Transit-Oriented Development Toolkit

for CT

Complete Streets

Communities

Green Infrastructure & Energy Efficiency

Parking

Mixed Income Housing

A Collaborative Project by:
Connecticut Fund for the Environment
Partnership for Strong Communities
Regional Plan Association
Tri-State Transportation Campaign

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Introduction to Transit-Oriented Development

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Figure Intro-1. New Canaan, CT (Image: RPA)

What is Transit-Oriented Development (TOD)?

Transit-oriented development at its simplest is development that's built to take advantage of the ability of people to access it with transit. TOD is a strategy for growth that produces less traffic and lessens impact on roads and highways. Households located within walking distance of transit own fewer cars, drive less, and pay a smaller share of their income on transportation-related expenses. Homes and businesses can be built with less parking, reducing the cost of development, making development more feasible in weak markets, and increasing local tax revenue.

The kinds of communities supported by transit - walkable, mixed use neighborhoods that include housing, shops, and services - are in high demand by young professionals and empty nesters. Over the past ten years, we've seen the real estate market shift from an emphasis on single-family home construction to a recognition that "in-town" multifamily homes are increasingly popular and are an opportunity for developers to market to a growing segment of the population.

Post-recession, the emphasis has shifted from condominiums to rentals, but in-town development remains a focus of the real estate industry. Research continues to demonstrate that properties near transit enjoy a value premium and that real estate values near transit hold up better during real estate downturns.[1]

Transit-oriented development is also sometimes called "transit-supportive" development to emphasize its role in transportation. A TOD strategy can support long-term plans to improve transit service frequency and quality. Destinations near rail stations and bus hubs make it easy for transit to be the preferred mode for residents and commuters. More transit riders increase the efficiency of our bus and rail systems and generate demand for more frequent and better quality service.

Figure Intro-2. Station at South Orange, NJ. (Image: RPA)

1 For example, see "The New Real Estate Mantra: Location Near Public Transportation" by the National Association of Realtors, American Public Transportation Agency, and Center for Neighborhood Technology. March 20, 2013, http://www.realtor.org/reports/the-new-real-estate-mantra-location-near-public-transportation.

TOD also increases regional access to educational and employment opportunities, both by increasing housing options near transit and by making regional destinations accessible to non-drivers.

This toolkit introduces the primary components of a TOD program that meets common community goals of strengthening town centers, supporting municipal budgets, expanding housing and commercial opportunities, and minimizing environmental impacts.

Chapter 1 covers the process and design for getting TOD built in your community, from developing a community vision and supportive zoning, to determining how accessible your station is for non-drivers.

In **Chapter 2**, we review the demographic trends that favor mixed-income, transit-accessible housing, the fiscal impacts of residential TOD, and mechanisms to include affordable housing within TOD development.

Chapter 3 illustrates Complete Streets strategies that enhance your community's streets and sidewalks to promote walking and biking to your station and to TOD built around it. Transit access, walking and bicycling, and the mix of uses in TOD mean that TOD districts require less parking than traditional development. **Chapter 4** details best practices for managing parking, including parking maximums, shared parking, and transit incentives.

Chapters 5 and 6 provides information and resources for incorporating green infrastructure and energy solutions in your community. Green infrastructure minimizes wastewater and pollutant impacts from development. Energy-efficiency, local energy generation and micro-grids help communities use less power and withstand disruptions to the regional energy supply.

Chapter 1: TOD In Your Community

Written by:
Regional Plan Association

TOD in Your Community

Good TOD doesn't happen by accident. It takes a coordinated effort by community leaders, elected officials, municipal staff, and the private market to align regulations, the public realm, and the private sector to support development which contributes to a walkable, vibrant community.

Examine your current regulations. What does your town's plan of conservation and development (sometimes also called a master plan) envision for your station area? How old is your plan, and how much support does it currently have from elected officials, residents, neighborhood groups, and members of your planning and zoning commissions? Do your zoning regulations and parking requirements support the plan's vision?

Figure 1-1, 1-2, 1-3, 1-4. Interactive, participatory work sessions using multiple visualization methods help stakeholders understand how new development will look and feel. (All Images: RPA)

The Town of Fairfield, CT anticipated that the new Fairfield Metro rail station on their eastern edge would attract developers seeking variances from the existing zoning, which emphasized low density residential and industrial uses with traditional parking ratios. They wanted to get ahead of new development and update their regulations to include clear expectations for local development. Fairfield contracted with Regional Plan Association to lead a one-year public process culminating with a public workshop and the development and adoption of a zoning overlay that allows higher-density residential and commercial development within walking distance of the station when design conditions are met.

State law requires that municipalities update their plans of conservation and development every ten years, which usually involves a significant public participation process. These updates provide an opportunity to develop a vision and goals for your station's neighborhood that will define what next steps are needed.

Fig. 22.1: Unacceptable: Photo simulation of unacceptable residential development. This building has no orientation to the sidewalk and half of the frontage is a pedestrian un-friendly surface parking lot.

Fig. 22.3: Preferred: Photosimulation showing the kind of pedestrian-oriented mixed-use building enabled by TOD zoning.

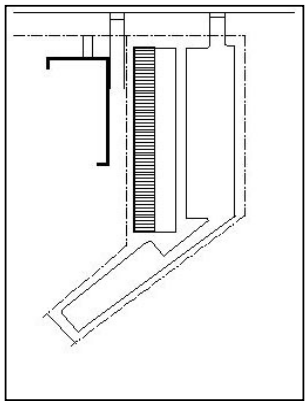


Fig. 22.2: Unacceptable: Site plan of typical deep-lot residential development with no orientation to the street.

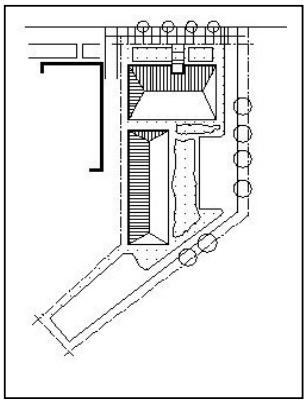


Fig. 22.4: Preferred: Site plan of preferred configuration for new mixed-use residential development enabled by TOD zoning. Except for the narrow driveway, the building frontage maintains the definition of the street.

Figure 1-5. Illustrated design guidelines help applicants and community members understand expectations and requirements. (Image: RPA)

Once you've completed an initial evaluation through your master planning process, devote time and resources to a planning process that will provide clarity and certainty to both residents and developers. It's crucial to develop a plan with the participation and support of residents, property owners, and elected officials. Public outreach can take the form of a series of informal workshops, town halls, or public hearings.

Many communities are incorporating digital conversations into their planning processes to solicit comments from community members who would not otherwise attend meetings in person. Examples of digital participation include BristolRising.com, Envision New Rochelle (EnvisioNR.com), and the Sustainable Knowledge Corridor's MetroQuest website (http://skc.metroquest.com/). Planning for TOD is an iterative process that can take months or years to complete.

Getting Zoning Right

Zoning for transit-oriented development encourages design that addresses the needs of pedestrians and transit riders, promoting easy accessibility to nearby destinations on foot. TOD comes in all shapes and sizes, from townhouses to high-rises, but the following features are common in TOD of every scale:

- High-quality sidewalk and bicycle infrastructure.
- Building entrances fronting to the sidewalk, not to rear parking lots.
- A street grid that encourages walking through small block sizes (less than 400 ft. by 400 ft.).
- Reduced parking and parking hidden from view
- Active first-floor uses.
- A mix of uses - residential, office, shopping, etc. - within a single neighborhood.
- Housing that meets the needs of different family sizes and income levels.

Resources for TOD Zoning Regulations

Connecticut communities, including:
Bethel
Stamford
Fairfield
West Haven
Greenwich
New Canaan

Massachusetts Transit-Oriented Development Overlay District Model Bylaw and Guidance
http://bit.ly/MAmodelTOD

Pace University Land Use Gaining Ground Database-TOD Topic (A database of relevant ordinances from towns across the country)
http://bit.ly/PaceTOD

Good TOD design is good community design - and will benefit all users regardless of how they travel. New TOD gets built only when the community vision, zoning regulations, and private market support one another. Research on current market conditions can help define the scale of development necessary for projects to occur. Zoning for too high a density in a weak real estate market can encourage property owners to hold on to vacant properties until the market can support more intense development. Densities that are set too low will not attract new development, especially when vacant land or redevelopment opportunities have substantial upfront costs due to brownfields contamination - a common situation in Connecticut.

Calibrating your zoning to the existing and future real estate market is a major challenge for planners. Many communities over-zone for ground-floor retail and end up with vacant storefronts. Analyze the market you're hoping to serve and estimate the demand using tools such as the University of Wisconsin's at bit.ly/RetailDemand. Focus demand to your TOD center by limiting the growth of retail elsewhere, and consider other first-floor uses such as restaurants, services, medical office, or townhouse style residential. Aspects of form-based code, which regulates building form with less emphasis on use, can be helpful in documenting requirements while still providing flexibility to the market place.

According to retail demand calculations, the approximately 5,000 residents who live within walking distance of Fairfield Metro provide demand for a local grocery and drugstore. Additional retail must attract customers from outside the area, who will most likely require additional parking.

What If Your Town Is Built-Out?

It's often hard to imagine where new development could happen in towns that have been settled for centuries, but opportunities exist. Look for underutilized surface parking lots or single-story commercial and industrial buildings in decline. Once supportive zoning is in place, smart property owners and developers will look to maximize the value of properties through redevelopment In many towns, declining sites that once housed former car dealerships or industry have been redeveloped into homes or offices near transit. Redevelopment plans that require assembling multiple parcels are often difficult and take longer to implement than plans which rely on the gradual redevelopment of individual parcels.

Your Station is an Asset - Make the Most of It!

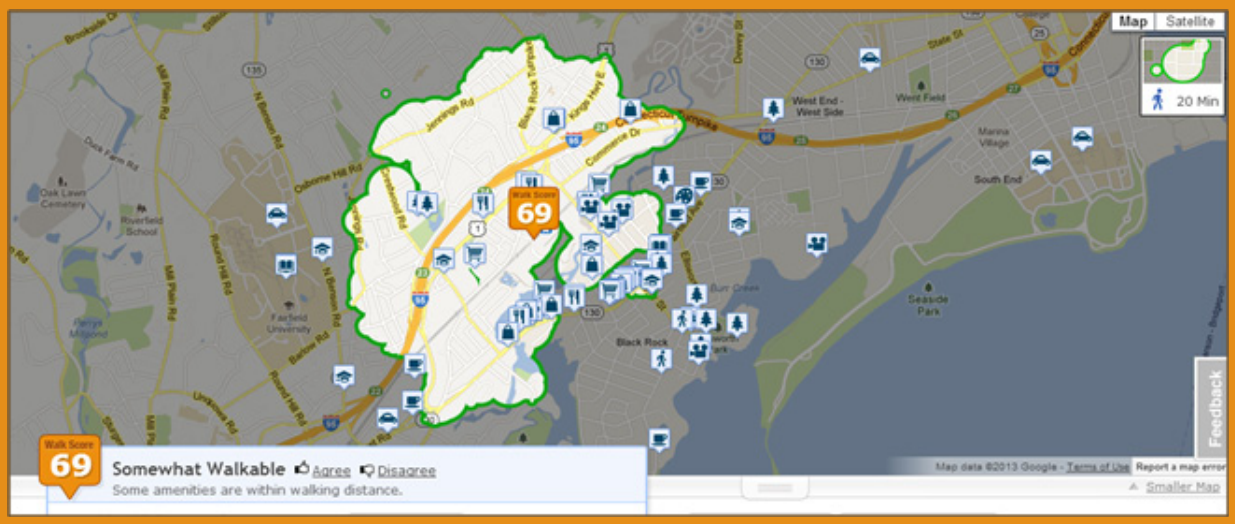
Figure 1-6. The station as a community center. (Image: RPA)

Towns that already have high-quality transit service attract residents and employers who appreciate access to the regional job market. Walkable town centers are in demand by Baby Boomers and young professionals. Many towns that already have high-quality transit service are looking to make the most of this tremendous asset. Other towns are planning for improved transit or pushing for new service in the future. In all cases, community actions can jumpstart and supplement private investment while turning stations into community assets by pursuing a handful of key strategies:

- Maximize access to transit.
- Prioritize alternative transportation modes.
- Create a pedestrian-oriented environment.
- Prioritize alternative transportation modes.
- Make the train station a community destination.
- Support place-making uses and activities.

Make sure that your station is easy to get to by foot. A walking audit is an essential component of station area planning. Walking audits mobilize planners and community members to explore and document neighborhood conditions. Audits identify problem areas that discourage walking and suggest solutions. One good resource for information on walking audits is the "Walkable 101" guide at http://www.walklive.org/project/walkability-workbook/.

Another exercise is to review the "walkshed" or "pedshed" of a station- the area from which residents can reach a station by foot in a given amount of time (usually 10-20 minutes) given the existing street network and geographic barriers such as hills and waterways. Although a basic rule of thumb is that transit riders will walk up to ½ mile to reach a train station, in practice the walkshed covers a smaller area due to gaps in the street network. Street extensions and pedestrian paths can open up entire blocks to walkable transit that were once inaccessible, providing additional residents and employers with the benefits of transit. Complete Streets treatments can tame traffic and encourage walking and biking, and are covered extensively in Chapter 3 in this toolkit.



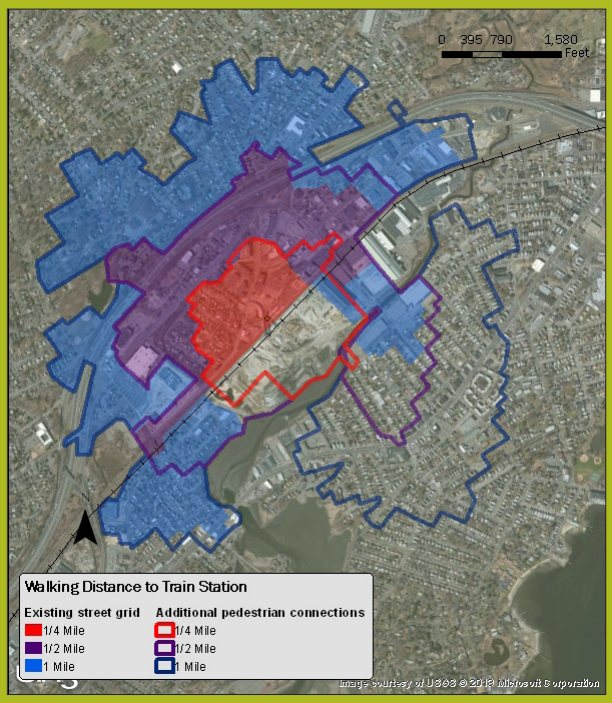


Figure 1-6, 1-7. The 20-minute walkshed of Fairfield Metro, top, as estimated via WalkScore.com's free "Street Smart" web application. The rating of 69, "somewhat walkable," considers the proximity of shops based on walking distance to the center. Left, the same station area's estimated walkshed after proposed (and now partially implemented) pedestrian connections, mapped by ArcGIS. GIS mapping can also estimate the impacts of pedestrian improvements by the number of homes and businesses which will be added to the walkshed. (ArcGIS Image: RPA)

Support bus and bike infrastructure. They extend your station's value further into your community and increase ridership without increasing the need for on-site commuter parking. Buses need space within your station area to drop off and wait for passengers. Bus riders need clear, reliable information about available connections. Encourage major employers to run shuttles to your station, pooling resources if necessary. Hardy cyclists will find places to lock their bikes, but many will only ride if they have a dry, secure space to lock their bicycles near the station. A biking audit can also reveal the need for dedicated bike paths.

Figure 1-8. The Town of Westport helps fund bus shuttles from homes, schools, and businesses to local rail stations (Image: Norwalk Transit District)

Chapter 2: Mixed-Income Housing Solutions for TOD

Written by:
Partnership for Strong Communities

A Changing Housing Market

The nation's 2008 financial crisis, the ensuing Great Recession and evolving economic and demographic forces have reshaped Connecticut's housing market. To preserve the quality of life in their communities and meet the housing needs of their residents, Connecticut municipalities, most observers believe, will need to reshape their array of housing options.

To meet the demand of the future, Connecticut municipalities will need to create additional small, dense, affordable, energy-efficient and, if possible, transit-proximate rental housing units and modest home ownership opportunities. Census figures show that 33% of Connecticut households rented in 2011, up from 30% in 2009 and 31% in 2000. The reasons can be summed up in the following economic and demographic terms.

Rising Demand

There is less demand for large, single-family homes and, conversely, more for smaller, denser, more affordable, energy-efficient, walkable and, if possible, transit-proximate homes for several reasons:

Assess the Opportunities for Housing in Your Community

Is there increasing demand for multifamily housing in your town? Some indicators:

- **Have you seen an increase in rental prices in your town over the past year? Three years?**
- **Has the stock of multifamily housing increased over the past year? Three years? Five years?**
- **Are there properties suitable for multifamily development?**
- **Have developers approached property owners in town or the town's planning or economic development departments?**
- **Have foreclosures had an impact on price and supply in your town? Are outside investors buying foreclosure or distressed properties in your town?**

- Large growth in the state's (and nation's) 65+ population has led to demand from empty-nesters who want to stay in their towns but can't afford the taxes or upkeep of their present homes.

- Younger workers and professionals have education debt averaging $24,300 according to the Federal Reserve Bank of New York and $26,000 by the Pew Research Center. With the National Association of Realtors reporting that 37% of all mortgages in 2011 required a down payment of 20% or more, that 25-34-year-old cohort is not in a position to buy more than the most modest home. Like empty-nesters, they are demanding rentals and small ownership opportunities.

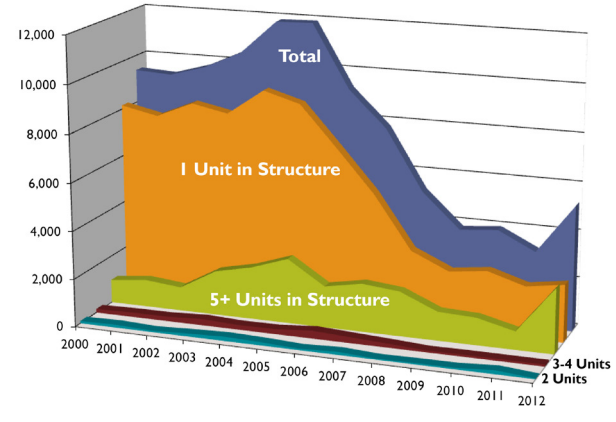
In an age of high gasoline and heating oil prices, proximity to work and other key destinations and energy-efficiency – either due to design features or simply the area to be heated – have become high-ranking considerations in weighing affordability.

- Large homes far from the office and shopping cost considerably more to run. Smaller homes walkable to transit, shopping and other necessities are much less so.

- Significantly, municipalities with housing stock dominated by large single-family homes may experience

shrinkage in their grand lists. Those that add smaller, denser, more affordable, energy-efficient and transit-proximate homes will diversify their grand lists.

Figure 2-1. Building Permits Issued in Connecticut by Number of Units in Structure, 2000-2012



Housing production in Connecticut has been anemic over the last five years, but 2012 saw an upturn, driven by an increase in building permits issued in multifamily structures. (Source: U.S. Census Bureau)

Limited Supply

While demand for smaller, more affordable homes has risen, supply remains limited. It is likely that limited supply will keep housing prices in Connecticut higher than in other states. According to Census figures, Connecticut fell to 50th in 2011 – and for the decade 2002-'11 – in the number of housing units built per capita. The majority of the units created since 2000 have been predominantly single-family homes, which is unlikely to meet future demand. Housing prices remain high, indicating a potential lack of supply:

- Despite a falloff in demand caused by the recession, housing prices statewide have fallen only 19%, much less than the national average. Housing values for owner-occupied housing units in Connecticut dropped by 9.9% from 2007 to 2011, as measured by the ACS. This was less than the national average of -10.7%.

- Many towns in Fairfield County have median home sales prices that exceed the state median, with some over $1 million.

- Connecticut's housing wage – the hourly pay one must earn to afford a typical 2BR apartment in the state – rose to $23.22/hour in 2013, a nearly 80% increase over the last decade.

- In Fairfield County, the housing wage is even higher: $31.69 or more than $65,000/year in average salary for the towns of the Stamford-Norwalk HMFA (Darien, Greenwich, New Canaan, Norwalk, Stamford, Weston, Westport and Wilton) and $26.62/hour or over $55,000 for the towns in the Danbury HMFA (Bethel, Brookfield, Danbury, New Fairfield, Newtown, Redding, Ridgefield and Sherman). Visit www.nlihc.org/oor for the latest Out of Reach report and data.

- According to 2011 American Community Survey 1-Year data from the U.S. Census Bureau, Connecticut has the 6th highest rental prices in the nation and the 8th highest home values.

TOD-Supportive State Policy

Adding momentum to the rapidly evolving housing market are changes in state policy. New investments in mass transit – from construction of the Springfield-New Haven rail line and Hartford-New Britain CTfastrak in central Connecticut to service upgrades and new rolling stock on MetroNorth and

ShoreLine East – are leading state policymakers to focus housing creation near transit stations. They see a wide range of benefits:

- Communities have more tolerance for higher density near stations and the density can permit more affordable housing costs.
- Greater energy efficiency.
- Lower transit costs and less highway congestion and lower auto emissions when people choose mass transit over their cars.

In addition, the state has made investments in higher-density affordable housing, brownfields remediation, transit-oriented development and a major revision of the state plan of conservation and development. All are aimed at a higher density development around transit, and de-emphasize sprawling development in suburbs and rural areas.

The Impacts of Housing Creation: Reality and Misconception

The impacts of affordable, or unaffordable, housing can be looked at several ways. One way is to look at statistics compiled by the Census Bureau and other reputable sources:

- Figure 2-2 demonstrates that median household income in Connecticut is high compared to the national median. Those making 80% of the median household income in Fairfield County earn more than $60,000. Because of high housing costs, however, even these households may have trouble finding housing that is affordable for them.

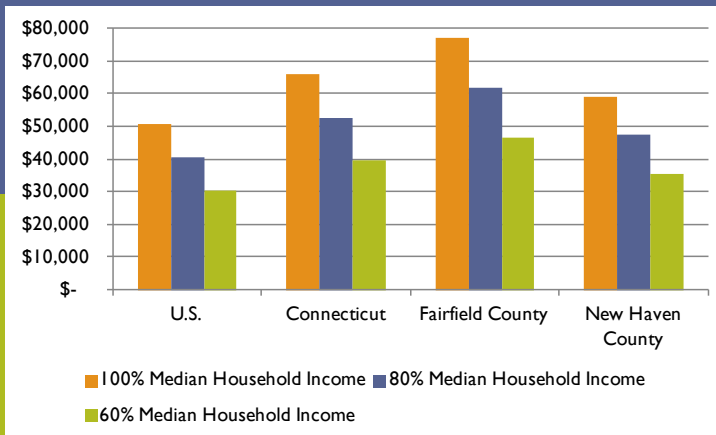
Can Your Housing Stock Meet Future Demand? Understanding Housing Supply in Your Community

Take a fresh look at the data to understand your community's housing stock and ability to meet demand:

- **What percentage of your housing stock is single-family? Multi-family? Vacation/second homes?**
- **What is the percentage of owner-occupied housing units? Renter-occupied housing units?**
- **What are the characteristics of your rental housing? Single-family, 2- or 3-family homes, small multifamily or larger multifamily? What is the distribution of bedrooms for the housing units in your town?**
- **How many building permits have been issued in your town over the last five years? Three years? Last year? For what type of unit (single-family or multifamily)?**
- **What is the median home sales price? Does it vary by neighborhood? What is the median home value? Have these increased or decreased over the last five years? Three years? Last year?**
- **What percentage of home owners in your town still pay a mortgage? What is the median monthly housing cost for those with a mortgage? For those without a mortgage?**
- **What is the median gross rent? Has it increased or decreased over the last five years? Three years? Last year? What is the distribution of rental units in your town by gross rent?**
- **What income does the median monthly housing cost in your town equate to?**
- **What is the median age in your town? What is the distribution of income by age for your town?**

- Of the occupations listed by the state Department of Labor, nearly half pay an average hourly wage below $23.22, the aforementioned "housing wage" determined by the National Low Income Housing Coalition. Among them: beginning teachers, firefighters, EMTs, nurses, food service workers and other necessary professions and occupations.

Figure 2-2. Median Household Income at Various Levels of Income



(Source: 2011 American Community Survey, 1-Year)

- Among all Connecticut households, 41% were "burdened" by their housing costs in 2011, i.e. they paid more than 30% of their income on housing. That total includes 52% of renters and 36% of homeowners – each up approximately by 50% since 2000.

Housing is considered "affordable" if someone can pay 30% or less of his income on housing, i.e. s/he has enough left over to pay for food, clothing, healthcare, transportation and other necessities. If not, s/he is considered "burdened" by housing costs.

Resources Related to Property Values, School Costs and Crime

Over the years, misconceptions about the impact of affordable or mixed-income housing have arisen: that they cause property values to fall, crime to rise, and increases in the number of school children in a school district, thereby increasing school costs. These myths and misconceptions have been the subjects of numerous studies and have typically been found to be untrue.

The Partnership for Strong Communities has compiled resources that address these issues:

- ***Profiles of Mixed-Income Communities***
  The Partnership profiled two Connecticut mixed-income communities using records provided by assessors and school departments, and testimonials by municipal officials, showing the positive impacts mixed-income housing has had on their communities. Available at http://pschousing.org/mixed-income-housing-ct

- ***Municipal Officials Assess Mixed-Income Housing***
  This fact sheet contains assessments from municipal officials across Connecticut and their impressions of affordable housing in their cities and towns. Available at http://pschousing.org/local-officials-fact-sheet

- ***Mixed-Income and Affordable Housing Impact On Nearby Property Values***
  MIT's Center for Real Estate study found no significant differences between home values close

to affordable developments and those in other parts of town. Available at http://pschousing.org/property-values-fact-sheet

- ***New Housing's Impact on Enrollment and School Costs***
  The University of Massachusetts' Donohue Institute found teaching staff levels and overall expenditures increased independently of changes in enrollment. and a Rutgers University study found multifamily housing development brings very few school children. Available at http://pschousing.org/school-costs-fact-sheet, http://pschousing.org/files/rutgersctmultipliers.pdf

Grand Lists

Karl Case and Robert Schiller, the authors of the noted Case-Schiller housing price index, indicated in late 2012 that a structural impact may be looming for municipalities that are overly dependent on single-family housing: They stated that a falloff in demand for such units among the emerging 25-34-year-old cohort and the growing Baby Boomer age group could lead to a lowering of their value. Municipalities with housing options dominated by such homes could see grand lists flatten, leading to the necessity of raising mil rates, reducing services or both - politically difficult choices. Some Connecticut economists are currently studying that potential impact.

What Does Your Grand List Look Like?

- **Has your grand list grown or shrunk over the last five years? Last three years? Last year?**
- **What percentage of your grand list is comprised of residential vs. commercial? Of single-family homes? Of multi-family homes?**
- **What are the trends for assessments over the last five years? Last three years? Last year? For single-family properties? For multi-family properties?**
- **Have mil rates risen over the last five years? Three years? Last year?**

Meanwhile, a growing array of communities - many of them wealthier towns with single-family housing stock approaching 90% - are seeking to add higher density units to not only increase the town's diversity of housing options but also to "give the market what it wants" and, thereby, swell grand lists with those increasingly valued housing options.

Transit Impact on Housing, Property Values

As a rule, housing and transportation are the two largest expenses in a typical American household budget: 32% for housing, 19% for transportation, according to Reconnecting America. Suburban locations that force dependence on an automobile are expensive: each car costs a household about $300 a month.

But if a family lives in a "transit-rich" neighborhood, within a half mile of a transit station, the household transportation expense is reduced to 9% of its income. Conversely, households living in auto-dependent suburbs spend an estimated 25% of their incomes on transportation. The 16 percentage-point difference could be used for better housing, more education, enhanced healthcare and many other necessities.

The impact of high housing-plus-transportation costs is felt most by low- and moderate-income households: recent college graduates and young families, empty-nesters on fixed incomes, and such key workers as teachers, nurses and beginners in many professions. Those households earning between $20,000 and $35,000 spend an average 67% of their income on housing and transportation. For those earning $35,000 to $50,000, it's a combined 50%.

Municipalities that foster creation of affordable rental and ownership opportunities near transit - taking advantage of the potential for higher-density and mixed-use, mixed-income development - can not only provide the housing they need for important town residents but also improve their town fiscal situations in two ways:

1. The "general consensus" of studies reviewed by the Center for Housing Policy in *Public Transit's Impact on Housing Costs: A Review of the Literature*, indicates that home and property values close to transit increase and the benefits tend to outweigh the "nuisance effects" (http://www.nhc.org/media/documents/TransitImpactonHsgCostsfinal_-_Aug_10_20111.pdf). Assuming continued high gasoline costs, municipalities that allow housing creation near transit stations are likely to bolster local grand lists with housing that commands higher rental and purchase prices.

2. By fostering housing creation for residents near transit, municipalities will leave them with more disposable income to spend with local merchants in town and put "feet on the street" in shopping districts near transit, increasing the value of businesses and the parcels they occupy.

The Housing + Transportation Affordability Index

Visit the Housing + Transportation Affordability Index at http://htaindex.cnt.org/map/, type in your town's name and take a look at the data.

Use the drop-down menus to explore various aspects related to the relationship between housing and transportation.

Zoom in to your town's area and compare the maps that show housing affordability and housing + transportation affordability.

This tool assesses income at the metro level, so be sure to look at the menu item that shows median income for your local area. Compare the housing costs and housing + transportation costs.

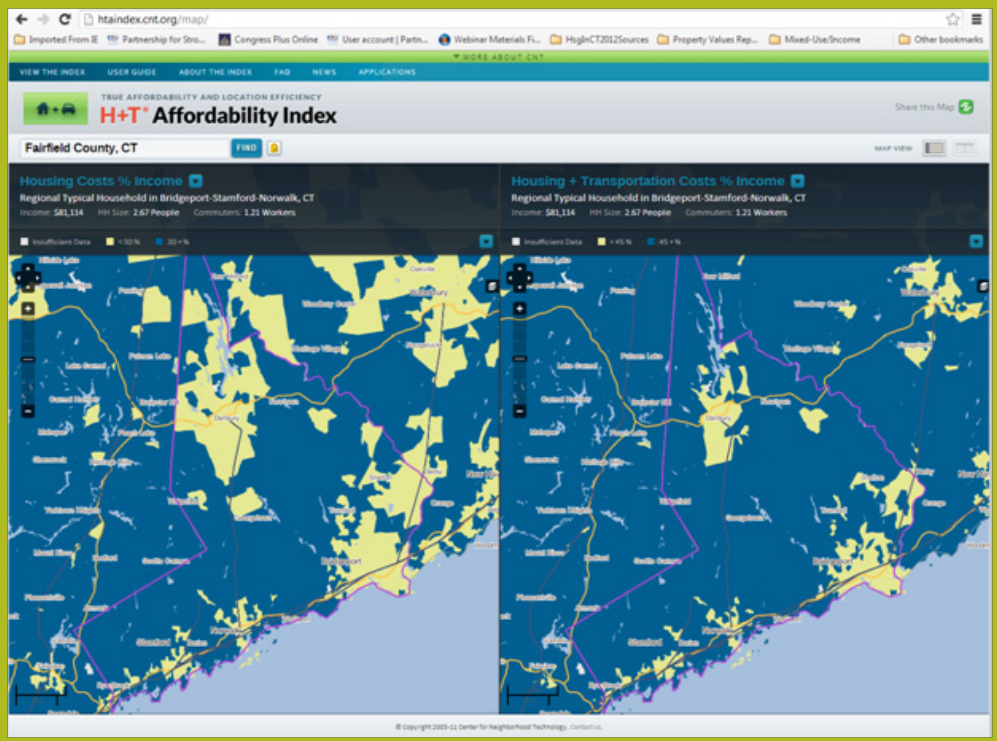


Figure 2-3. The H+T Affordability Index offers various ways to map data related to housing and transportation costs. (Image: Screencapture by PSC)

Housing Creation

Below are descriptions of several concepts at play wherever and however housing is created.

Proactivity: The Way to Avoid Controversy, Court Costs

Connecticut municipalities are finding that involving their residents at the beginning of the planning process unearths many creative ideas, expands understanding and achieves buy-in, all while avoiding controversy. These municipalities have eschewed the typical development path: reacting to development proposals, often in acrimonious public hearings and long, expensive court battles.

The proactive municipalities have used charrettes (multi-day design workshops), facilitated town meetings, visioning, interactive websites and other methods to achieve success. Their experiences can be reviewed in "Idea Factories: Residents Shaping The Future of Their Towns," a 14-minute video available at http://pschousing.org/news/idea-factories-residents-shaping-future-their-towns.

Design

Mistakes made by housing developers of the past have shrouded the impact of design. Many municipal officials and town residents hear the word "density" and rapidly envision dilapidated high-rise buildings, cinder block barrack-style housing, Quonset huts and other monuments to less-than-creative thinking. Many of those mistakes were made in the immediate post-WWII building boom and, since then, architects and designers have developed ways to design housing that makes it look much less dense.

Two books by Julie Campoli underscore the importance of design on our perceptions of density: "Visualizing Density, "with photos by Alex MacLean, and "Made for Walking." The Lincoln Institute of Land Policy has a section of its website devoted to exploring Visualizing Density: http://www.lincolninst.edu/subcenters/visualizing-density/. More on "Made for Walking" is available at https://www.lincolninst.edu/pubs/2150_Made-for-Walking

Materials & Labor: The Uncontrollable Costs

Sheetrock, 2x4's and the skill of craftsmen generally cost the same whether a developer is building homes for low-, moderate- or high-income residents. While such organizations as Habitat for Humanity can lower construction costs by using volunteers or sweat equity, commercially produced homes at any significant scale will cost the same to build no matter who will live in it.

Land: A Controllable Cost

Land can be obtained through donation or reduced cost from municipalities, land trusts or individual donors. But the most significant way of reducing land costs is by increasing density and allowing a developer to spread his/her land cost over more units. Even if materials and labor costs remain constant, reducing land costs can make all or some of the units created affordable for low- and moderate-income residents.

Subsidy: Valuable, In Short Supply, Not Always Necessary

Federal and state housing subsidies - for construction, mortgage financing, down payment and rental assistance - are extremely useful but increasingly unavailable from the federal government and, thus, increasingly sought after from state government. While the Malloy Administration has significantly increased the level of capital available for construction, rental assistance and other supports have been constricted by the slow economy and underperforming revenue sources. Available sources are listed below.

Generally, as income levels of proposed residents become lower, more subsidy is needed. Across the nation, and in many cases in Connecticut, "internal subsidies" have been employed by building mixed-income housing: developments where only a small portion - 10% to 30% - of the homes are affordable. Developers in some, but not all, locations are able to earn enough profit on the majority of units, which are priced at market rate, to allow them to take less income from the affordable units.

Mixed-Use Mixed-Income Development

The potential benefit of mixed-income and mixed-use development are obvious: mixed-income housing with 2-, 3-, or 4-times as many market rate units as affordable units provides developers with greater income/revenue stream/profitability to maintain the property and provide attractive amenities.

Such a ratio also provides more upper-income shoppers to patronize the commercial ventures in a mixed-use development (although the proximity of working-class residents of the affordable units can provide labor for the commercial portion and heighten productivity because of their short/non-existent travel time).

The proximity of convenient goods and services, particularly in TOD locations (dry-cleaning, prepared foods, etc.), can also enhance the value of the residential units.

But municipalities and developers must be careful to understand not only the local competitive market - always a consideration - but also the requirement of lenders to have signed leases for the commercial space before they will provide financing.

As TOD becomes more commonplace in Connecticut, those requirements should ease. But for now, credit for mixed-use projects is tight and closely pegged to requirements for high-scale foot traffic and patronage.

Figure 2-4. 30 Haven, a mixed-use, mixed-income development in Reading, MA, was built in a Smart Growth Zone adopted by the town under MA's 40R program, similar to CT's Housing for Economic Growth program (Incentive Housing Zones). The zone requires 20% of the residential units to be available to those making 80% or less of the area median income. The zone, located in Reading's downtown and near its commuter rail station, encourages mixed-use development and provides design guidelines for developers to follow. (Image: Oaktree Development, LLC)

Tools and Techniques

Many methods and tools have been used in Connecticut and across the country to create affordable and mixed-income housing. They are listed and explained briefly below, with links to expanded explanations.

Incentive Housing Zones

Despite recent fiscal challenges, the State of CT's Office of Policy and Management has continued to provide support for the Housing for Economic Growth program (also known as the HOMEConnecticut program). The program is seen as an efficient way to encourage municipalities to undertake the types of planning, zoning and development that will cater to the demographic and economic challenges facing the state and its municipalities: creating smaller, denser, more affordable, energy-efficient, walkable and, if possible, transit-proximate homes for the expanding elderly empty-nester population and the young workers, families and professionals the state seeks to attract.

The program provides planning and pre-development grants of $20,000 to $50,000 to municipalities seeking to create Incentive Housing Zones, which require minimum densities and an affordable set-aside of 20% of a development's units. The program also offers lump sum payments of up to $50,000 when creating a zone or issuing building permits in the zone. More information is available at http://goo.gl/wWiBb

Form-Based Codes and Design Guidelines

An alternative to traditional zoning codes, form-based codes use the physical form as the basis for the code, as opposed to the separation of uses (residential, commercial, industrial, etc). Form-based codes regulate how physical structures will look, focusing on their mass, bulk, relationship to the street and sidewalk. The benefits of form-based codes are a greater degree of certainty regarding the physical appearance of buildings and streetscapes, an area in which traditional use-based zoning often offers little structured guidance. Design guidelines can also be used to provide direction regarding the physical appearance of buildings and structures.

In terms of housing, form-based codes and design guidelines may be a strategy that communities use to adopt density levels that are higher than they might adopt through traditional zoning, as they can provide more certainty regarding the look and feel of the housing to be built. When layered with design guidelines, form-based codes can offer localities the chance to be more proactive in planning for housing, creating a vision of what they want rather than reacting to developer proposals.

Floating zones

The following definition is from the Square Feet Commercial Real Estate Blog (http://www.squarefeetblog.com/resources/land-use-glossary/#F): "*A floating zone is a zoning district that is added to the zoning law but that "floats" until an application is made to apply the new district to a certain parcel. Upon the approval of the application, the zoning map is amended to apply the floating district to that parcel of land.*"

As a method for creating denser housing options, a floating zone can offer a municipality the option to create higher density zoning that can be applied to parcels subject to their approval. While as-of-right zoning would be preferred, many localities may be attracted to zoning options that still include an approval process.

Housing Trust Funds

The following definition is from The Center for Community Change (http://www.communitychange.org/page/housing-trust-fund), a helpful resource in understanding housing trust funds: "*Housing trust funds are distinct funds established by city, county or state governments that receive ongoing dedicated sources of public funding to support the preservation and production of affordable housing and increase opportunities for families and individuals to access decent affordable homes. Housing trust funds systemically shift affordable housing funding from annual budget allocations to the commitment of dedicated public revenue. While housing trust funds can also be a repository for private donations, they are not public/private partnerships, nor are they endowed funds operating from interest and other earnings.*"

On a local level, housing trust funds can be used to support a wide range of activities that support the preservation and creation of affordable housing. Some towns have created housing trust funds as part of an inclusionary zoning policy that includes a fee-in-lieu of development option – the fees can be deposited into the trust fund and those funds are used to develop affordable housing in the locality. Other towns designate funds from other sources.

At the state level, Connecticut has a Housing Trust Fund that is used to fund projects and programs that help create affordable housing opportunities across the state, from development of new multifamily housing to mortgage programs to promote homeownership. To learn more about housing trust funds and how to create one in your area, visit http://www.communitychange.org/page/housing-trust-fund.

Land banks

The following definition is from SmartGrowth America (http://www.smartgrowthamerica.org/issues/revitalization/land-banking/): "*Land banks are public authorities created to acquire, hold, manage and develop vacant properties. Land banks aim to convert vacant properties that have been neglected by the open market into productive use, thereby transforming neighborhood liabilities into assets. A land bank:*

- *Acquires title to vacant and abandoned properties;*
- *Eliminates barriers to redevelopment; and*
- *Transfers property to a new owner in a way that supports community needs and priorities. As such, land banks often provide marketable title to properties previously impossible to develop.*"

Several localities in the U.S. have successfully used land banks to preserve and create affordable housing. Some of these land banks are focused on redevelopment like the Cuyahoga Land Bank (http://cuyahogalandbank.org/) in Cleveland, while others have focused on issues like transit-oriented development, such as Denver's collaborative effort (visit the Urban Land Conservancy at http://www.urbanlandc.org/ to learn more). Land can be acquired through various means including purchase, tax lien sales/foreclosure, donations, foreclosure, etc. Successful land banks are careful to acquire properties for which they have a disposition plan.

Land-lease

Land-lease strategies have been used often overseas - but seldom in the U.S, New England or CT - as a way to foster housing and commercial development in unproven markets. The goal is to attract developers by reducing their initial risk/investment by allowing them to lease the development parcel from the government at a nominal rate at the outset of a 40- to 50-year lease agreement - thus recognizing high start-up costs and low initial demand and/or activity - and pegging future lease payments to the expected growth in profitability.

Land-lease arrangements have been used in China, The Netherlands, Singapore and other nations. The Lincoln Institute for Land Policy offers resources on land-lease: http://www.lincolninst.edu/

What is Land Value Capture?

Governments with limited resources need not forego or postpone development and infrastructure that will help the local economy grow, ie. they need not become mired in the Catch-22 that state and local officials can feel stuck in: lacking revenue to finance development, but needing to spur development to raise revenue. Rather, Connecticut and its municipalities can, like many jurisdictions across the country, employ innovative financing approaches that bridge the gap between current needs and future revenue growth.

"Value capture" is a term increasingly used in transit policy to describe approaches governments can use to capture the increased value that comes from public investment and use it to finance development around transit stations. The new value - from both new development and increased value from existing structures in the area - would not exist without the public investment. Instead of simply creating a windfall for private property owners benefitting from the public investment, value capture allows governments and residents/taxpayers to share the benefits of the value they create by investing public dollars - and even pay for the investments that make it all possible.

If the experience of other states is a guide, Connecticut will likely have significant new value fueled by the New Haven-Springfield rail line and CT*fastrak*. Across the country, proximity to transit has generally increased values, sometimes bringing no additional value but more often causing significant increases. Connecticut's experience will likely depend on how well communities and the state capitalize on the opportunity. Determining factors include: properties' proximity to stations; quality and compactness of development; connectivity that makes transit, walking, biking and parking convenient; and whether a mix of housing, retail, services, offices and entertainment meet market demand.

As the additional value is created in TOD areas, governments can use an array of revenue tools to capture that value to (a) repay bonds that financed new transit and TOD-supporting infrastructure, and (b) support transit operating costs, affordable housing, additional transit service or surrounding development. The various tools need to be tailored to Connecticut's unique governance structures, market realities and community needs but the potential is enormous.

These options are described in more detail in the Partnership for Strong Communities publication:
Transit Value Capture: Harnessing the Future to Create Healthy Transit Neighborhoods
http://pschousing.org//files/PSC_ValueCaptureBrief.pdf

Financing methods

Financing for affordable housing is available from both the state and federal governments as well as through banking institutions and community development financial institutions (CDFIs). There are a wide range of programs designed to meet a variety of housing needs: capital programs for new construction and substantial rehabilitation; loan programs aimed at increasing home ownership; revolving loan funds that help retrofit or upgrade occupied properties; programs aimed at improving energy efficiency; rental assistance programs, both tenant-based and project-based; and many more.

The agencies and programs listed below are some of the most well-known and heavily used, but this is not a complete list. In addition, federal and state budget issues may limit the availability of various programs.

A more detailed list of programs is available here: http://pschousing.org/files/PSCDECD-TODWkShp_StateAgencyOne-Pagers.pdf

Connecticut Housing Finance Authority (CHFA)

A quasi-governmental agency, CHFA has the ability to issues bonds, which ensures that it plays a significant role in the funding of affordable housing in CT, both single-family and multifamily. CHFA also administers various housing tax credit programs in Connecticut. The state's public housing developments are part of CHFA's housing portfolio along with many private properties developed under state programs.

Contact: Dara Kovel, Vice President of Multifamily Housing, CHFA, Phone: 860-571-4360,
Email: dara.kovel@chfa.org, Website: www.chfa.org

How Do Housing Tax Credits Work?

- **9% Low Income Housing Tax Credits (9% LIHTC)**
  These tax credits are allocated by the U.S. Dept. of Treasury to each state, with the amount based upon population. The roughly $8 million in credits available each year for CT projects are administered by CHFA through a competitive process, with one funding round each year.

  9% credits can be used to fund up to 70% of the total development costs of a project and are extremely competitive, requiring significant financing experience due to the reporting requirements and the legal structures that must be put into place in order to access the credits.

- **4% Low Income Housing Tax Credits (4% LIHTC)**
  Unlike the 9% LIHTC program, 4% credits are virtually unlimited, and can be used when a project receives Tax-Exempt bond financing and cover a smaller 30% of total development costs. Because 4% tax credits cover a smaller portion of the development costs, other financing is needed to make 4% deals work.

- **Housing Tax Credit Contribution program (HTCC)**
  HTCC, the state's housing tax credit program, is a straightforward tax credit program, with each $1 credit translating to $1 in cash for affordable housing projects or programs.

  The state awards $10 million in HTCC credits each year on a competitive basis, with individual projects limited to a maximum of $500,000 in credits, which are sold to state business firms for cash. Non-profits can use the funds for development projects, revolving loan funds or workforce housing loan funds. For more on the HTCC program, click here: http://goo.gl/h8OYu

For a brief description of the Low Income Housing Tax Credit program, visit http://goo.gl/OeZR8. For more details on how the 9% and 4% LIHTC programs work, visit http://goo.gl/CDxmm.

Programs:
- Low Income Housing Tax Credits (9% and 4%) - http://goo.gl/clqrv
- Housing Tax Credit Contribution Program - http://goo.gl/h8OYu
- Single-Family Mortgage Financing - http://www.chfa.org/Homeownership/default.aspx
- Multifamiliy Mortgage Financing - http://goo.gl/SAeyA

State of CT Department of Economic and Community Development (DECD)
State of CT Department of Housing (DOH)

DECD offers a number of programs that fund housing development and administers others that are funded by the federal government. DECD is currently administering funding for affordable housing projects in rounds dedicated to meeting specific strategies, i.e. increasing affordable rental housing, providing funding for affordable housing programs or revitalizing state public housing.

Starting in 2013, the state formed the Department of Housing, which is expected to take over funding for housing-related programs from various agencies to better leverage funding opportunities.

Contact - TOD projects: Michael J. Lettieri, Community Development Director, Office of Financial Review and Special Projects, CT DECD, Phone: 860-270-8128, Email: michael.lettieri@ct.gov, Web: www.decd.org

Contact - Housing-Related projects: Nick Lundgren, Director, Housing and Community Development, CT DECD, Phone: 860-270-8190, Email: nick.lundgren@ct.gov, Web: www.decd.org

Federally funded programs:
- HOME - http://goo.gl/eQNJH
- Small Cities Community Development Block Grants (CDBG) - http://goo.gl/DDr6a
- Historic Tax Credits - http://goo.gl/YL5vH

State funded programs:
- FLEX housing program - http://goo.gl/bSzcf
- State of CT Housing Trust Fund - http://goo.gl/XJKJZ
- Pre-development funding - http://goo.gl/kjWue
- State historic preservation tax credit programs - http://goo.gl/NkRn5

State of CT Office of Policy and Management (OPM)

OPM currently administers the Housing Program for Economic Growth, aka HOMEConnecticut Program or the Incentive Housing Zone program, which requires mixed-income housing in exchange for incentives. OPM also administers other programs that can be used to fund infrastructure investments related to TOD.

Contact: Daniel D. Morley, Policy Development Coordinator, CT OPM, Phone: 860-418-6343, Email: Daniel.Morley@ct.gov, Web: www.ct.gov/opm

Programs:

- Housing for Economic Growth program - http://goo.gl/wWiBb
- Small Town Economic Assistance Program (STEAP) - http://goo.gl/NoSNj
- Main Street Investment Fund (MSIF) - http://www.ct.gov/opm/cwp/view.asp?a=2990&q=505894
- Local Capital Improvement Program (LoCIP) - http://www.ct.gov/opm/cwp/view.asp?q=383108

U.S. Department of Housing and Urban Development (HUD)

The federal government provides various forms of funding for affordable and mixed-income housing, primarily through HUD. HUD's programs include various types of financing for multifamily housing, which are administered at the local and state levels, as well as through HUD's CT Field Office.

Contact: Suzanne Piacentini, Field Office Acting Director and Director of CT Multifamily Program Center, HUD CT Field Office, Phone: 860-240-9702, Email: suzanne.piacentini@hud.gov

Programs:

- HOME - This program is allocated to local jurisdictions in CT that qualify, as well as to the State (administered by DECD) for distribution to smaller towns. - http://goo.gl/HRr6A

- CDBG - Like HOME funds, CDBG funds are distributed to a group of "Entitlement Communities" in CT that qualify for their own allocations. In addition, DECD administers Small Cities CDBG funds throughout the state. - http://goo.gl/b5dax

- Multifamily finance programs - HUD provides a variety of financing programs for multifamily housing, some targeted to specific populations, i.e., elderly, disabled. - http://goo.gl/sa5XP

Other Lenders

Other lending institutions provide funding for affordable housing, including private banks and Community Development Financial Institutions (CDFIs). While banks offer traditional financing for affordable housing development, they may also work with other institutions, such as the Federal Home Loan Bank, to offer affordable housing developers a slightly lower rate for their projects.

Connecticut also boasts several strong CDFIs within its borders that can provide access to predevelopment funds, short-term loans or

Housing Vouchers

Housing vouchers provide individual households with a subsidy so that they can afford a rental unit. Households typically contribute 30% of their household income and the voucher makes up the difference between that amount and the monthly rent.

The federal government provides funding for the Housing Choice Voucher Program (aka Section 8) More: http://goo.gl/cWMB4

The state of Connecticut provides funding for vouchers through its Rental Assistance Program (RAP). More: http://goo.gl/uQesp

Vouchers are known as tenant-based when the voucher stays with the tenant household. More: http://goo.gl/0X0sY.

Project-based vouchers are those where the subsidy stays with the rental unit – whoever lives in that unit is able to utilize the subsidy, as long as their income qualifies them for the unit. More: http://goo.gl/FZtjm

other financial products that are needed to make an affordable housing development deal work. CDFIs in CT include the following:

- Local Initiative Support Corporation (LISC) http://www.lisc.org/connecticut_statewide/
- Housing Development Fund (HDF) http://hdf-ct.org/
- Greater New Haven Community Loan Fund (GNHCLF) http://www.gnhclf.org/
- CT Housing Investment Fund (CHIF) http://www.chif.org/

Other Federal Resources

The federal government offers a number of additional funding opportunities that can help fund affordable housing development:

- New Markets Tax Credits – While this program limits the amount of a project's income that can come from residential units, it can be used for mixed-use developments that include a residential portion. NMTC deals are complex and significant expertise is required to make them work. Learn more: http://cdfifund.gov/what_we_do/programs_id.asp?programID=5; http://www.irs.gov/pub/irs-utl/atgnmtc.pdf; http://nmtccoalition.org/

- Historic Tax Credits - The tax credits can be used for properties that qualify as "certified historic structures" by the Secretary of the Interior, through the National Park Service. Adminstered locally by DECD. Learn more: http://www.nps.gov/tps/tax-incentives.htm

- USDA Rural Development– The housing programs run by USDA Rural Development are limited, but are designed to meet the need to create affordable housing in more rural areas of the nation. Learn more: http://www.rurdev.usda.gov/HMF_MFH.html

Location-Efficient Mortgage (LEM)

A LEM is a mortgage designed to take advantage of savings from living in locations that reduce transportation costs. The LEM resulted from a three-year research program in 1995 by the Center for Neighborhood Technology, the Natural Resources Defense Council, and the Surface Transportation Policy Project with funding from several foundations.

A LEM increases the amount of money homebuyers in urban areas are able to borrow by taking into account the money they save by living in neighborhoods where they can shop at nearby stores and use public transit, rather than driving long distances to shop and work.

Standard loan underwriting recognizes that a buyer can afford to spend 28 percent of gross monthly income on a mortgage payment. The LEM increases the amount to up to 39 percent by recognizing transportation-related cost savings, thus increasing the size of the loan available to the consumer. A household earning $50,000 a year can qualify for a $163,000 mortgage under current lending practices; in transit-accessible neighborhoods, a household can save $200 per month on transportation over its suburban counterparts and can qualify for a $213,000 mortgage. A LEM is also considered effective in reducing air pollution, fuel use and sprawl.

Chapter 3: Complete Streets

Written by:
Tri-State Transportation Campaign

Completing Your Community's Streets

Towns and cities across the country have embraced "complete streets." These streets are "complete" because, in addition to moving cars, they are walkable and bikeable, accommodate transit, and feel welcome to people of all ages and abilities. Complete streets help create active, cohesive neighborhoods and support local businesses by creating a safe and pleasant streetscape for walkers, bikers, transit riders, and drivers. A complete streets philosophy is also required by Connecticut law for transportation projects receiving state funds.

Complete streets offer many benefits, which is why 27 states and over 400 local and regional governments (as of 2013) have passed complete streets policies. Research collected by the National Complete Streets Coalition shows that the benefits include:

- **Improved safety.** Between 2008 and 2010, 121 people were killed while walking in Connecticut.
- **Economic benefits and increased real estate values.** Complete streets are essential to creating vibrant, local downtowns. They also support improved quality of life in residential neighborhoods. For example, the Florida Sustainable Communities Network found that people would pay $20,000 more for houses in pedestrian-friendly communities.

Fig. 3-1. A complete streets redesign of Prospect Park West in Brooklyn, NY added a protected bike lane and pedestrian islands and removed one automobile lane. Before the redesign, 74% of cars were speeding and 46% of cyclists were riding on the sidewalk. After the redesign, only 20% of cars were speeding and only 3% of cyclists rode on the sidewalk. Injury crashes declined by 63% after the redesign and travel time for drivers was not affected. (Images and stats: NYC Dept. of Transportation)

- **Lower transportation costs for residents.** The costs associated with driving and maintaining a car—or multiple cars—can quickly add up. According to Reconnecting America, the typical American household spends 19% of its income on transportation, more than on food. But in places with transit and safe walking and cycling infrastructure, transportation costs can be as low as 9% of household income.
- **Improved mobility for older residents.** Senior citizens who don't drive make 65 percent fewer trips (compared to their driving peers) to visit family and friends or go to church, according to AARP. In Connecticut, people over the age of 60 make up 19% of the state's population, but 36% of all pedestrian fatalities, according to an analysis by the Tri-State Transportation Campaign. Complete streets help older residents "age in place."

Examples of Complete Streets Infrastructure

There is no "one size fits all" template for a complete street; each street treatment reflects its community context and can be implemented in urban, suburban, and rural communities. What's important is that complete streets are designed to balance safety and convenience for everyone using the road. Especially on wider roads, specific interventions can help calm traffic and send a message that the area around a transit station is a pedestrian-oriented neighborhood.

Trees and Streetscape: Trees and streetscape improvements send a message to drivers that they are entering a "Main Street" neighborhood where pedestrians are expected. Street trees, textured crosswalks, neighborhood banners, "gateways," and ornamental lighting are just some examples of streetscape changes that can be done as part of a complete streets redesign.

Bump-outs (also called bulb-outs or neckdowns): "Bumping out" the sidewalk at intersections shortens the distance needed for pedestrians to cross the street, reducing their exposure to vehicles. They also force motorists to make turns at reasonable speeds.

Fig. 3-2. A pedestrian bump-out in Philadelphia using inexpensive materials. (Image: BetterBlock.org)

Fig. 3-3. A raised crosswalk in Oceanside, California. In this example, decorative materials have been used for the crosswalk to further increase visibility of pedestrians crossing. (Image: WalkSanDiego)

Speed tables and raised crosswalks: A "speed table" is a longer, flatter version of a speed hump that can slow traffic to reasonable speeds while being less disruptive than traditional speed bumps or speed humps. Speed tables can be placed at pedestrian crosswalks to create raised crosswalks

Bicycle lanes: Different types of lanes are appropriate for different roads. On narrow, slow speed roads, shared lane markings, or "sharrows," let drivers know they are on an identified bike route. On other roads, a striped, dedicated bike lane is appropriate. On the widest and busiest roads, protected or "buffered" lanes provide the safest experience. A 2012 study published in the American Journal for Public Health found that bike lanes reduced cyclist injury by up to 50%, and protected bike lanes by up to 90%.

Figure 3-4. Shared lane markings. (Image: Rye, NY Shared Roadways Committee)

Bike lanes go hand-in-hand with pedestrian improvements. Bike lanes narrow the street, calming traffic, and protected lanes can be combined with pedestrian refuges.

Figure 3-5. Dedicated bike lane in New Haven. (Image: New Haven Register)

Figure 3-6. Buffered bike lane in Redwood City, Calif. (Image: Silicon Valley Bike Coalition)

These represent only some of the traffic calming techniques that have been successfully used across the country. More examples can be found in the design manuals and resources described later in this section.

Figure 3-7. Protected two-way bike lane in Brooklyn, NY. Parked cars separate the bike lane from the rest of the street, creating a protected space for cyclists. Bollards or concrete can also be used to physically separate a bike lane. Note pedestrian island at left. (Image: L Magazine)

Safe Access to Transit

Municipalities should place special emphasis on ensuring complete streets in the area around transit stations and stops, because these are likely to be areas with particularly high pedestrian traffic. A 2012 analysis by Tri-State found that 51% of pedestrian fatalities in Connecticut occur within a quarter-mile of a rail or bus stop.

Both New Jersey and New York City have created "Safe Routes to Transit" programs which fund projects to improve safety around transit stations. Though such a program does not exist in Connecticut, many state and federal programs are available for these and other complete streets improvements.

Fig. 3-8. Sidewalks were built to and from this bus stop as part of New York City's Safe Routes to Transit program. (Image: NYC Dept. of Transportation)

Funding for Complete Streets

Many complete streets projects can be done quickly and inexpensively. For example, adding bike lanes often requires little more than restriping a road. A host of state and federal transportation funding programs can fund complete streets improvements, on both state and local roads. The list below is not comprehensive but offers some places to begin:

Transportation Alternatives/Transportation Enhancements*
These federal programs (administered locally by Connecticut DOT and the state's regional planning organizations) are dedicated for projects that support nonmotorized transportation.

Safe Routes to School*
This federal program (administered locally by ConnDOT) can fund transportation infrastructure that improves safety for students walking and biking to school. Projects must be within a half mile of an elementary or middle school.

Surface Transportation Program
This federal program (administered locally by ConnDOT and the state's regional planning organizations) is flexible and can pay for many different types of improvement, including complete streets redesigns of roads.

Highway Safety Improvement Program (HSIP)
This federal program (administered locally by ConnDOT) funds projects that reduce traffic fatalities and crashes, including those involving pedestrians and cyclists.

Congestion Mitigation and Air Quality (CMAQ)
This federal program (administered locally by ConnDOT) funds projects that improve air quality, including pedestrian and bicycle infrastructure.

TIGER
This federal program (applications are sent directly to the U.S. Department of Transportation) funds projects that "have a significant impact on desirable long-term outcomes for the nation, a metropolitan area, or a region," as measured by economic competitiveness, livability, sustainability, and safety. Since 2009, Stamford, Hartford, New Haven, and Bridgeport have received TIGER grants to make complete streets improvements in downtown areas.

**There will be no new federal funding for the Transportation Enhancements and Safe Routes to School programs (they were replaced by the Transportation Alternatives program when the current federal transportation legislation was passed in 2012) but, as of 2013, Connecticut and most other states still have remaining funding in these programs.*

Complete Streets Resources and Guidance for Municipalities

"Complete Streets in a Box"
In 2012, Tri-State Transportation Campaign (in collaboration with the Connecticut Conference of Municipalities) created a "Complete Streets in a Box" toolkit to support the adoption and implementation of complete streets policies by municipalities in the state. The toolkit includes a sample municipal complete streets policy, complete streets presentation and fact sheets, design manuals, and more. Available at http://www.tstc.org/reports/ctcsbx/

New Haven Complete Streets Design Manual
The City of New Haven has been a pioneer of safer street design in Connecticut. The city's Complete Streets Design Manual provides technical guidance for the building, repair, and reconstruction of city streets in a way that balances the needs for all road users. It includes engineering drawings for bike lanes, bump-outs, and other traffic-calming measures. Available at http://www.cityofnewhaven.com/TrafficParking/pdfs/CS-Manual-04-05-10.pdf

NACTO Urban Bikeway Design Guide
Issued by the National Association of City Transportation Organizations. Although it has the name "urban" in its title, it was created for municipalities with densities and traffic volumes similar to many villages and towns in Connecticut. It emphasizes the need to treat bicycles not solely for recreation, but as transportation. Available at http://nacto.org/cities-for-cycling/design-guide/

Liability and Complete Streets in Connecticut
In 2012, Tri-State Transportation Campaign reviewed state and federal case law to produce a primer and analysis of governmental liability for roadway design defects. Among its conclusions are that "under Connecticut's Complete Streets law, Complete Streets designs and funding are required to be a routine part of the planning, design, construction and operating activities of all highways and thus should not be subject to different legal requirements than other roadway planning decisions." Available at http://www.tstc.org/reports/ctcsbx/liability_memo_CT.pdf

National Complete Streets Coalition Factsheets
The National Complete Streets Coalition, a program of Smart Growth America, has compiled a series of complete streets factsheets, grounded in academic research and real-world case studies. These factsheets look at the benefits of complete streets for children, older adults, people with disabilities, public transit, economic revitalization, climate change, and safety, among other topics. They also look at implementation issues, such as green infrastructure and best practices for rural areas. Available at http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets

Chapter 4: Parking Solutions for TOD

Written by:
Tri-State Transportation Campaign

Parking in Transit-Oriented Developments

Because transit-oriented development supports multiple modes of transportation and reduces the need for residents and visitors to drive, it should come as no surprise that TODs require less parking. In fact, too much parking can adversely affect transit-oriented communities by promoting needless automobile use, making development less affordable, increasing pollution, and creating an oversupply of half-empty parking lots that degrade the pedestrian environment. Conversely, reducing parking leads to more compact, walkable development.

To support and manage the growth of TODs, municipalities should adjust their zoning ordinances to reflect the actual parking needs of communities that are within close proximity to transit and mixed-use development. There are a myriad of strategies to reduce parking demand.

Parking Minimums and Maximums

Most municipalities require developers to build a minimum number of parking spaces to provide enough off-street parking to accommodate traffic generated by the site—and in many cases, these requirements are inappropriate for TOD areas. A study of suburban residential developments in California and Oregon found that demand for parking was actually 30% lower than the supply provided.[2]

Areas with robust transit service, attractive pedestrian environments, or a concentration of businesses and services would benefit from adjusting zoning requirements to mandate parking maximums instead. Establishing a maximum allowable amount of parking can prevent developers from building excessive lots, promote more efficient use of land, capture the availability of existing transit options, increase pedestrian safety and enhance downtown environments.

Examples of Parking Regulation Reform

1. Jersey City, NJ supports the case for reforming parking regulations to support

Ordinance of the Municipal Council of the City of Jersey City Adopting the Journal Square 2060 Redevelopment Plan, City Ordinance 10-103

"Section 7, Design Requirements for All Zones

2) Automobile Maximum Parking Ratios By Use:

(a) For lots of less than 60 feet in width: no parking is permitted.

(b) Residential uses may provide up to a maximum of 0.5 off-street parking space per dwelling unit.

(c) Office and other commercial uses may provide up to a maximum of 0.5 spaces per 1000 square feet of gross floor area.

(d) Retail, restaurants, bars, nightclubs and health clubs may provide up to a maximum of 0.5 space per 1000 square feet of gross floor area.

(e) Theaters may provide up to a maximum of 1 space per 20 seats.

(f) Hotels may provide up to a maximum of 1 space per every 3 rooms.

(g) Public/semi-public uses may provide a maximum 0.5 space per 1000 square feet of gross floor area.

(h) Colleges and Universities may provide a maximum of 1 space per faculty and administrative member per 8 hour shift.

(i) All other uses may provide a maximum 0.5 space per 1000 square feet of gross floor area.

(j) Public parking garages as a stand alone use are exempt from the parking maximum."

2 Cervero, Adkins, and Sullivan, "Are Suburban TODs Over-Parked?" Journal of Public Transportation, 2010.

the growth and management of TODs. In this dense, transit-robust city, zoning regulations have done away with parking minimums, and have mandated parking maximums of 0.5 spaces per residential unit and 1,000 square feet of gross commercial and retail floor area.[3]

2. Smaller municipalities have also found that less parking is needed in a TOD zone. For example, Cranford, NJ, a suburban community with an attractive downtown oriented around a rail station, generally requires two parking spaces per residential unit. The town decreased this for Cranford Commons, a 50-unit mixed-use development near the train station, requiring 1.5 parking spaces per unit—but still found that much of the parking was going unused by residents. For a new TOD development, The Riverfront, the town will require only 1.25 spaces per unit.

3. Stamford, Connecticut, has made changes to its zoning ordinance to better support a city with good access to rail and buses. Previously, downtown developers were required to have at least 1.25 parking spaces per dwelling unit. As of October 2012, the Stamford zoning board lowered this minimum requirement for developers in most parts of downtown to include one parking space for every residential unit.[4]

Residential Car Sharing Programs

Car sharing is an attractive way for individuals to use a car without dealing with the hassles of car ownership. It allows access to a fleet of vehicles that are located in communities, to use on an as-needed basis. Having access to car-share vehicles can significantly decrease the amount of car ownership per household, thereby addressing parking demand issues.

Cities can provide financial incentives to encourage car-sharing services. For example, the City of Alexandria will reimburse first-time residents and businesses within 30 days of signing up for the program.[5]

Figure 4-1. Hoboken, NJ's 'Corner Car' dedicated parking spots. (Image: northjersey.com, Kevin R. Wexler)

To address their parking shortage, the City of Hoboken, NJ implemented a car-sharing program called Corner Car, in 2010. This has been a convenient alternative to owning a car in this transit-oriented city, especially for residents who don't drive to work and need a car just once or twice a week. The city's studies show that over 17 households have given up their cars, and an additional 20 households have

3 Journal Square 2060 Redevelopment Plan, Ord. #10-103 (2010). http://www.cityofjerseycity.com/uploadedFiles/City_Government/Department_of_Housing,_Economic_Development_and_Commerce/JOURNAL%20SQUARE%202060%20RDP%20-%20Ord%2010-103.pdf, 13

4 Kim, Elizabeth. (2012, October 30). Zoning Board Lowers Parking Minimum. The Stamford Advocate. http://www.stamfordadvocate.com/news/article/Zoning-Board-lowers-parking-minimum-3425414.php

5 City of Alexandria, VA. Local Motion, Transportation Planning Division. http://alexandriava.gov/localmotion/info/default.aspx?id=11130#benefits

delayed purchasing cars because of convenient access to Corner Cars.[6] Corner Cars offer guaranteed parking by dedicating on-street parking spots lined with green paint that are within a five-minute walk to 90 percent of households in the area. The city adds another incentive to use Corner Cars by offering $100 in driving credit to residents who surrender their parking permit.

Parking Regulations That Support Transit-Oriented Development

Residential Permit Parking Zones: In areas near popular commuting, shopping, or tourism destinations, municipalities can designate parking permit zones to prioritize curb space for local residents – incentivizing visitors to arrive via transit or park off-street. The City of Hoboken, NJ took this a step further in 2010 by offering incentives for residents who turn in their parking permits, encouraging residents to get rid of their cars altogether, or to park their cars off-street. They offered $500 in rewards that include transit passes, discounts on car-sharing programs, car rentals and bike accessories.[7]

Ordinance of the Township of South Orange Village, NJ Article XXXVI. Off-Street Parking

"§ 92-203. Exceptions to off-street parking in business districts.

A. Any owner or group of owners of a business building or buildings in the business zones may jointly sponsor off-street parking facilities, provided that the area of the parking facilities equals the total parking area requirements of each owner "participating therein, that such jointly sponsored facilities comply with all the other requirements of this Part and further provided that any participating use is no farther from the parking area than 300 feet.

B. Parking requirements for individual uses in the B-1 and B-2 Business Districts may be reduced to the extent it can be demonstrated to the approving authority by the applicant that parking requirements will be provided in public or private off-street parking facilities open for use by the general public."

Shared Parking: Regulations can encourage businesses and destinations to share parking facilities. This helps support a pedestrian-friendly environment because less space is needed for parking lots. This tool is most effective in downtown settings, where businesses can share a parking lot within walking distance to different destinations at varying peak times. An example is nightclub customers parking in a lot on evenings and weekends, while commuters use spaces during weekday hours. Incentives for developers that could be provided for shared parking include providing an increase in floor area ratio, permitting shared parking to meet minimum parking requirements, and providing flexibility in bulk regulations, such as building coverage or height.

The parking regulations in South Orange, NJ encourage businesses to participate in shared parking.[8] Several businesses and institutions in downtown South Orange share parking. For example, visitors to the South Orange Performing Arts Center (which includes a 400-seat theater and five movie screens) are directed to park in nearby middle school, library, and commuter parking lots that are busy during the day but emptier at night and on weekends.

6 City of Hoboken, NJ. Corner Cars, Transportation and Parking Division. http://www.hobokennj.org/departments/transportation-parking/corner-cars/

7 City of Hoboken, NJ. Surrender Your Permit, Transportation and Parking Division. http://www.hobokennj.org/departments/transportation-parking/surrenderyourpermit/

8 New Jersey Code § 92-201.

Parking Exempt Overlay Zone: To support pedestrian-friendly areas, cities can adopt a "Parking Exempt Overlay Zone," which identifies a specific area within the community where parking requirements are eliminated. A new residential development south of the UC Berkeley Campus in California established such zoning.[9] The ordinance reads:

Figure 4-2. South Orange transit village. (Image: online.wsj.com)

"A. The following provisions shall apply to properties within the R-S District:

1. No Off-street Parking Spaces shall be required for new Dwelling Units or Group Living Accommodation rooms, for the properties within the Car-Free overlay shown in the map titled "Southside Subareas Proposed Zoning."

Zoning for Unbundled Parking: Typically, the cost of parking and housing are grouped together in the price or rent of a home. Local zoning ordinances could require the cost of housing to be unbundled from the cost of parking. For example, rather than renting an apartment with an included parking space for $1,000/month, renters could rent the apartment for $900 and a parking space for $100 if they chose. Such regulations provide flexibility for developers to vary the number of parking spaces, show residents the actual cost of parking and make housing more affordable. In transit-rich areas, building occupants may save in parking expenses by opting to use other modes of transportation.

Employer-Based Strategies

With the support of local government, employer-based strategies can be an effective way to decrease demand for parking, by providing employees with incentives and additional options to commute to work.

Parking Cash-Out: Employers who provide subsidized parking for their employees can also offer cash in lieu of a parking space. This gives employees the option to keep their parking space at work, or to accept a cash reward for giving up their space. This promotes use of public transit, reduces the demand for parking and lowers the cost of parking facilities.

Car Sharing Programs: Employers can encourage car sharing by setting up systems to match employees with similar trips. One of the best incentives of car sharing is the guaranteed parking spot right next to the main entrance. Placing a car share parking spot in a highly visible spot is a way to advertise this opportunity to those who may not be aware of it.

9 City of Berkeley, CA. http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=430

Reforming Parking Fees: While employees can be charged fees for using parking lots, employers can make exceptions for those commuting by car pool or vanpool. Aetna, a major Connecticut employer, deducts fees for use of its company parking lot directly from employee paychecks.[10] Employees who vanpool, however, are not required to pay these fees.

Pre-Tax Commuter Benefits: The federal tax code allows employees to use pre-tax dollars for the cost of public transit or vanpooling to work, up to $245/month (as of 2013), but only if employers choose to provide the benefit. Many do, because the benefit saves employees money on their daily commute and on their taxes, and saves employers on their payroll taxes.

Employer-Funded Transit Benefits: The tax code also allows employers to provide employees with free or subsidized passes to use for commuting via mass transit, vanpool, or shuttle service (up to $245/month as of 2013). For example, businesses in Ann Arbor, Michigan, were offered free, unlimited-use bus passes for the first two years to all downtown employees through Ann Arbor's "Get Downtown" Bus Pass Program.[11] This program was subsidized by the Ann Arbor Downtown Development Authority, and resulted in a 10 percent car-use reduction in the downtown district. Passes are now offered to downtown businesses at greatly reduced cost (businesses pay $10/year per employee for commuting benefits that normally cost $71/month).

Bicycle and Pedestrian-Friendly Facilities and Services: Investing in facilities, services or infrastructure that accommodate bicyclists and pedestrians can make non-motorized commute options more attractive and viable. These improvements include secured bicycle parking, shower and locker facilities, and pedestrian infrastructure such as sidewalks, crosswalks and medians that ensure a safe walking environment. New York City requires large commercial buildings to allow tenants to store bicycles inside, with some exceptions.[12]

10 Naparstek, Aaron. (2007, January 8). A Tale of Two Cities' Parking Policies. Streetsblog.org. http://www.streetsblog.org/2007/01/08/a-tale-of-two-cities-parking-policies/

11 City of Ann Arbor, MI. Get Downtown. http://www.getdowntown.org/

12 New York City Department of Transportation. Bikes in Buildings. http://www.nyc.gov/html/dot/html/bicyclists/bikesinbuildings.shtml

Chapter 5: Green Infrastructure Solutions for TOD

Written by:
Connecticut Fund for the Environment

Stormwater and Combined Sewage Overflow Challenges in Connecticut

Stormwater runoff is one of the most serious water quality problems for Connecticut's Rivers and Long Island Sound.

Connecticut cities and towns have impermeable surfaces like pavement and rooftops, which disrupt the natural evaporation and soil absorption of rainfall. Runoff from hard surfaces causes flooding locally and accumulates greases, salts, fertilizers and pesticides that can kill fish and damage shellfish beds and aquatic plants. Additionally, impermeable surfaces allow large and fast pulses of stormwater to enter stream and rivers, resulting in streambank erosion and the degradation of stream habitat.

In older cities like Bridgeport, Norwich, New Haven and the Greater Hartford area, stormwater and sewer systems are often combined, forcing sewage into local rivers and harbors, and eventually Long Island Sound, even during small rain events. During an average rainfall year, an estimated 2 billion gallons of mixed raw sewage dumps into our rivers and harbors. These discharges close beaches and shellfish beds every summer, a move necessary to protect human health but costly for the tourism and shellfishing industries.

A majority of our rainfalls cause sewage overflows and carry pollutants into the Sound. But runoff from our highways, roads, roofs, and other impermeable surfaces doesn't have to be so destructive, particularly in future redevelopment areas in Connecticut, such as new transit-oriented development (TOD) zones.

Green Infrastructure Definition & Benefits

Green Infrastructure (GI) captures and filters stormwater, reduces sewage overflows and decreases flooding while saving money and enhancing communities.

It uses primarily the known benefits of natural systems to provide pollution reduction by trapping, filtering, and infiltrating stormwater. Unlike some traditional "grey" infrastructure approaches that focus on consolidating runoff management into catch basins, large piping and storage systems, green infrastructure source controls are typically widely distributed throughout an area, managing runoff from the immediately surrounding areas. Some techniques include vegetated swales, permeable pavement, green roofs, and rainwater harvesting in new construction and redevelopment.

Cities across the US, including Philadelphia and NYC, have embraced green infrastructure as part of their stormwater and sewage overflow reduction plans. This includes the incorporation of green infrastructure approaches into their sidewalk and road reconstruction plans and new developments. While costs vary, implementation expenses can be lower or equal to traditional "grey" infrastructure approaches. When costs are comparable, its feasibility is boosted by additional benefits like improved aesthetics, reduction of localized flooding, increased wildlife habitat, reduction of soil erosion, urban greening, carbon sequestration, increased groundwater recharge, improved air quality, and reduction of the urban heat island effect.

With over 1,000 acres of available property within ½ mile of Connecticut's current and future rail and bus rapid transit hubs for new development and redevelopment, a significant opportunity exists to incorporate green infrastructure into transit-oriented development zones.

Green infrastructure inclusion not only makes financial sense in many cases, but it can also set Connecticut's TOD developments apart, creating a distinct competitive edge by creating inviting and functional green space, as well as improving water quality and numerous other environmental values.

Types of Green Infrastructure

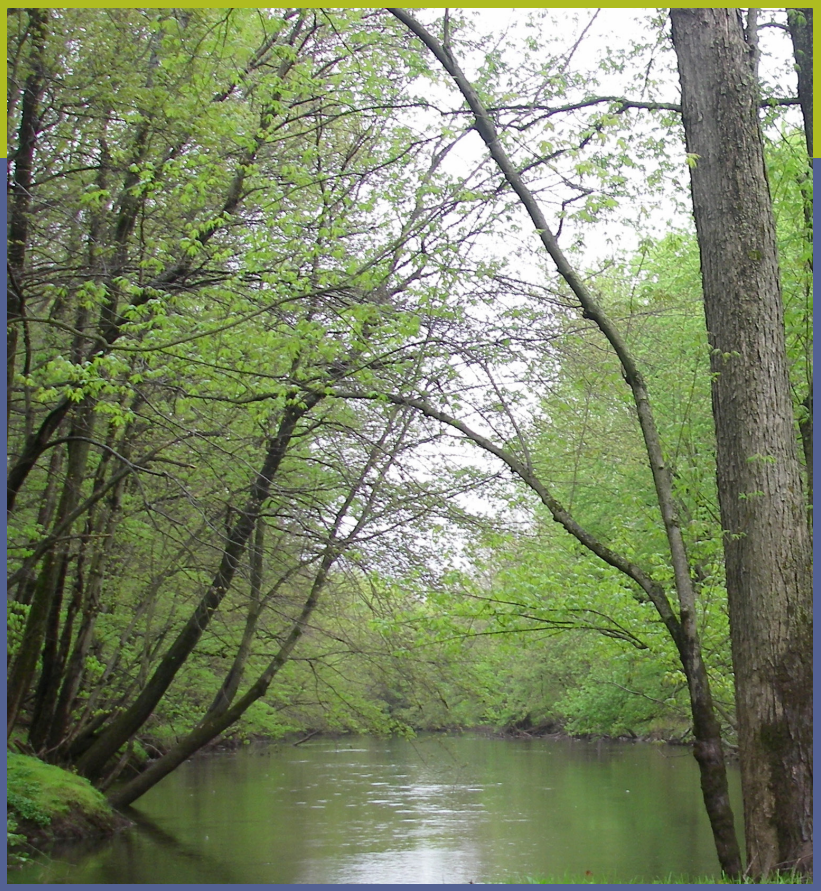
Use of Abundant Trees

Trees manage stormwater in three basic ways: a) Roots absorb water and distribute it to the tree; b) leaves break the force of falling rain and retain 2 to 7% or more of the water produced by a short downpour, allowing it to slowly evaporate back into the atmosphere; c) roots create gaps in the soil, allowing water to seep through.

Well-Landscaped Parking Lots/ Garages with the use of trees can be designed to slow stormwater run-off and beautify the area. Trees cool parked cars, reducing evaporated gasoline that contributes to air polluting ozone. Tree shade also adds longevity to paved surfaces.

Tree-Lined Streets can retain large volumes of rainfall, while reducing and cleansing runoff. They also increase property values, encourage shopping and business, reduce air pollution, and calm traffic. Additionally, enhanced tree pit structures (see page 49) can be installed in sidewalk areas, which are designed to maximize runoff retention and absorption, and can sometimes reduce the number of required catch basins.

Nature's Original Green Infrastructure



Trees, Shrubs and Landscaping can be used for enhanced roadway and rail sound barriers. According to the Connecticut Nursery and Landscaping Association, the correct mix and placement of trees, shrubs, and other plants can act as an effective sound barrier, sometimes outperforming traditional constructed sound barriers.

Bioretention Methodologies to Absorb Stormwater

Bioretention is a prevalent green infrastructure technology that consists of a shallow vegetated basin filled with an engineered sandy soil mixture that is generally underlain by a stone drainage layer and underdrain system. Bioretention functions by storing water on the surface and allowing that water to infiltrate through the engineered soil. Because the bottom of these systems is generally in contact with the existing soil, there are opportunities for runoff to seep into shallow groundwater. There are a variety of green infrastructure source controls that consist of variations on bioretention design, which could be implemented in transit-oriented development zones. Each of these can become beautiful, naturalized garden areas, depending upon the plant and flower selections used.

Fig. 5-1. Roadside bioswale with check dams.

Bioswales to Capture Runoff from Roads: Depending on hydrology and soil structure, and the availability of median and roadside space, bio-swales can be constructed to retain and absorb road and highway stormwater runoff very effectively.

Bioswales are modified vegetated swales that use bioretention media beneath the swale to improve water quality, reduce the runoff volume, and reduce the peak runoff rate. Sometimes bio-swales can eliminate or minimize the amount of traditional and costly catch basin, piping, and storage system installations, as well as reduce long-term maintenance costs of below-ground systems.

Curb Bump-outs/Extensions: Streets that have on-street parking provide an opportunity to install curb bump-outs and use bioretention in the right-of-way. By creating a new curb, and saw cutting and removing the road surface behind the new curb, bioretention can be placed right in the flow path of stormwater (the gutter area) without sacrificing more than one or two parking spaces.

Fig. 5-2. Bioretention bump-out on N. Main Street, Bridgeport, CT (Image: Save the Sound)

Fig. 5-3. Enhanced Tree Pit in New York City (Image: Hazen & Sawyer)

Enhanced Tree Pit Structures: Similar to bump-outs, runoff from the street is diverted by a curb cut and routed into a tree pit, where specially engineered soils and native plant species are used to absorb water and filter associated pollutants. In some enhanced tree pits, storage chambers hold additional runoff, available for plant uptake or groundwater recharge.

Parking Lot Median Bioretention: New parking lot construction allows for the cost-effective installation of vegetated median areas. Curb cuts can be installed along the length of surface parking lot areas to divert runoff into the median area where runoff can be stored and infiltrated.

Fig. 5-4. Parking Lot Median Bioretention area

Fig. 5-5. Rain garden capturing sidewalk run-off in New York City (Image: Hazen & Sawyer)

Rain Gardens to Capture Roof, Sidewalk, and Parking Garage Runoff: Rain gardens are essentially smaller bioretention areas that can be installed near structures to retain and infiltrate roof runoff, as well as stormwater collected from sidewalk and parking garage structures.

Fig. 5-6. Downspout disconnect into a stormwater planter box (Image: EPA)

Engineered Planter Boxes are flow-through planter boxes that can be used in tight urban areas, such as TOD zones, and are filled with vegetation planted in an engineered soil mix. The soil acts as a filter that captures pollutants while the plants and bacterial activity in the soil metabolize the trapped pollutants. The soil mix in the planter box also acts as a sponge during rain events, helping to reduce runoff.

Fig. 5-7. Subsurface perforated pipe infiltration system in New York City. (Image: Hazen & Sawyer)

Subsurface Infiltration can take a variety of forms; however, the main objective of all these systems is to detain water in voids underground such that it can seep into the underlying soil. Common variations of subsurface infiltration systems include gravel beds, perforated pipe systems, and chamber systems. Subsurface infiltration systems can be utilized in a variety of site configurations, since they do not occupy space on the surface, and are often installed under parking lots.

Fig. 5-8. A blue roof on a New York City building (Image: Hazen & Sawyer)

Blue Roofs: A blue roof system detains rainwater directly on a rooftop and slowly releases that water to the sewer system, allowing for some depression storage and evaporation losses. A blue roof can be created with a control structure installed over or within the roof drain, detention berms or check dams installed on the rooftop, or a series of detention trays laid on the rooftop. Blue roofs can be paired with other green infrastructure practices downstream to infiltrate runoff released from the rooftop.

Blue roofs are most effective and practical when installed on relatively flat surfaces, which are often associated with commercial or industrial buildings. In some cases, special structural considerations are necessary to ensure that adequate support is provided for the detained water and blue roof materials themselves.

Fig. 5-9. A green roof garden at the Smilow Cancer Center at Yale-New Haven not only acts as an outdoor space and meditation garden for patients, but also absorbs, filters, and slows stormwater run-off from the roof. (Image: Save the Sound)

Fig. 5-10. A green roof box system on a sloped roof.

Green Roofs: A green roof system utilizes an engineered drainage layer and soil media in combination with specially selected vegetation to manage rooftop runoff. Due to the nature of the soil media and presence of vegetation, green roofs can combine the detention elements of blue roofs with enhanced retention and evapotranspiration (the combined evaporation and plant transpiration into the atmosphere).

When installed in areas with direct roof access or higher adjacent buildings, green roofs can also provide aesthetic benefits. Similar to blue roofs, these systems are best suited for relatively flat rooftop surfaces, although some low slope roofs can be accommodated. Structural evaluations are also necessary to ensure that there is adequate support for the green roof materials and captured rainwater.

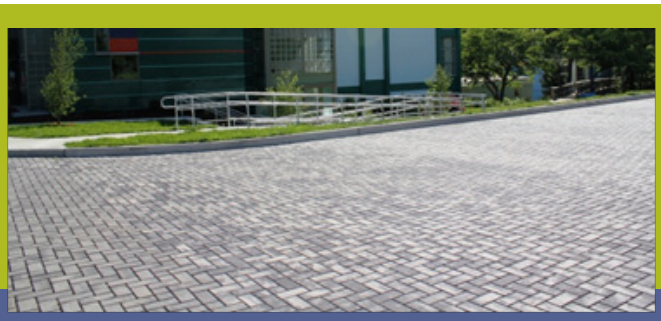


Fig. 5-11. Permeable pavers at the Discovery Museum and Planetarium in Bridgeport, CT. (Image: Save the Sound)

Fig. 5-12. Permeable pavement used in parking stalls.

Permeable Pavement consists of a pavement structure that supports stormwater infiltration, underlain by a stone drainage layer and typically some type of underdrain system. Common types of permeable pavement include pervious concrete, porous asphalt, concrete grid pavers, and permeable interlocking concrete pavers. Permeable pavements are generally best suited for locations that do not experience high traffic loads, such as sidewalks, parking areas, and driveways.

Fig. 5-13. A rainwater cistern and irrigation system design for a home. This same design concept can be used in more urban TOD settings as well. (Image: Hazen and Sawyer)

Rainwater Harvesting is the practice of capturing rainwater, often from a rooftop, and storing it for subsequent use. Rainwater harvesting systems are often used to satisfy non-potable demands, since these uses of water can be substantial and treating captured water to potable standards can increase the complexity and cost of a system. Captured rainwater can be reused for site irrigation and toilet flushing. The main system component is a cistern, which can be installed above or below ground. These cisterns may be constructed from plastic, concrete, metal, or fiberglass. Establishing a consistent and substantial use for the water captured by the rainwater harvesting system is important in order for stormwater management benefits to be realized.

Green Infrastructure Guidance For Municipalities

Land-Use Regulations and Ordinances

At the time of this tool kit's publication, the 169 municipalities in Connecticut each have different land use regulations, ordinances, and design guidance related to the inclusion of green infrastructure techniques (also known as low-impact development techniques) in existing development projects. Likewise, each municipality has its own set of hurdles and barriers that work to prevent the use of green infrastructure.

As municipalities with transit hubs begin the visioning and planning process for TOD zones, an opportunity exists to do a Municipal Land Use Evaluation (MLUE) in order to identify potential revisions to current land-use regulations and ordinances that would act to encourage and incentivize the implementation of green infrastructure techniques in future TOD projects, as well as other municipal developments.

In 2008, towns in the Farmington River watershed, embarked on an MLUE process. Planning and engineering firms were hired by each town to assist local land-use committees with technical and legal reviews of issues encountered during design and approval processes, proposed code statute and ordinance revisions, and implementation of green infrastructure techniques in projects. Proposed revisions to regulations and ordinances were drafted to remove barriers to green infrastructure inclusion. To learn more about the Farmington River MLUE Project and its outcomes, please go to the Connecticut Department of Energy and Environmental Protection's web site at: http://www.ct.gov/dep/cwp/view.asp?a=2719&q=477274&depNav_GID=1654

Green Infrastructure Design Guidance and Standards

Over the last 20 years, green infrastructure techniques and best management practices have evolved and improved as more performance monitoring data has been collected and analyzed. Below are some links to resources for green infrastructure design and performance standards.

Connecticut Stormwater Quality Manual

Currently, the state of Connecticut provides stormwater management guidelines to municipalities and developers in the Connecticut Stormwater Quality Manual. Included in this manual are general guidance and performance measures for certain green infrastructure techniques. This manual can be downloaded from the Connecticut Department of Energy and Environmental Protection's web site at http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325704&depNav_GID=1654

Connecticut Municipal Stormwater Management Design Manuals

Each municipality in Connecticut is encouraged to develop its own stormwater management guidance documents. Connecticut has some recent examples of state-of-the-art green infrastructure design standards and manuals that were produced as a result of the Municipal Land Use Evaluation process for towns in the Farmington River watershed. Here are links to design manuals for the towns of Plainville and Tolland.

Plainville's Low Impact Development and Stormwater Management Design Manual - http://www.plainvillect.com/pages/page_content/board_and_commissions_planning%20and%20zoning%20commission.aspx

Tolland's Low Impact Development Design Manual - http://www.tolland.org/wp-content/uploads/2008/02/lid-design-effective-2-1-2008.pdf

Other Stormwater Management Design Guidance

New York City

In 2010 the City of New York developed a comprehensive and innovative plan to advance the implementation of green infrastructure throughout the city. The 2012 updated GI annual report can be downloaded at http://www.nyc.gov/html/dep/pdf/green_infrastructure/gi_annual_report_2012.pdf

Additionally, in 2012 the City of New York developed a design manual for stormwater management to coincide with its green infrastructure plan. It can be downloaded at http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf

Rhode Island

The Rhode Island Stormwater Management Design Manual can be downloaded at http://www.dem.ri.gov/pubs/regs/regs/water/swmanual.pdf

New Hampshire

The New Hampshire Stormwater Management Design Manual can be downloaded at http://des.nh.gov/organization/divisions/water/stormwater/manual.htm

Green Infrastructure Financing Mechanisms

The Opportunity and Incentive

In Connecticut, green infrastructure implementation, although becoming more prevalent, still remains in a period of infancy. There are many examples of individual green infrastructure projects throughout the state, but there are not yet examples of neighborhood scale implementation, which can have a significant impact on stormwater capture, infiltration, and quality. However, this may be changing as plans are in the works in the cities of Bridgeport and New Haven to pursue neighborhood scale demonstration projects on city and state-owned land, as well as areas that are in the city right-of-way. To learn more about these projects that are under study go to www.ReduceRunoff.org.

Municipalities with existing or planned rail or bus transit hubs have the opportunity to move forward with new development and redevelopment, creating new TOD zones that can incorporate neighborhood scale implementation of green infrastructure from inception. Additionally, from an economic perspective, municipalities may be increasingly incentivized to implement green infrastructure should proposed federal regulations be passed to establish a single set of minimum requirements for pollution discharges from regulated municipal separate storm sewer systems (MS4).

Financing Options

There are a variety of options available for financing the short and long-term implementation of green infrastructure. During the initiation of a green infrastructure program and implementation of demonstration projects, grants may serve as a major source of short-term funding. Both public and private green infrastructure grant programs are becoming more prevalent as more people become familiar and interested in this wet weather management strategy. The existence of an implementation plan accompanied by green infrastructure design concepts can facilitate the compilation of successful grant applications by illustrating directed implementation efforts.

Historically, the Connecticut Clean Water Fund program, administered by the Connecticut Department of Energy and Environmental Protection (DEEP), has served as a valuable funding source for the design and construction of projects intended to reduce combined sewage overflows (CSO) in cities like Hartford, Bridgeport and New Haven that continue to have challenges with CSOs. Under this program, approved projects can have 50% of project costs covered by a grant, with the remainder funded through low-interest loans.

Funded projects have generally been closely related to management efforts which are incorporated into the city's long term control plan, which contain sewer separation and other grey infrastructure strategies. If green infrastructure can be proven as a valuable component of CSO management efforts

through demonstration projects and other efforts, program approval and funding support from DEEP for this management approach could increase and greatly facilitate implementation.

While grant programs can play an important role in initial implementation, they are not always feasible as a long-term funding source. Opportunities exist to directly or indirectly fund green infrastructure implementation through new development and redevelopment activities. It is possible for direct green infrastructure implementation to be required or recommended on-site through either a regulatory requirement or incentive-based programs. Doing so defers direct implementation costs from municipalities to developers. Most municipalities already have stormwater management requirements in place for new development and redevelopment, but there exists the potential to incorporate additional incentives specifically for green infrastructure. Additionally, user fees collected from these development activities could be utilized to implement community-based green infrastructure projects.

In rapidly developing areas, like some potential TOD areas in Connecticut, it may be feasible to directly require developers to implement green infrastructure or fund the majority of green infrastructure implementation through fees and assessments on new development and redevelopment. In areas that are approaching built-out conditions, the feasibility of utilizing these funding mechanisms for widespread green infrastructure implementation may be limited.

A stormwater utility is generally considered to be a viable, long-term funding option for stormwater management in communities with substantial existing development. The concept of a stormwater utility or user fee is becoming increasingly prevalent within the United States as the need for increased funding to maintain and improve stormwater infrastructure and address water quality issues becomes more evident. Unlike a property tax, which is based on the value of a property, or a sewer bill that is based on potable water usage, stormwater utilities are generally based on the amount of runoff generated by a property. Consequently, this framework is generally considered to serve as a more equitable funding mechanism.

For example, a large shopping center parking lot could generate much more runoff than a multistory building with a much smaller footprint, but similar property value. Incentives can also be incorporated into the utility framework to provide discounts and other benefits for property owners who implement and maintain green infrastructure source controls to reduce their impact to the sewer system. It may be possible to incorporate similar incentives into WPCA rate structures. Providing these incentives may serve as a cost effective means of implementation, with property owners taking a greater role in stormwater management activities.

While stormwater utilities can serve as valuable funding mechanisms, their implementation must follow careful study and be accompanied by educational efforts to ensure that these programs are implemented in an effective and understandable manner. Without fully understanding the challenges at hand or benefits that improved management efforts provide, the public may view stormwater utilities as additional fees for existing or unnecessary services.

Due to the multiple benefits and high visibility green infrastructure can provide, implementation of source control demonstration projects may be a way to promote public acceptance of a stormwater utility program, as the benefits of such a program can be more recognizable. In Connecticut, the cities

of Norwalk, New Haven, and New London have recently completed studies to evaluate the potential implementation of a storm water authority.

When evaluating green infrastructure funding options, it is important to recognize that increased investment in infrastructure may be unavoidable in order to maintain a level of service or address existing sewer capacity and CSO concerns due to regulatory requirements, environmental health and safety issues, and public demands. Because these issues must be addressed in some fashion, green infrastructure implementation does not necessarily represent an extra expense a municipality would not otherwise incur, but rather one of several approaches which could address stormwater issues which require resolution.

Green Infrastructure Resources

The Connecticut Department of Environmental Protection has a website devoted to green infrastructure practices, examples of green infrastructure in Connecticut, along with municipal outreach resources. It can be viewed at http://www.ct.gov/dep/cwp/view.asp?a=2719&q=464958&depNav_GID=1654

The Environmental Protection Agency has a green infrastructure website and is a good municipal resource for green infrastructure basics, tools, and case studies. It can be viewed at http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm

The CT NEMO program of the University of Connecticut is an educational program for local land-use officials that addresses the relationship of land use to natural resource protection. It runs a website that has a plethora of green infrastructure and low-impact development information and tools, including an atlas of completed green infrastructure projects in Connecticut. Go to http://nemo.uconn.edu/

Save the Sound, a program of Connecticut Fund for the Environment, recently developed a website that provides green infrastructure basics, a rain garden installation "how-to", and follows green infrastructure news and projects in Connecticut. Go to http://reducerunoff.org/

The Center For Watershed Protection provides practical and technical information for people and communities interested in protecting and restoring urban watersheds. Its website has a Stormwater Manager's Resource Center. Go to http://www.cwp.org/

The UNH Stormwater Center at the University of New Hampshire is a research, testing and educational facility that serves as a technical resource for water managers, planners, and design engineers in New England. Its website has numerous tools and resources for stormwater managers and can be viewed at http://www.unh.edu/unhsc/

Chapter 6: Energy Solutions for TOD

Written by:
Connecticut Fund for the Environment

Our Energy Challenge

By its very nature, transit-oriented development is designed to reduce the biggest category of energy consumption in Connecticut – transportation. However, transit-oriented development can incorporate features that make positive changes in other energy consumption sectors, such as electricity and the fossil fuels used for heating. First, re-development can reduce overall energy needs with measures such as modern heating and cooling equipment and improved building shells. Second, new developments can include localized electricity generation and other energy systems to make our energy supply cleaner, more efficient, and more reliable.

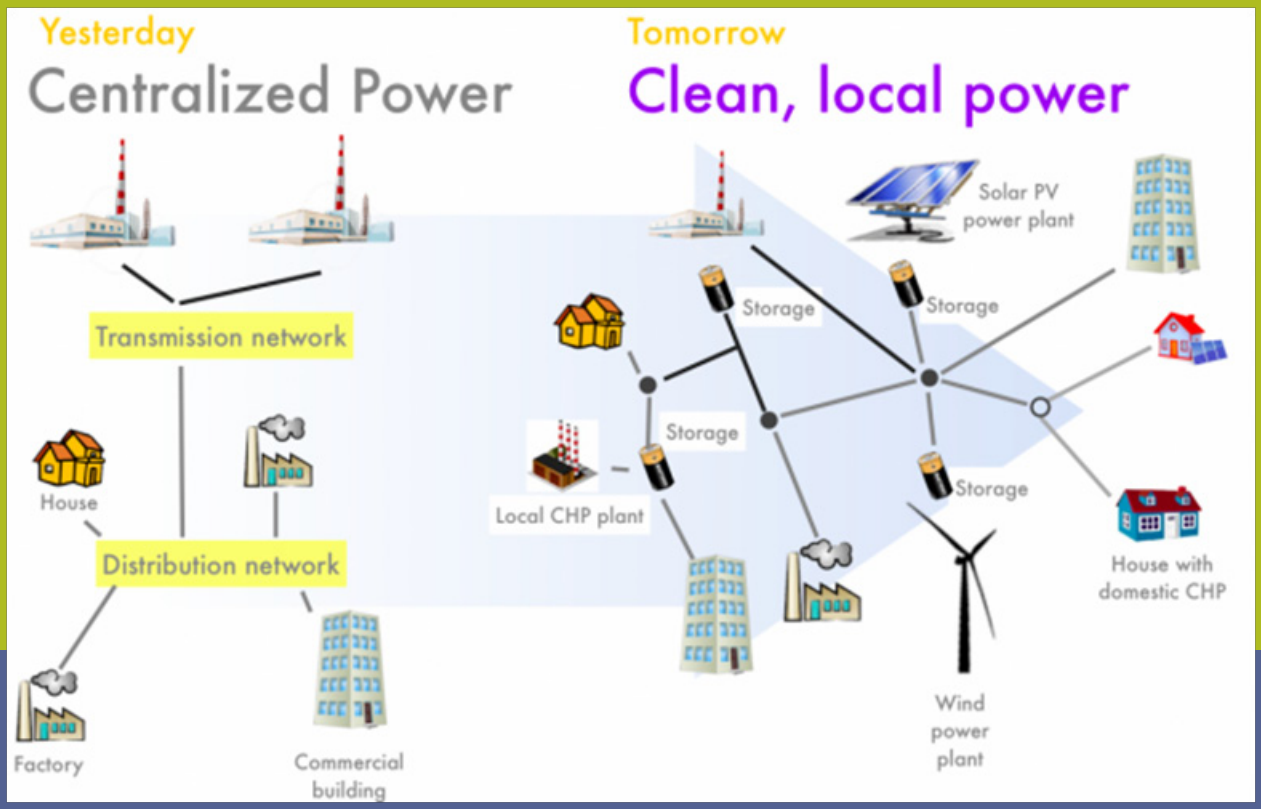


Figure 6-1. Moving from centralized power to green, local power. (Image: grist.org)

Many government programs exist, both in Connecticut and at the federal level, to facilitate and incentivize these types of improvements. Unfortunately, there are currently also numerous regulatory barriers that hinder progress, particularly for energy supply projects that intend to serve more than one customer. The energy field is rapidly evolving so this chapter lays out the general concepts and points to key sources for further information.

Energy Demand

Residential and commercial developments use energy for many different purposes. Important end uses include lighting, space heating and cooling, and water heating. Energy for these end uses can come from different types of sources. In a typical building in Connecticut, energy for space heating is provided by

combusting fossil fuels in a boiler located directly on-site. In these situations, where energy is purchased in the form of fuels, demand can be reduced in two ways:

- First, installing more efficient combustion equipment (e.g., a new boiler for space heating) reduces the direct demand for fossil fuels by producing more usable output per unit of fuel.

- Second, installing more efficient end use equipment (e.g., low flow showerheads) or improving the building shell with modern insulation and windows indirectly reduces the demand for fossil fuels by reducing the need for the existing combustion equipment to run.

By contrast, energy for lighting is typically provided by electricity purchased from a utility. In these situations, where the energy is converted into a usable form off-site, energy demand can only be decreased by installing more efficient end-use equipment (e.g., better light bulbs). In new buildings and developments, there are additional steps that a developer can take to optimize energy performance.

Figure 6-2. (Image: http://www.realhomeimprovement.)

Connecticut currently has numerous programs to promote energy efficiency. These programs are mainly run by two different types of entities. One set of programs is run through the public utilities, such as United Illuminating (UI) and Connecticut Light & Power (CL&P). The other set is run through the Clean Energy Finance and Investment Authority (CEFIA), a green bank run by the State of Connecticut. Recently, there has been an effort in Connecticut to have a united marketing effort and comprehensive website for the diverse array of programs in the state under the name of "Energize Connecticut."

Existing Buildings

For existing buildings, where the structure is already fixed in place, programs to improve energy performance largely take the form of incentives, technical assistance, and specialized financing. The utilities run a wide variety of programs in this vein.

Buildings in TOD developments will primarily be commercial, multifamily residential, or mixed use. For building-wide services, the utilities run specialized commercial programs and "multifamily" programs that cover both multifamily residential and mixed-use properties. Individual residential tenants or condo owners are allowed to access the Home Energy Solutions program that is more typically associated with single family homes.

As a part of all of these programs, a variety of rebates are available for high-efficiency equipment. At the present time, CEFIA is primarily operating only one program that applies to the commercial and multifamily sectors, the Commercial Property-Assessed Clean Energy (C-PACE) program. C-PACE is

a financing program that provides low-cost capital through contributions from CEFIA and the use of a lien on the property. Although this program is statewide, it is only available in certain municipalities because city approval is required. Numerous types of energy improvements are eligible for financing under C-PACE, including both demand-side and supply-side measures. There is also a federal tax deduction of up to $1.80 per square foot available for commercial buildings that meet certain energy efficiency standards. This tax deduction is currently scheduled to expire at the end of 2013.

In addition, there are major efforts underway to improve the energy performance of existing buildings on a market basis. First, there are voluntary benchmarking and rating systems for existing buildings. In addition to the savings on energy expenditures, these programs and activities give incentives to building owners to increase energy performance in exchange for a public rating that can be used to attract tenants and favorable publicity. Important programs of this type include the Leadership in Energy and Environmental Design (LEED) program for existing buildings run by the U.S. Green Building Council, and ENERGY STAR, a program run jointly by the U.S. Department of Energy and the U.S. Environmental Protection Agency.

Second, cities across the United States, notably New York City and Washington, D.C., have begun to implement energy use disclosure and benchmarking requirements. These policies give building owners the information necessary to take advantage of energy efficiency opportunities. Disclosure allows buyers to take energy performance into account and, in turn, this allows sellers to recoup their energy efficiency investments in the selling price. Even without these types of requirements, non-profits and real estate organizations are promoting the broader economic case for energy efficiency investment in commercial spaces.

One important recurring opportunity for commercial buildings is build-outs for new tenants. Case studies by the Center for Market Innovation, a program of the Natural Resources Defense Council, indicate that implementing all measures that have a three- to five-year payback in these build-outs will reduce tenant energy usage by 30 to 50 percent.

New Buildings and Developments

For new construction, most of the options for existing buildings are available, albeit often under different program names. This includes utility programs, the federal tax deduction, as well as labeling, disclosure, and benchmarking. One of the utility programs for new buildings and major rehabs is called "Energy Conscious Blueprint." This program provides technical support and incentives to maximize the energy efficiency of these construction projects. There are separate LEED standards for new buildings. However, specialized financing mechanisms are often unnecessary in this context because any additional cost of high efficiency equipment can be included in the overall financing scheme for the project.

In addition, developers of new buildings face additional requirements for energy efficiency and can take advantage of additional opportunities. The primary additional requirement for new buildings is energy conservation codes. Under current law, Connecticut will automatically adopt the 2012 International Energy Conservation Code for residential buildings and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 90.1 for commercial buildings. This provides a wide array of standards that must be met by all new buildings.

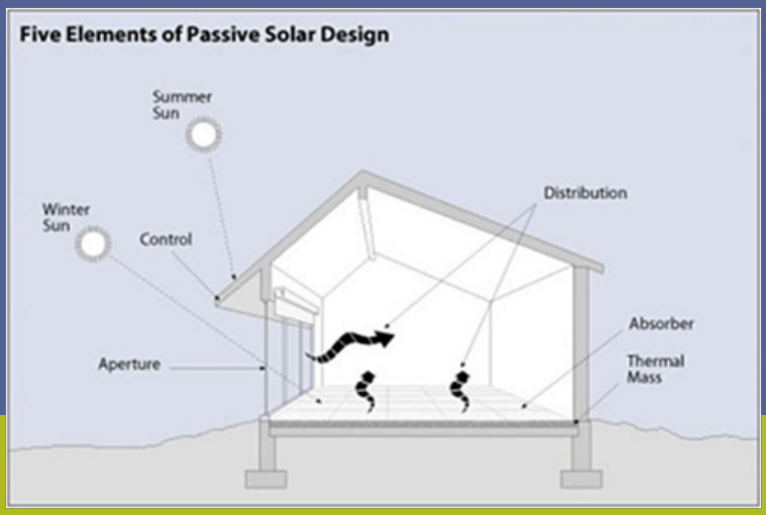


Figure 6-3. Elements of Passive Solar Design (Image: http://www.wbdg.org/resources/psheating.php)

Because new buildings are being designed from scratch, this means that additional energy savings opportunities are present. For example, new buildings can be designed so that heating requirements are reduced by taking advantage of natural sunlight. This is often referred to as "passive solar" heating. Similarly, the orientation of entire developments can be designed with this in mind. New developments can also include efficient infrastructure, such as energy efficient street lights and traffic lights.

Energy Supply

In addition to minimizing energy demand, TOD developments can incorporate energy supply measures that are cleaner and more efficient than current energy supply arrangements. First, buildings can use generation technologies that are naturally cleaner than the generation technologies most commonly used in Connecticut. For example, a building can switch from fuel oil to ground source heat pumps for its space heating needs. Similarly, a building can reduce the amount of electricity purchased from utilities, which is typically produced by the combustion of natural gas, by installing a solar photovoltaic (PV) system.

Second, even if the same source of energy is used, on-site generation may be more cost-effective and efficient than the purchase of electricity from a utility for several reasons. Any on-site generation prevents the sizeable losses that come along with the transmission of electricity. In addition, combined heat and power (CHP) systems can capture the heat that is a by-product of electricity generation and use it for either space heating or water heating.

Figure 6-4. Installation of solar panels. (Image: ecooutfitters.net)

Finally, generation resources that are located at the source of demand provide important reliability benefits because they can lessen transmission issues and can continue to provide power when the broader electric grid fails. In the not-too-distant future, similar reliability benefits may be available from localized energy storage options. Energy storage for electricity would also save electricity costs because it helps to fix one of

the most vexing problems in the electric sector, the variability of demand across the day and over the course of the year. One concrete example of this is electric vehicles. These vehicles could be charged at night when the cost of generating electricity is low and actually provide power to the grid during the day when the cost of generating electricity is high.

Available Incentives for Clean Energy Supply Options

One source of incentives for clean electricity generation comes from Connecticut's Renewable Portfolio Standard (RPS). The RPS requires electric suppliers to purchase renewable energy credits (RECs) from clean energy generators. There are different percentage requirements for different types of generation:

- The largest category, known as Class I, includes a wide variety of generation technologies: solar power, wind power, fuel cells, methane gas from landfills, ocean thermal power, wave or tidal power, low emission advanced renewable energy conversion technologies, certain hydropower facilities, and certain biomass facilities.

- Class II includes trash-to-energy facilities, certain hydropower facilities, and certain biomass facilities.

- Class III includes CHP systems. For the most part, purchases of RECs by electric suppliers are done on a yearly basis.

Recently, Connecticut began the ZREC/LREC program, where clean energy projects submit bids to receive 15-year contracts for Class I RECs. There are also numerous federal tax incentives available for clean electricity generation. There is an investment tax credit (ITC) of 30% for solar PV, fuel cells, and wind, and an ITC of 10% for CHP systems and geothermal. There are also production tax credits (PTC) available for a wide array of technologies. The PTC for wind, geothermal, and closed-loop biomass is 2.2 cents per kilowatt-hour and the PTC for other eligible technologies, not including CHP systems, is 1.1 cents per kilowatt-hour. Renewable generation systems are also eligible for accelerated depreciation over five years.

The previously mentioned C-PACE program, run by CEFIA, will provide financing for renewable energy systems. CEFIA also runs a program to provide incentives for commercial solar hot water systems.

Submetering, Net Metering, Micro-Grids, and District Energy Systems

Energy supply projects are relatively straightforward when the energy produced is used on-site by the same customer that owns the project. Complications arise when the owner of the energy supply project seeks to sell the energy to other customers. These sales can be to tenants in the owner's building (submetering), the electric utilities for general usage on the electric grid (net metering), or other consumers and businesses (microgrids for electricity or district energy systems for heating or cooling).

Traditionally, these sales would run afoul of the regulation of energy prices and the rights of utilities to control transmission lines. In addition, a price must be set for sales of electricity to the grid and utilities

often charge high "standby rates" to owners of electricity generation projects intended to recover costs of transmission lines and other equipment necessary for any period of time when that generation project does not run.

Figure 6-5. Illustration of a microgrid. (Image: American Clean Skies Foundation)

However, Connecticut has taken several steps to enable owners of local projects to receive a fair price for their energy while protecting their customers and the ability of utilities to recover their costs. Connecticut has a statute allowing municipalities to establish an "energy improvement district," an entity to establish a local electrical grid with local generation sources. While several cities set up an energy improvement district, this program has not been successful so far.

More recently, the Department of Energy and Environmental Protection (DEEP) has established a Microgrid Pilot Program to fund municipal microgrids for critical buildings and infrastructure. In addition, DEEP has proposed taking steps to remove hurdles for submetering, net metering, and other obstacles to local energy projects.

Energy Resources

Clean Energy Finance and Investment Authority (CEFIA) - http://www.ctcleanenergy.com/

EnergizeCT - http://www.energizect.com/

Websites for multi-family program:

- Connecticut Light & Power (CL&P) - http://goo.gl/xUJS4
- United Illuminating (UI) - http://goo.gl/FDAnx

U.S. Green Building Council LEED - http://new.usgbc.org/leed/rating-systems

ENERGY STAR - http://www.energystar.gov/index.cfm?c=business.bus_bldgs

Center for Market Innovation - http://www.nrdc.org/greenbusiness/cmi/default.asp

Connecticut's Renewable Portfolio Standards - http://www.ct.gov/pura/cwp/view.asp?a=3354&q=415186