Understand your hot water usage and loads (average costs and usage type)
2. NYC Solar Map
3. Talk to a professional
4. Ask for bids from several contractors
5. Installer will take care of paperwork (DOB application, NYSERDA) installation, maintenance
6. Installation usually takes 1-2 weeks, planning can take a few months
7. Put your system on the map!

Team

- Building manager who understands physical workings of your heating and hot water system
- NYSERDA-approved contractor
- NYC Department of Buildings will require a licensed professional (architect or engineer) to submit permit application

Resources and Links

Information

- Alternatives for existing buildings burning No. 4 or No. 6 fuel oil (NYC Clean Heat), http://nyccleanheat.org/content/alternatives
- The City University of New York (CUNY), New York City Solar Water Heating Roadmap http://www.cuny.edu/about/resources/sustainability/solar-america/solarthermal/CUNY_NYC_Solar_Thermal_FINAL.pdf
- New York City Solar Map (CUNY), http://www.nycsolarmap.com/
- Case studies from the New York City Economic Development Corporation (NYCEDC) solar thermal pilot program http://www.nycedc.com/program/solar-thermal-pilot-program
- New York State Energy Research and Development Authority (NYSERDA), Solar Thermal Resources http://www.nyserda.ny.gov/File%20Not%20Found?item=%2fenergy-efficiency-and-renewable-programs%2frenewables%2fsolar-technologies%2fsolar-thermal-resources&user=extranet%5cAnonymous&site=website
- NYSERDA approved solar thermal installers http://www.nyserda.ny.gov/Contractors/Find-a-Contractor/Solar-Thermal-Installers.aspx
- Estimating hot water demand (Energy Department), http://energy.gov/energysaver/articles/sizing-new-water-heater

Resources and Links

Incentives and Financing

- Clean Heat financing provider, GSG Energy Finance, can finance solar thermal projects http://nyccleanheat.org/content/financing
- ULS 2 Conversion Specialist, Accardi, works with solar thermal suppliers http://nyccleanheat.org/content/uls-2-conversion-specialists
- Federal Residential Renewable Energy Tax Credit http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US37F
- New York State Residential Solar Tax Credit http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY03F&re=1&ee=1
- NYSERDA Solar Thermal Incentive Program http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2149-Solar-Thermal-Incentive-Program.aspx

Upcoming Events

Opportunities to learn more about NYC Clean Heat

Upcoming NYC Clean Heat Webinars

- ULS 2 Conversion Specialists
  - October 17th, 12pm-1pm
  - RSVP info@nyccleanheat.org

Upcoming Events

- Solar Thermal Installation Tour in the Bronx
  - St. Mary's Recreation Center
    450 St. Anns Ave, Mott Haven
  - September 24th, 10am – 12pm
  - RSVP info@nyccleanheat.org

St. Mary's system in construction

Photo: DCAS

NYC cleanheat

Cleaner air is within reach!

Call 311

nyc.gov/cleanheat