

SMART CITIES FINANCING GUIDE

Expert analysis of 28 municipal finance tools for city leaders investing in the future



Developed by the Center for Urban Innovation
at Arizona State University

Smart**Cities**Council
LIVABILITY | WORKABILITY | SUSTAINABILITY

Foreword



Cities everywhere are challenged by congestion, pollution, crime, aging infrastructure, falling budgets and many other issues. They need new strategies and new technologies to address those challenges.

Smart technology is a key piece of the solution.

But smart city projects come with price tags.

And many smart technologies are relatively new and haven't established the kind of track record financiers want to see, which makes securing capital investments even more challenging.

Happily, there are numerous financing tools available to help cities and regional governments pay for smart city projects. This guide highlights 28 of the most promising — including al-

ternatives to the traditional funding mechanisms municipalities have used for decades. It also includes:

- Detailed analyses of each option based on 10 characteristics to help decision makers easily identify the best tools for specific types of projects.
- Examples of how these tools are being used today..

The Smart Cities Council® is grateful to the Arizona State University Center for Urban Innovation for the financial expertise and insights that made this Smart Cities Financing Guide possible. Please refer to page 78 to learn about the authors and the Center and to page 81 to learn more about the Council and our partner companies and advisors.

*Jesse Berst,
Chairman, Smart Cities Council*

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Chapter 1: City Financial Challenges and Opportunities



In 2008, the world passed a milestone. That year, over half of the world's population lived in urban areas. There's no foreseeable end to the trend that has today's cities expanding at an unprecedented rate and new cities emerging. The world's total urban area is expected to triple between 2000 and 2030 and urban populations could double in that same timeframe.

Such rapid urbanization carries significant implications for the world's ecosystems as outlined in a 2012 [United Nations report](#). Of critical concern is the growth in the number of mega-cities emerging in Asia, South America and Africa. In 2011, the [World Bank listed](#) 26 cities with an urban population over 10 million inhabitants and nine of them exceeded 20 million. These mega-cities – places like Tokyo, Mexico City, New York City, Mumbai, Karachi, and Beijing – are enormous. And they're expanding beyond traditional city boundaries into dynamic regional entities.

As critical economic hubs, cities contribute to national stability and growth. Yet they are typical-

ly resource-constrained – a reality that becomes increasingly burdensome as burgeoning populations put increasing pressure on often inadequate and outdated infrastructure, from water and sewer systems to transportation networks. And these cities will remain fragile and struggle under the demands of a swelling population unless we find ways to move the needle on making them more sustainable.

One solution we're seeing in pioneering cities around the world is the use of advanced information and communications technologies (ICT) to make infrastructure smarter and more sustainable. By design, ICT-enabled cities – or **smart cities** – are more resilient during times of distress due to effective resource allocation and infrastructure management.

No one said infrastructure upgrades would be easy

Still, upgrading physical infrastructure with smart technologies is often a huge challenge for cities. One example is Mumbai, India's most populous city,

where the physical infrastructure is already so fragile that simply keeping it relevant and usable in the face of an exploding population is an enormous undertaking. Finding the wherewithal to take it to the next level – to implement innovative technologies that are both sustainable and financially feasible – isn't easy.

Yet Mumbai is managing to do it. In 2012, smart meters from Itron, a Smart Cities Council Global Partner, were placed on the system that supplies tap water to Mumbai. The meters helped find leaks and discourage waste so more residents could get water. The system ultimately [cut water losses](#) by 50%.

Making city infrastructure operate more efficiently with advanced technologies, like the smart water meters installed in Mumbai, has become an imperative for public officials, scholars and citizens seeking solutions to the growing environmental ills and urban challenges that cities face. As advocates of smarter cities, they recognize the important role ICT plays in driving economic competitiveness, environmental sustainability and general livability.

They see how:

- Smart meters can monitor and incentivize energy and water conservation
- Electronic road pricing, sensors and tolling can regulate traffic and lower congestion
- Public safety departments can use predictive analytics to target crime hotspots

Integrating intelligent infrastructure with city-wide connectivity and data analytics – three foundations of a smart city – provides situational awareness that makes possible some amazing developments. For example, Singapore crunches data to predict traffic jams while there is still time to minimize their effects. Rio de Janeiro can predict just where flooding will occur from a particular storm, so emergency crews and evacuation teams know just where to go.

Promise of smart cities vs. the challenge of paying for them

Clearly, the emergence of innovative technologies to help cities become smarter holds great promise. Yet a significant challenge remains: *finding ways to finance the much-needed infrastructure upgrades.*

Cities and other public entities hoping to upgrade infrastructure with smart technologies must find investors and financial institutions willing to finance smart projects in an environment still cautious after one of the most significant global economic crises in generations. Financing smart infrastructure projects is expensive and requires creative approaches that focus on both short-term and long-term goals.

Cities have been slower to emerge from the financial crisis and many are desperate for ways to bring in cash to offset depressed tax revenues and longer term cuts in federal support. Unfortunately, such desperation combined with limited financing infor-

Chicago's tough lesson in finance

As we've said, many smart technologies are relatively new. Models that compare various financing tools to fund investments are not yet available. That forces instigators of smart projects to do the best they can with the knowledge and resources available. And costly mistakes can happen. That was the case in Chicago where a string of public goods were privatized so the city could receive immediate income. A particularly striking example was in 2008 when Chicago leased its parking meters to a private concessionaire for a 75-year period in return for about \$1.2 billion in upfront cash; a sum the city's inspector general calculated was about \$974 million less than the concession was worth, according to a [Bloomberg report](#). The



Lack of due diligence in financial deals can be costly.

manner in which the deal was done caused a public uproar and the sudden and steep increase in parking fees triggered a [lawsuit](#). In the end, the city had to pay a consortium of plaintiffs \$8.9 million for procedural wrong-doing.

mation has led to some poor decisions on the part of public officials.

Wisely funding technology investments is critical to the realization of smarter cities. Certainly some technology investments are a one-time event, but most are operationalized in the context of projects. These projects are often complex undertakings, involving longtime horizons, multiple stakeholders and risk.

Matching the project to the financial tool

Part of the challenge for cities is in selecting the right tool at the right time. As you read through this guide you can familiarize yourself with numerous financing options available for various types of smart city investments and see which ones are

most appropriate for specific types of projects. For instance, the European Commission expects energy consumption to rise by 50% over the next 20 years. That increasing demand for energy and the need to reduce environmental pollution are issues cities everywhere must address. Renewable energy is one obvious solution — but renewable energy projects are extremely [capital intensive](#). The nature of capital projects is that there is a large front-end investment with the benefits captured over the life of the project. Consequently, these are often financed with some kind of long-term financing package. Renewable projects, e.g., solar power also have other challenges; without some kind of subsidy, revenues can't cover operating costs and a return of and on capital. A public-private partnership may be a viable option with this sort of project.

The challenge with many of the newer smart city technologies is that would-be investors see them as high risk because the ROI is uncertain. On the other hand, Many projects that have uncertain ROIs can be financed through traditional sources, albeit with lower levels of debt financing. However, projects that embody some element of technology risk—first-of-a-kind projects, for instance — cannot attract debt financing and generally require guarantees or other forms of credit support (or all equity financing).

The financing options outlined in this guide generally fall outside the realm of early developmental venture capital. Rather, the tools highlighted in the pages that follow fall into four general approaches:

- Government-based financing tools
- Development exactions
- Public-private partnerships
- Private fund leveraging options

You'll see details about each tool, case studies where they are being used and a standard scheme for evaluating them as a potential tool for any given capital project, including common pros and cons with each.

But first, let's quickly consider "The Project."

That's a capital idea

Financially viable capital projects play a starring role in sustainable development. We're referring, of course, to projects cities undertake to construct, retrofit, restore or upgrade capital assets. Municipal buildings, sewer lines or local roads are common examples. Capital projects are both important and

Table 1: 28 Municipal Finance Tools at a Glance

Government-based Finance Options	Development Exactions	Public and Private Options	Private Sector Leveraging
General Obligation Bonds	Dedication Requirements	Public-Private Partnerships	Loan Loss Reserve Funds
Revenue Bonds	Tap Fees	Pay for Performance	Debt Service Reserves
Industrial Revenue Bonds	Linkage Fees	Securitization and Structured Finance	Loan Guarantees
Green Bonds	Impact Fees	Catastrophe Bonds	On-Bill Financing
Qualified Energy Conservation Bonds			Pooled Bond Financing
Social Impact Bonds			Pooled Lease-Purchasing Finance
Public Benefit Funds			Value Capture
Linked Deposit Programs			Tax Increment Financing
Energy Efficiency Loans			
Property-Assessed Clean Energy Programs			
Greenhouse Emissions Allowance Auctions			
User Fees			



Historically in the U.S., the federal government shouldered the cost of major infrastructure like the interstate highway system.

challenging because, as the name implies, they require capital.

By their nature, these assets have a long expected life cycle. So the goal in financing them is to spread the payments over the life of the asset, which requires a revenue stream to cover the financing repayment as well as a return to investors.

Historically, public sector entities took on the financing of major physical infrastructure development. A familiar example is construction and repair of the U.S. interstate highway system, which is financed primarily by the federal government because the benefits accrue to the nation as a whole. Highways that crisscross the country facilitate travel for citizens, but also the movement of goods to market. Most would agree that economic development and aggregate wealth in the nation has risen due in large part to the interstate highway system.

Given today's political and budgetary climate, relying on historical support from either federal or state sources is not as viable an option for U.S. cities as once was the case. Nor does it seem likely we'll see another stimulus program like the 2009 American

Recovery and Reinvestment Act anytime soon. The numbers below tell the story:

- From 2000-2010, the U.S. government averaged \$300 billion per year in support to state and local governments solely for infrastructure maintenance
- Since 2010, that average has dropped to \$150 billion at the same time public works specialists projected the amount should have been increased to \$450 billion just to keep up with the current [level of disrepair](#).

Many would argue this reduction in infrastructure support is the new reality in the U.S.

Yet cities are increasingly rising to the challenge in creative ways — exploring new opportunities to work together on shared infrastructures and investigating new funding tools and partnerships that rely more heavily on private investors and private sector sources.

From the financier's perspective

When approached with a new project, financiers typically take a critical look at similar capital projects

to understand the expected feasibility, viability and profitability. As we've mentioned, this can be a challenge for city leaders with capital intensive projects that leverage newer technologies. With limited information on how a new project might perform, risk associated with the investment increases. And with increased risk, the cost of capital will likely increase too. While this is true of any project requiring financing, the challenge is more acute with newer technologies that have yet to prove out or achieve scale.

That's where creative financing models enter the picture, as you'll see in the pages that follow.

Chapter 2: 10 Characteristics of Finance Options



Never before have cities had quite so many new technologies to evaluate. Yet the speed and breadth of technology advances – exciting as they are – also pose some real challenges for decision makers: Which investment is the best for the community – and when? And how will the community pay for it?

While financing options are not evolving quite as fast as technology, they are evolving nonetheless. But before we drill down on specific options, let's look at the 10 characteristics that should help decision makers see how different types of projects in different types of communities demand different types of financing. This chapter will focus on these characteristics:

1. Sources of capital
2. Number of parties
3. Ease of securing financing
4. Duration of financing
5. Risk to investors
6. Risk to borrowers
7. Tax implications
8. Source of repayment

9. Advantages
10. Disadvantages

1. Sources of capital

A concern when considering finance options is the source of the capital generated by the tool. There are multiple possibilities ranging from dedicated fees for service, targeted tax tools, general tax sources, private investors or even philanthropic support.

Understanding the source of the capital is important for three reasons:

- Such awareness will help decision makers understand the institutional context of those responsible for the capital financing decision.
- This institutional understanding will help decision makers be as sensitive as possible to the risk concerns of investors.
- That risk concern will help in constructing the request for financing by highlighting certain aspects of the project that address risk drivers.

2. Number of parties

Rarely is financing for capital intensive infrastructure projects determined by one person. Normally boards are involved with various members bringing their values and concerns to the decision. Depending on the source of the capital, the parties involved in the financing decision may have conflicting goals or different values. For instance, in a public-private partnership, the values of the public officials will not be driven primarily by a profit motive, as it logically will be for private investors.

Understanding the number and identities of the parties involved in a financing decision will enable a clearer presentation of the project to address everyone's goals. Still, the more parties that are involved, the more challenging the financing is likely to be. The least challenging, of course, are those rare cases where an agency can self-finance its infrastructure investment without reliance on external funding.

3. Ease of securing financing

Not all finance mechanisms provide the same level of accessibility. Some are relatively easy compared to others, and much of the ease is dictated by how sensitive the option is to the risk associated with the project. Another factor that can make securing financing easier is the extent of control the financing agent (whether a utility, local government, limited partnership, etc.) has over the revenue stream dedicated to paying off the investors. The “safer” or more predictable the revenue stream dedicated to repaying the upfront financing is, the easier the financing will be.

For instance, in a tax increment financing (TIF) arrangement, the revenues to repay upfront financing are tied to future (and therefore speculative) increased land values or taxes. Because of this speculative aspect, local governments that seek financing based on TIF arrangements often have to back up the future revenues with promises of other revenues should the future development not materialize. That guarantee lowers the risk and eases the likelihood of financing in such a scenario. As discussed below, lower risk also lowers the cost of borrowing.

Ease also involves how stakeholders perceive the option. If stakeholders buy into the project and the financing model, securing the financing can be easier than when they do not. Some of this ease has to do with how the model and its transparency are communicated.

Each tool presented in the guide is scored on this “ease of securing finance” characteristic. The scoring ranges from one (very easy) to five (very difficult). The score takes into account factors such as control over dedicated revenue streams, how many parties are involved in the decision, risk elements and interest costs.

4. Duration of financing

Different kinds of projects will need different kinds of financing tied to them. Some projects are relatively short term, focusing for instance on material procurement only. In those situations, short-term financing tools will be most appropriate. Other situations may call for medium-term financing. For example, cities and transit agencies have to finance bus fleets. Such assets have a 12-year or a 500,000 mile recommended life expectancy (though currently the average retirement age for public transit buses has risen to 15.1 years due to budget pressures). Medium-term financing tools would be appropriate for replacing buses on schedule (or other similar capital assets). And this actually saves money in the long run since the maintenance costs for vehicles beyond their recommended life are 10% to 50% higher. Regardless, dedicated transit funding must be available to repay the costs of the upfront capital borrowing.

In situations involving financing an infrastructure asset, such as a major bridge or building, decision makers need access to financing tools with longer time horizons, as these assets have expected lifespans that often exceed 50 years. These projects also tend to have significant upfront costs for construction and thus will require access to deeper pools of finance capital.

For purposes of classifying each of the finance options, each tool is scored in terms of its most common duration usage:

- Quick tools are those that typically finance projects of a year’s duration.
- Short-term tools are for projects of a two- to five-year duration.
- Medium-term tools fund projects with a six- to 15-year duration.

- Long-term tools target capital projects with lifespans that exceed 15 years.

Finally, some finance tools are actually ongoing sources that are supported with ongoing dedicated revenues, such as a surcharge on a fee for service collected by a utility. The revenue generated by the surcharge could be dedicated to ongoing infrastructure improvements, a practice common in the telecommunications industry.

5. Risk to investors

Investors want a return that is commensurate with the risk. Buyers of municipal revenue bonds buy based on an assessment (contained in the offering memorandum) of the revenues generated to pay bond principal and interest with the expectation that both will be repaid. Equity investors, for example in a public-private partnership project, take more risk and receive higher returns.

However, since infrastructure projects that utilize newer technologies are often perceived as riskier, public entities needing capital to finance them must still rely on transitional sources. The challenge is in communicating the project to the finance community in a way that convinces them the project is not only viable, but so is the fiscal health of the borrowing jurisdiction.

On that latter point, think about Detroit, Michigan or Stockton, California. Both cities have significant infrastructure investment opportunities, but their fiscal health will undermine investor confidence. In cities with serious financial challenges, even if an infrastructure project is a success — smart heating and cooling systems that yield real savings, for example — the jurisdiction’s ability to repay on the debt incurred to install the systems is still an issue.

In a project that is expected to lower energy consumption costs, it's unlikely the savings projections alone will overcome investor concerns. What if the savings don't materialize? In situations like this, borrowers may need to spread the financing (and therefore the risk) across multiple sources. Perhaps it's a revenue bond in combination with available cash from the general fund (or private equity if a public-private partnership). Or as happens more commonly, borrowers may need to provide additional guarantees of payment from other revenue sources to alleviate investor unease.

Risks take many forms. For purposes of classifying each of the finance options we'll discuss in the following chapters, risk to investors is graded simply from very low risk (1) to very high risk (5). These scores take common aspects of risk into consideration to generate a relative score on that one-to-five scale.

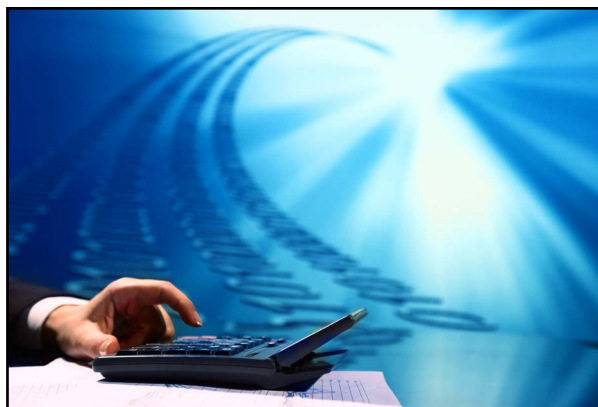
6. Risk to borrowers

Investors aren't the only ones facing risk in a finance decision. Those borrowing the capital (or those they represent) also face risks that decision makers should keep in mind when determining the relative merit of one funding option versus another. Most of this risk relates to how commitments to pay back borrowed capital are structured relative to the likelihood that the new technology and/or infrastructure will generate the savings or revenues to the extent necessary to cover the borrowing costs.

If a jurisdiction borrows a significant amount of upfront capital for the construction of a bridge with the intent that tolls from bridge users will cover the payoff costs, then this can work fine under the assumption that demand for the bridge yields sufficient tolls. But many toll roads in the U.S. have failed to generate the toll revenues anticipated. And that

means jurisdictions have to raise tolls (which drive more users away), dip into general funds to pay the difference, or sell the asset to try and get out from underneath the debt burden.

As with risk to investors, each finance tool is also scored on a five-point scale (very low to very high risk). The score takes into account various risk factors to provide a relative score that decision makers



Investors look for a reasonable return at an acceptable risk level.

can use to compare against other tools.

7. Tax implications

It's important to understand the goals of all of the parties involved in financing smart technologies. For cities interested in creating more sustainable infrastructure, financing is a means to achieve that goal. For an investor, the financing goal is to achieve a reasonable return at an acceptable level of risk.

In some instances, finance markets are unable to overcome the risk-to-return ratio and governments may intercede to try to alter one or both sides of the ratio by mitigating risks and/or by increasing the

likely return to the investor. To increase the appeal of investing in public sector projects involving infrastructure and smart technologies, governments have created a family of bonds that accomplish both. Here's how:

- The interest paid to investors on these kinds of bonds is exempt from federal taxation.
- If the buyer of the bond lives in the state where the bond is issued, then the buyer is also exempt from state income tax on the interest paid.
- The rate of return is slightly lower than non-tax exempt bonds, but historically municipal bonds have been insured against default so return is highly likely.

Many of the tools presented in the next chapter are tax exempt.

8. Source of repayment

Financing tools are basically instruments to facilitate borrowing today and repayment over some period in the future — plus interest. As capital is repaid, it and the interest become available for additional financing of other investment options which in turn fuels additional capital growth.

This system breaks down if repayment fails to materialize. It's the risk of this failure that investors want to minimize. Some instruments are evaluated and scored by ratings services — Moody's, Standard & Poor's and Fitch, for example — to help investors gauge how risky the borrower is. Meanwhile, some instruments are government-backed, but some governments are not good credit risks. In this guide each tool is also assessed on the source responsible for repayment of the obligation.

9-10. Advantages and disadvantages

In addition to the eight characteristics above, this guide also highlights some of the advantages and disadvantages of each of the tools. These are all tools that can be used individually or in coordination with other tools to provide capital financing for a wide range of evolving technologies and infrastructure needs. Therefore, one score across all six characteristics is not going to be truly useful as an indicator of the best tool to choose.

Rather, the best tool will depend on the project to be funded. So in addition to the evaluation scores, you'll see that each tool we highlight includes a brief description of the possible advantages and disadvantages associated with it.

Financing tool availability can vary from city to state to country

The financing tools highlighted in this guide are available in the United States today. Most are also available in European Union nations as well, though some go by different names. But not all of the tools are available in every nation.

Furthermore, the tools may be limited to different kinds of projects from nation to nation. This is true even within the U.S., as some of the state-based tools apply only to certain types of investment projects.

So while this guide illustrates 28 tools, those interested in utilizing them should do their due diligence in learning if and how such tools can be used in their location.

Success is not guaranteed; why failures happen

One final consideration before we get into the finance tool chapters. Any of the 28 tools presented in this guide have the possibility of success. But they can also fail. Here are four examples of why that happens:

- **Seeking benefits without doing adequate research can lead to higher costs and lower returns.** Here's a scenario: A facility engineer takes on a lighting replacement project that includes replacing 4,000 lamps and 1,000 fixtures with a new and seemingly better system. The new system does achieve lower lamp wattage with a higher lumen output and lower mercury content. But the engineer didn't know that the previous lamps lasted 35% longer than the replacements. He also didn't realize the mercury content in the new lamps were only a decimal point lower than the previous lamps. And he discovered that half of the fixtures did not fit so they were unusable. Bottom line, the project cost his organization more money than it needed to pay.
- **Market failures can be widespread and intrinsic.** Intrinsic features of a system can include information problems, imperfect competition and resource allocation based on existing information and experience and not on opportunities. In 2006, Nicholas Stern, author of the Stern Review, claimed that climate change is the world's biggest market failure ever. Since market prices are supposed to reflect the costs of production, the problem is that the market had not accounted for the costs of greenhouse gas emissions. To remedy the market failure, Stern called for mitigating actions to reduce emissions through a global carbon tax.

- **Funding and model mismatch can occur when funds are not structured or timed appropriately.**

This can lead to elevated fixed costs, freezes in resources and [lower project quality](#). Additional problems occur when the model isn't relevant to the local market or conditions. This often happens when adopting a model that had success elsewhere without taking into account localized information that considers the environment and economy. For instance, many refer to India's budding tech city, Bangalore, as the new Silicon Valley. Although growing, Bangalore is nowhere near the success of Silicon Valley. Many believe the reason for this is the adoption of a model that was not the best fit for India. Simply put, there are fewer Indian technology entrepreneurs when compared to the U.S. Many say this is because of educational style differences. Where the U.S. education system is more liberal and allows students to focus on their interests, the Indian education system is more rigid and less supportive of students pursuing their own paths.

- **Accountability to stakeholders is careless.** Not to be confused with control, accountability involves reporting on the development of the project and the achievement of pre-determined outcomes and impacts. Accountability assists with eliminating unrealistic expectations through the course of the project. Not managing expectations with stakeholders can give rise to situations such as the established funding period being too brief — a common problem with financing in the private sector.

In the next few chapters we'll drill down on specific financing options in which federal, state and local governments, private sector and philanthropic interests can participate to bring smart technologies to their cities. The options fall into four general categories: government-based finance options, development exactions, public-private partnerships and private fund leveraging tools.

Chapter 3: Government-based Financing Options for Cities



General funds in most cases are supported by a city's taxation authority as their primary source of revenue to pay for services citizens expect their city to provide. But general funds are usually only available to pay for regular annual operating expenditures.

Many city projects involving smart technologies represent infrastructure upgrades that last well beyond one year. So to protect citizens, cities also maintain capital funds separate from their operating funds. These are used to repay the financing of long-term investments in infrastructure with lifespans over many years.

Under the model of public finance, governments issue debt instruments with an agreement to pay back the debt, usually over the lifespan of the item being financed at some agreed-upon interest. By far the most common family of tools to pay for these kinds of capital costs is a government's bond activity.

Bonds are an important method of financing smart cities. Most bonds are issued by governments or corporations with an underwriter that provides the borrower with the full amount of the financing by buying all the bonds issued and then reselling them to investors at a profit on the open market. Of late, bonds have been used heavily to finance renewable energy initiatives.

In this chapter we'll focus on 12 government-based financing tools. Some will be familiar, some perhaps less so:

1. General obligation bonds
2. Revenue bonds
3. Industrial revenue bonds
4. Green bonds
5. Qualified energy conservation bonds
6. Social impact bonds
7. Public benefit bonds
8. Linked deposit programs
9. Energy efficiency loans
10. Property-Assessed Clean Energy Programs
11. Greenhouse emissions allowance auctions
12. User fees

1. General obligation bonds

General obligation (GO) bonds are one of two common types of municipal bond instruments. Such bonds are typically used to finance basic core infrastructure investments at the local level of government. These could be GO bonds to finance a new park, a new city hall, a new forensics crime lab, a library, a light rail line, a new school and so forth.

In the GO framework, the issuing entity — city, town, county, school district, etc. — backs the issuance of the bonds with the full faith and credit of the jurisdiction. In practice, this means that the jurisdiction will tap its tax revenues at a level sufficient to repay the bond buyers plus interest. Selling bonds yield capital immediately for project construction, with the repayment of the debt taking place over the life of the asset created.

The important distinction of GO bonds is that they are guaranteed with taxpayer revenues. For instance, one government in a metropolitan area might take the lead on investing in the creation of a new forensics crime lab. That government might enter into an intergovernmental agreement with other local governments in the region and provide access to the lab for a fee. Minus operating costs, those fees can serve as the basis for payments against the bond. Should those fees prove inadequate, then the issuing government will have to add its own tax money from its operating budget into the annual bond payment.

As long as the bonds are sold for the purpose of funding a capital asset with significant benefits for the community, GO bond interest is exempt from federal taxation. This exemption makes municipal GO bonds an appealing product for buyers. Bond ratings agencies such as Standard & Poor's, Moody's and Fitch evaluate and grade the risk of the bonds in terms of the fiscal health of the issuing

California mixes GO bonds, public-private partnerships and existing revenues to initiate its Strategic Growth Plan

In January 2006, then-California Gov. Arnold Schwarzenegger unveiled his Strategic Growth Plan for the state. In it he outlined his expectation that California would grow by 30% over the next 20 years which would result in a \$500 billion strain on the current infrastructure. He proposed a two-phased, 20-year investment, the first phase of which would leverage \$68 billion in GO bonds as well as other federal and private sector monies. His plan: to invest \$222 billion over 10 years in the state's transportation, education, water and health infrastructures.

California, like many states, has experienced an increase demand for services on its transportation infrastructure over the last two decades. California's transportation department, Caltrans, operates and maintains more roads than any other state, with about 50,500 lane-miles of highways, while cities and counties maintain approximately 327,000 lane-miles of local roads. California's traffic congestion and transportation infrastructure has been growing faster than revenues can meet. To deal with this challenge, in November 2006, voters passed a \$37.3 billion GO bond package, [the largest general obli-](#)



California is using GO bonds for transportation improvements.

[gation bond package](#) ever offered on a single ballot. The money would go to transportation, housing, education and flood control.

The transportation sector received \$19.9 billion of the allocation. Those funds went to congestion reduction, highway and local road improvements, transit, air quality, safety and security. [Transportation's proposed share](#) of the Strategic Growth Plan's overall investment into California infrastructure was nearly half at \$107 billion supported by existing revenues, public-private partnerships and two \$6 billion bonds that were to be implemented with a 6% statutory cap on the state's debt service.

jurisdiction. This rating influences the interest rate the jurisdiction will have to pay on the bonds (e.g., the cost of borrowing). The returns to investors are not as aggressive as other types of bonds. The

spread on these bonds and resultant return to investors is lower reflecting the lower risk of default.

Table 2: Summary Characteristics for General Obligation Bonds

Characteristic	Score
Source of capital	Private bond buyers
Number of parties	3: The issuing government, the bond broker and the investors buying the bonds
Ease of financing	3 - medium: Varies based on the fiscal health of the issuing community
Duration of financing	Varies. Rarely used for quick financing, but very common for most long-term financing
Risk to investors	2 - relatively low risk: Ratings help determine risk with higher returns on riskier purchases; could lose investment if jurisdiction became insolvent which is rare
Risk to borrowers	2 - relatively low risk: As long as jurisdiction is not overstretched on other demands for its revenues
Tax implications	Tax exempt
Source of repayment	Usually tax revenue
Advantages	Relatively easy to use tool overall if the jurisdiction is fiscally healthy
Disadvantages	As long as the jurisdiction balances its long term debt obligations relative to revenues, the disadvantages are small (which is why GO bonds are so popular)

2. Revenue bonds

A second popular form of municipal bond is the revenue bond. While the GO bond is guaranteed by tax revenues of the issuing jurisdiction, a revenue bond is paid back from revenues generated by the asset the bonds funded. Municipal projects that can generate revenues, such as a parking garage, can be financed with revenue bonds because parking fees can be dedicated to paying back the debt and interest.

With a revenue bond there is no guarantee that tax revenues will “back stop” any shortfall in bond payments should the asset revenues not be sufficient. As with GO bonds, selling revenue bonds yields capital immediately for project construction, and repayment should occur over the expected lifespan of the asset.

Here’s an example from New Mexico, where schools received \$20 million in energy efficiency upgrades through revenue bonds. They are required to allocate 90% of the savings that result from their upgrades to paying off the bonds. They can keep the remaining 10% for their own activities.

Like GO bonds, revenue bonds are also exempt from federal taxes if the bonds are sold for the purpose of funding a capital asset with significant benefits for the community. This exemption helps make municipal revenue bonds appealing to buyers, even though they are not typically backed by taxpayers. Bond ratings agencies also evaluate and grade the risk of revenue bonds in terms of the projected likelihood that the asset will be able to generate sufficient revenue to meet the debt obligation. Obviously, there is higher risk associated with revenue bonds than GO bonds and interest rates tend to be slightly higher on average as a result.

Cincinnati considers revenue bonds for smart parking meters

A plan proposed by Cincinnati Mayor John Cranley to upgrade the city’s parking meters and build a downtown parking garage involved up to \$30 million in revenue bonds issued by the Port of Greater Cincinnati Development Authority.



Mayor John Cranley

[Under the proposal](#), the smart meters would be installed on existing poles and accessible remotely by smartphone users. The improvements were expected to generate \$6.3 million in revenue the first year and \$7.6 million by the third year.

A contentious issue in Cincinnati, the city council eventually approved a less ambitious smart parking initiative.

Table 3: Summary Characteristics for Revenue Bonds

Characteristic	Score
Source of capital	Private bond buyers
Number of parties	3: The issuing government, the bond broker and the investors buying the bonds
Ease of financing	3 - medium: Varies based on the revenue generating capacity of the asset
Duration of financing	Varies: Rarely used for quick financing, but more common for medium-term financing
Risk to investors	3 - medium risk: Ratings help determine risk with higher returns on riskier purchases; could lose investment if asset fails to generate sufficient revenue
Risk to borrowers	2 - relatively low risk: As long as asset is reasonably projected to generate sufficient revenues to meet the debt obligations
Tax implications	Tax exempt
Source of repayment	Usually a fee related to the asset being financed (e.g., a toll for a new bridge)
Advantages	Relative easy to use tool overall if the asset is likely to generate sufficient revenues
Disadvantages	Added risk from lack of taxpayer backing increases the costs of borrowing relative to a GO bond

3. Industrial revenue bonds

Industrial revenue bonds (IRB) are another bond instrument issued by both municipal jurisdictions and state governments. These are most commonly issued as part of an economic development initiative in which the local jurisdiction issues IRBs and gives the proceeds to a private firm for development. These might involve capital improvements, expansions, facility enhancements or renewable energy and renewable energy efficiency upgrades. The firm is ultimately responsible for paying back the debt. That means the debt does not influence the city's rating, since the city has no obligation to repay.

The jurisdiction holds the asset as collateral until the debt is repaid. Because of that, there is often no property tax on that asset. This can be a significant savings for the private firm and is why jurisdictions use IRB deals as incentives to encourage business expansions or relocations to the jurisdiction.

Another appealing aspect is the tax-exempt status of the IRB due to issuance by a government jurisdiction. This means private firms can get lower interest financing through IRBs.

Here's one example of how an IRB comes together. In Illinois, a \$25 million IRB was issued to a private college to make campus housing improvements that reduced energy and water costs and achieved LEED certification. The bond is being repaid from additional fees paid by students who choose to live in the upgraded facilities. The college is responsible for ensuring that a sufficient number of students live in the facility to cover the bond debt.

Affordable senior housing gets \$44 million boost in Brookhaven

The town of Brookhaven on New York's Long Island announced late in 2013 that its Industrial Development Agency (IDA) [approved up to \\$44 million in bond financing](#) for BK at Lake Grove, LLC, which plans to build a 120,000 square-foot, 136-unit assisted living facility for senior citizens.

Officials said the project qualified for tax-exempt industrial revenue bond financing because at least 20% of the units will be affordable, designated for people who earn less than 50% of the area's median income. The bonds



Brookhaven uses revenue bonds to support affordable senior housing.

will be repaid with revenues generated by the facility.

The IDA also approved a PILOT (Payment-in-Lieu-of-Taxes) agreement for the project that provides property tax abatements. Exemptions from mortgage recording and sales taxes on construction materials and equipment were also granted.

Said Brookhaven IDA Chairman Frederick C. Braun, III: "This project will meet the growing needs of a segment of the town's aging population who no longer are able to live alone, enhancing their quality of life while allowing them to remain close to their families in our town."

Table 4: Summary Characteristics for Industrial Revenue Bonds

Characteristic	Score
Source of capital	Private bond buyers
Number of parties	4: The issuing government, the private firm handing the project, the bond broker and the investors buying the bonds
Ease of financing	4 - moderately difficult: Varies based on the health of the firm ultimately responsible for repayment
Duration of financing	Varies: Sometimes used for quick financing, but more common for short- and medium-term
Risk to investors	4 - moderate risk: Depends on health of the firm responsible for repayment, but tax exemption offsets some of the higher risk pricing; could lose investment if firm fails
Risk to borrowers	3 - medium risk: Lower interest due to tax exempt status, but will add strain on firms carrying additional debt
Tax implications	Tax exempt
Source of repayment	Private firm for which the government issued the bond
Advantages	Useful tool for governments working with firms on relocation and expansion to create jobs; appealing for borrowers due to tax-exempt status of the bonds and property tax relief while asset held by city
Disadvantages	Added risk for investors; many states cap the amount available for IRB financing per firm

4. Green bonds

Based on a practice begun in Europe, green bonds are instruments issued to raise capital for funding specific clean power, carbon-reducing projects. Since 2008, the World Bank has issued over \$4.5 billion in green bonds. The U.S. federal government seeded a green bond fund with \$2 billion in 2004 legislation. Here are more examples:

- The state of California purchased \$300 million of World Bank green bonds in 2009 in support of the state's commitment to climate change mitigation.
- Massachusetts, taking its cue from the World Bank, in 2013 became the first American state to sell green bonds to pursue an array of energy efficiency projects.
- Toronto, Ontario, meanwhile, announced in 2013 that it plans to issue green bonds to fund an innovative [green-certified transit project](#).

Green bonds can be more appealing than bank loans because they offer longer maturity periods, third-party credit enhancement and more flexible covenants. When issued by government entities, these are tax-exempt.

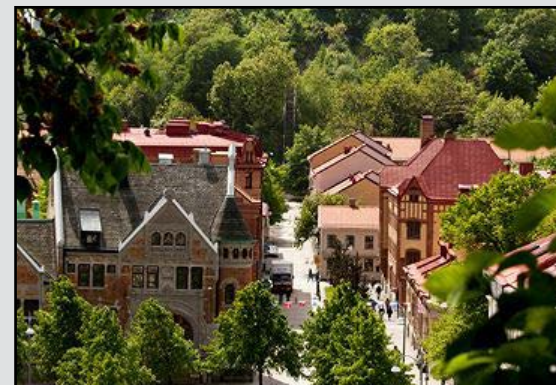
Green bonds offer a number of additional benefits, such as:

- Avoiding direct investment, which brings exposure to regulatory uncertainty and technology risk, plus there are limited investment grade opportunities of significant scale
- Providing an opportunity to meet investor demand for alternative ways to invest in the high-growth clean energy sector
- Affording a relatively easy place to integrate environmental investing policies into portfolio strategy due to the fixed-income structure
- Attracting investors partial to risk/return characteristics of conventional bonds
- Featuring design, risk and return similar to existing products in investment portfolio
- Providing the opportunity to integrate environmental, social and governance criteria throughout portfolio, and to signal commitment to stakeholders and policymakers
- Producing solid credit ratings, as international financial institutions and governments are principal issuers

Swedish city first in the Nordic region to issue green bonds

With the issuance of a 500 million (in Swedish krona) green bond in the fall of 2013, Gothenburg, Sweden became a pioneer in the Nordic region for using the green bond financial framework, developed by Nordic financial group Skandinaviska Enskilda Banken (SEB) together with the World Bank and other Swedish investors. SEB facilitated the issuance.

According to SEB, the issuance is a [break-through in the Nordics](#), where interest in green bonds continues to grow among investors. "They see that green bonds offer the same yield as other investments with similar conditions, but at the same time these bonds contribute to a better environment and higher awareness of climate-related challenges and solutions," noted Christopher Flensburg, head of sustainable investments at SEB.



Gothenburg issued green bonds in 2013; a first in Sweden.

Gothenburg intends to support various environmental projects on public transport, water management, energy and waste management.

"We have a thorough program for environmental projects in Gothenburg. The city intends to be an obvious choice for investors seeking green investments," said Gothenburg CFO Magnus Borelius.

Table 5: Summary Characteristics for Green Bonds

Characteristic	Score
Source of capital	Private bond buyers or public seed capital
Number of Parties	3-4 (the issuing government, the firm/jurisdiction for whom the bonds are being sold, the bond broker and the investors buying the bonds)
Ease of financing	5 - very difficult: Varies based on the health of the issuing jurisdiction, but lack of performance data on these instruments increases difficulty; that should decrease with more bonds performing
Duration of financing	Medium to long-term: Targeted at capital intensive projects with longer implementation and operational lifespans
Risk to investors	5 - high risk: Lack of performance data increases the uncertainty for investors, both in terms of the bonding instruments and the new technologies that would be funded
Risk to borrowers	4 - moderate risk: Ability to repay debt dependent on new technology with limited market performance information on which to base long term financing projections
Tax implications	Tax-exempt status depends on the issuer; if public, then tax exempt, if private, then not tax exempt
Source of repayment	Ultimately the issuing authority
Advantages	See above
Disadvantages	Relatively new finance tool and unclear how deep the demand from investors is for such bond instruments though successful bond issues <u>doubled in 2013</u> over the previous year

5. Qualified Energy Conservation Bonds

Established by the U.S. Energy Improvement and Extension Act of 2008, Qualified Energy Conservation Bonds (QECB) are another relatively new bond instrument designed specifically to, as the name implies, fund qualified energy conservation projects. For example:

- Reducing energy consumption in publicly owned buildings by at least 20%
- Upgrading a public facility with sustainable technologies such as solar panels, wind converters or biomass reclamation systems; upgrading private buildings can also qualify as a public goal
- Financing demonstration projects and implementation of green building technologies
- Implementing smart grids to reduce peak energy usage

The appealing aspect of QECBs for local jurisdictions is they are good for lowering the costs of borrowing. Federally authorized states, cities and other jurisdictions that issue QECBs pay taxable interest to bondholders biannually and receive a cash rebate from the U.S. Treasury. The rebate is the lesser of: (1) the taxable rate of the bonds or (2) 70% of the U.S. Treasury's tax credit rate on the bond sale date. States and local governments still must pay interest and principal on QECBs, but the federal subsidy reduces their interest cost while ensuring that QECBs offer an interest rate attractive to potential investors.

St. Louis County uses QECBs to fund energy efficiency loans

In 2011, St. Louis County, Missouri issued \$10.4 million of QECBs to finance the Sustainable and Verifiable Energy Savings residential energy efficiency loan program – something that had not been done before. The county used \$592,000 from its Energy Efficiency and Conservation Block Grant (EECBG) to support QECB issuance to create a QECB-funded loan pool. Loans were then offered to St. Louis County residents to finance energy upgrades.

As the first issuers of QECBs for an energy efficiency loan, St. Louis SAVES administrators were met with [many challenges](#). Among them: federal interest rate arbitrage restrictions which restrict the return a QECB issuer can earn on



St. Louis County leverages QECBs to finance energy upgrades.

loans in pooled loan programs. Loan origination fees, high issuance costs, historical preservation costs and the mandate that 10% of QECB proceeds should be used in the first six months also proved challenging.

Table 6: Summary Characteristics for Qualifying Energy Conservation Bonds

Characteristic	Score
Source of capital	Private bond buyers; partial federal subsidy
Number of parties	4 to 5: The issuing jurisdiction, U.S. Treasury, the firm/jurisdiction doing the project, the bond broker, and the investors buying the bonds
Ease of financing	5 - very difficult: These are relatively new instruments and are slow to sell on the market
Duration of financing	Medium-term: Targeted at capital projects specifically designed to improve conservation
Risk to investors	3 - medium risk: While still new these bonds must be collateralized with public revenues, a separate GO bond, or an asset; not great return
Risk to borrowers	3 - medium risk: Jurisdiction risks the collateral against the payments, but the federal subsidy lowers the borrowing costs which offsets some of that risk)
Tax implications	Jurisdictions receive an interest rate subsidy
Source of repayment	Borrower pays back principal and usually the government provides a federal tax credit in lieu of the traditional bond interest
Advantages	Good tool for low-cost borrowing targeted at energy conservation measures; provides access to the larger taxable bond market investor
Disadvantages	Slow to sell; taxable bond market investors still wary of public bonds instruments.
Disadvantages	Relatively new finance tool and unclear how deep the demand from investors is for such bond instruments though successful bond issues doubled in 2013 over the previous year

6. Social impact bonds

Structured bonds are yet another option for financing capital projects. These bonds determine the value of capital at the bond's maturity. Social Impact Bonds (SIB), also known as Pay for Success, are unlike conventional bonds that offer a fixed rate of return. The SIB payment is contingent on the social outcomes agreed upon by the investor and the issuer.

Traditionally, the issuer receives funds based not on the amount of people they serve but how well they serve them and the outcomes associated with their service. Thus, the private investors assume the risk for improvements to social outcomes. If the goals are achieved, the private investor reaps the payoff of the bonds. If goals are not achieved, the investors lose their investment in the bonds.

SIBs create a mechanism for financial return for desirable improvements. But they are new and largely in a testing phase in places like the United Kingdom, Australia, Canada and more recently in New York, Massachusetts and Ohio.

Let's look at one SIB scenario: Goldman Sachs is working with New York City on a \$10 million bond to reduce recidivism by 10% at Rikers Island, the city's biggest jail complex. It demonstrates how SIBs are ushering in a new phase of accountability and outcome-based funding – certainly noteworthy for states and municipalities as they continue experimenting with financing and implementation of green and smart technologies.

UK initiates social impact bonds with focus on outcomes

The United Kingdom's Cabinet Office of Social Outcomes Fund and the Big Lottery Fund Commissioning Better Outcomes are two separate funds that support the development of Social Impact Bonds to confront the difficulty in assessing improved social outcomes in relation to costs.

In 2012, \$98 million was allocated between both funds to facilitate the growth of SIB projects. The Social Outcomes Fund received over \$32 million to catalyze innovative projects that lead to new approaches to public services in government agencies. In 2013, the Commissioning Better Outcomes Fund received \$65 million to [help people in need lead fulfilling lives](#).

Both funds focus on measuring outcomes, as they are the basis for payment. The funds assess whether the metrics associated with the projects are suitable and robust enough to effectively [capture social impacts](#). For example, both funds expect to see:

- Impact of an intervention measured against what would have happened absent the intervention
- Outcome comparisons between the baseline, the effected group and the unaffected group
- Impact of the SIB on the service delivery of the project



UK SIBs help improve outcomes for troubled kids.

Here's a look at how an SIB is helping UK kids:

The [Essex SIB](#) supports young people ages 11 to 16 with troubled home lives or who are living away from their families. It provides help designed to improve these kids' long-term outcomes using a five-month, evidence-based therapeutic program called Multi-Systemic Therapy (MST). The program is delivered at home by qualified therapists who focus on improving parenting and rebuilding positive relationships within the family as well as the wider community. The SIB will fund two MST teams to work with approximately 380 adolescents. The key metric their pay will be based on is the number of care placement days saved for each MST cohort over a 30-month period, benchmarked against a historical comparison group. Other metrics will measure the broader improvement in social outcomes, such as school attendance and emotional well-being.

Table 7: Summary Characteristics for Social Impact Bonds

Characteristic	Score
Source of capital	Private bond buyers
Number of parties	3: The issuing jurisdiction, the bond broker and the investors buying the bonds
Ease of financing	5 - very difficult: These are very new instruments and require negotiated criteria for measuring success in determining funding
Duration of financing	Short-term: While in this early phase, most SIBs have been quick or short-term projects
Risk to investors	5 - high risk: These new instruments have almost no track record and given the varied nature of each offering it will be some time before markets will understand the instruments and be able to invest with confidence
Risk to borrowers	5 - high risk: The nature of the performance requirements from certain kinds of investments may be influenced by factors outside the control of the issuer
Tax implications	Technically there is no bond; only an agreement between the government and the agency — so there is no exemption
Source of repayment	The supporting government will pay the guaranteed return on investment only if the goals are achieved
Advantages	Appealing new instrument for targeting socially oriented investors and those interested in alternative measures of financial performance
Disadvantages	New instrument with limited performance record; a complicated instrument

7. Public benefit funds

Public Benefit Funds (PBF) typically support energy efficiency and renewable energy, although not in every case. PBFs were born out of the electric power industry's restructuring in the late 1990s as a way to fund initiatives that were inadequately supported by competitive electricity markets. They also reflect a desire on the part of states to create energy efficiency and renewable energy programs.

PBFs are essentially the collection of funds generated by a small surcharge on customers' electricity bills, no matter who the electricity provider is. The surcharge generally ensures that money is available to fund investments by publicly managed efficiency projects.

One drawback to PBFs is how they are allocated and reallocated. PBFs serve as [tempting targets](#) for state legislators and governors who need to fill state budget gaps. Although assumed to be earmarked for energy efficiency or renewable energy programs, legislators in most states control how the funds are spent. In 2003, for example, PBFs suffered raids by legislatures in four states: Connecticut, Illinois, Ohio and Wisconsin. PBFs supporting R&D and energy services for low-income citizens [have been raided](#) in California, Delaware and Massachusetts.

Although PBFs are usually established at the state level, municipalities may also establish a PBF through a dedicated surcharge or flat monthly fee to support programs.

PBFs in 17 states and Washington, D.C. provide nearly \$1 billion annually for energy efficiency improvements and related programs, according to the [Environmental Protection Agency](#).

In New York, a PBF that began in July 1998 is

Wisconsin acts to prevent PBF raiding

Wisconsin Focus on Energy supports state-wide programs that promote energy efficiency and renewable energy by providing energy assistance programs for low-income residents. Originally authorized in 1999, the Wisconsin Department of Administration originally managed the PBF program and chose to switch over to third-party program administrators. Between 2002 and 2006, a total of \$108 million was transferred out of the PBF to the state general fund for other uses. To prevent raiding, the [program was overhauled](#) in 2006 to require util-

administered by the New York Energy Research and Development Authority (NYSERDA), a semi-independent organization set up by the state government in 1975. Through the use of PBFs over the years, NYSERDA has launched 25 complementary energy efficiency programs that address different sectors, measures and market niches. The programs run the gamut from energy efficiency and renewable energy to energy programs for low-income residents, R&D and environmental protection. NYSERDA has invested more than \$350 million to support energy efficiency programs alone.



Wisconsin uses PBFs for energy assistance programs.

ities to contract directly with third-party program administrators rather than passing funding through a state government account where it is vulnerable to raids.

Table 8: Summary Characteristics for Public Benefit Funds

Characteristic	Score
Source of capital	Consumer service surcharge (e.g., utility bill)
Number of parties	1: The entity collecting the fee to use for costs
Ease of financing	2 - moderately easy: Varies by regulations over agency
Duration of financing	Ongoing: fees provide ongoing revenue for infrastructure investment payments
Risk to investors	2 - relatively low risk: Utility customers risk lost fees if agency fails
Risk to Borrowers	2 - relatively low risk: As long as sufficient fees from customers continue, revenue stream is safe
Tax implications	Not applicable
Source of repayment	Not applicable
Advantages	Relatively easy to use tool overall if the agency has guaranteed access to fee revenues
Disadvantages	Vulnerable to revenue reallocation for other needs

8. Linked deposit programs

State treasurers have some discretion regarding options for utilizing surplus state revenues. As the manager of state-generated funds, state treasurers have the authority to invest available state funds in secure loans, often at below-market interest rates, to a guaranteed return. The family of Linked Deposit Programs (LDPs) is one example. These bank loans are subsidized by corresponding “linked” state deposits.

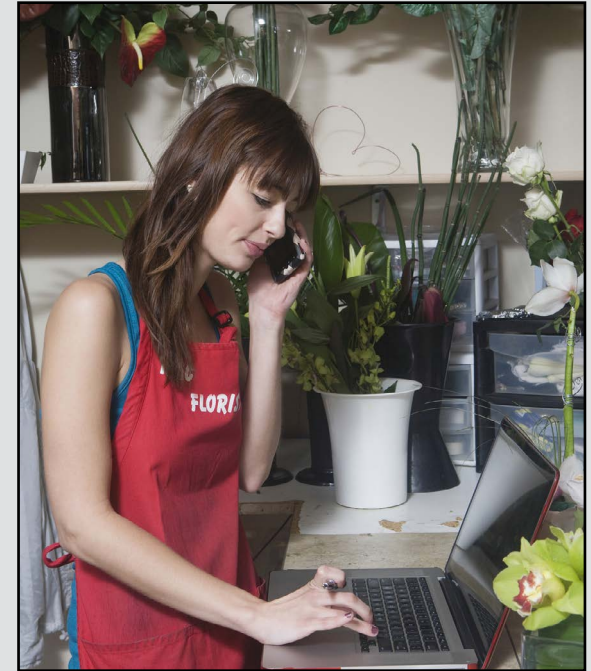
LDPs allow state treasurers to place state funds in a financial institution with below-market interest rates and, in turn, the financial institution lends the funds to a borrower. The borrower makes payments to the financial institution and the financial institution pays money back to the state treasurer. This program is mutually beneficial because the state experiences low administrative costs and the borrower receives capital for costly projects at lower interest rates.

In 2009, the state of Missouri made \$200 million in loans through LDPs. Sam’s Carpet Cleaning and Repair in the city of St. Charles was granted a \$575,000 loan through the First Bank of St. Charles to refinance its 17,850-square-foot building. Through the loan, the business owner was able to [reduce his interest rate](#) from nearly 30% to 2.15%. “Participating in the Missouri Linked Deposit program has allowed our business to lower our interest rate that will free up additional funds to invest in technology, training, and expansion,” business owner Jeff Sams said.

LDPs can also be used to fund individual borrowers seeking to upgrade infrastructure. In 1998, for instance, the Maryland General Assembly changed the governing legislation for these programs to [open the](#)

New York leads successful LDP for small businesses

In New York, LDPs assist manufacturers and small businesses obtain reduced-rate financing for projects that improve their competitiveness through better market access, product development, equipment modernization, facilities expansion and job creation. New York’s program is offered as a public-private partnership that provides businesses with affordable capital based on bank loans at reduced interest rates which are then subsidized by corresponding “linked” state deposits. To [make borrowing less expensive](#) with a maximum loan of \$2 million for four years, the program provides a 2% to 3% point savings on the prevailing interest rate for linked loans. In 2012, 187 firms received linked loans which totaled \$77.4 million coming from 72 lenders. As a result of the LDP, [some 562 jobs](#) were created.



New York LDPs provide small businesses with affordable capital.

[loans](#) to individuals to use the low-interest loans for capital improvements on private homes that reduce non-point source pollution threatening Chesapeake Bay. The limitation of the Linked Deposit programs is that they can only be used to finance certain types of projects, and the types vary by state.

Using a similar approach, cities and counties have also established LDPs. [Lucas County, Ohio](#), for

example, offers an LDP to help area businesses, builders and developers expand. And the [city of Wickliffe](#), also in Ohio, uses a LDP program to provide low-interest loan opportunities to businesses and property owners who are willing to make real property improvements.

Table 9: Summary Characteristics for Linked Deposit Programs

Characteristic	Score
Source of capital	State tax surplus
Number of parties	3: State provides investment capital, bank manages loans, businesses use loans for sustainable and other targeted upgrades
Ease of financing	4 - moderately difficult: Not all states have these programs, some are quite limited in funding, some have strict limits on eligibility
Duration of financing	Short term: Usually for projects less than two years
Risk to investors	3 – medium: However, the risk is managed by the bank which is responsible for loan approvals and is incentivized to seek credit worthiness
Risk to borrowers	2 - relatively low: Businesses or governments face lower rates and as long as they have healthy revenues should be able to make payments
Tax implications	Not applicable
Source of repayment	Borrower repays government unit that issued the financing
Advantages	A win-win for state government with a guaranteed return on investment and a significantly below market interest rate for specific kinds of projects
Disadvantages	Only available to fund certain kinds of projects

9. Energy efficiency loans

Another tool championed by an increasing number of state treasury departments is energy efficiency loans. These are low-interest loans to individuals who want to finance capital improvements to their homes. While the eligibility for types of improvements varies by state, the general intent is to lower the barriers for homeowners to upgrade their homes with more energy efficient heating and cooling systems, water recycling/reclamation equipment, insulation upgrades, door and/or window replacement and the like.

Under these plans, the government or a partnering bank makes the loan, using state money as the capital for the borrower to use in purchasing and installing the upgrades. Since the capital is state money, the interest rate can be below market rates while still covering inflation losses and yielding a small return on the investment.

The [success of this model](#) took a significant leap in 2013 when the state of Pennsylvania demonstrated the viability of a secondary market for these loans. The state bundled its 4,700 loans and sold them to a consortium of banks for cash and some deferred payments. This yielded an immediate return to the state and replenished the treasury, enabling additional loans so more citizens can take advantage of the program.

Cities are also in the business of helping fund energy efficiency upgrades. For example, Oklahoma City homeowners wanting to save money on their electric and gas bill by making their homes more energy efficient can apply for a [green home loan](#) offered through the city. [Anaheim](#) (California) Public Utilities offers low-cost financing to small businesses, some landlords and nonprofit organizations to help implement energy-efficiency measures.

Asian Development Bank supports energy efficiency with EEf loans

Asia's share of the [world's energy consumption](#) is projected to rise from 30% in 2010 to over 50% by 2035.

The Asian Development Bank (ADB), an organization that aims to end poverty in Asia, has worked to curb the consumption rate by supporting and financing energy efficiency projects.

In 2013, the ADB initiated a loan worth \$20 million for energy efficiency projects with Cofely Southeast Asia Pte. Ltd, a unit of France's GDF Suez. It was regarded as an innovative and flexible method of financing that allows Cofely to invest in building, upgrading and expanding energy efficiency infrastructure across the region.

The ADB sees energy efficiency upgrades as the most cost-effective and low-risk opportunity for sustainability. Yet energy efficiency financing can be difficult to obtain. Obstacles include scaling up investment due to a lack of awareness among business leaders and a lack of skilled experts and companies to manage the projects.

To overcome the challenges and catalyze direct



EEf loans are helping reduce energy consumption in Asia.

investments in energy efficiency projects, Cofely leveraged a business model that provides companies with a full suite of services that includes financing for the design and delivery of energy savings and subsequent measurement and verification of results. Ultimately the loan is projected to save 150,000 megawatt hours of energy, avoid 90,000 tons of carbon emissions, and yield average annual net savings of \$10 million by 2019.

In addition, ADB is implementing a \$600,000 [technical assistance program](#) to raise awareness about energy efficiency across Southeast Asia. It will bring senior business owners and leaders together to discuss the role of energy efficiency in improving sustainability and growing businesses.

Table 10: Summary Characteristics for Energy Efficiency Loans

Characteristic	Score
Source of capital	State tax surplus
Number of parties	2 or 3: State provides investment capital, state or bank partner manages loans, homeowners use loans for targeted home upgrades
Ease of financing	3 – moderate: Not all states have these programs, some are quite limited in funding, some have strict limits on eligibility
Duration of financing	Short term: Usually for projects less than two years
Risk to investors	3 – medium: State or bank is responsible for loan approvals and credit worthiness; loans are small
Risk to borrowers	2 - relatively low: Homeowners face lower rates and as long as they have healthy incomes should be able to make payments
Tax implications	No exemptions
Source of repayment	Borrower repays the government unit that issued the financing
Advantages	A win-win for state government with a guaranteed returned on investment while incentivizing efficiency upgrades in homes
Disadvantages	Only available to fund certain kinds of projects; volume could be a barrier to state capacity to process and manage loans

10. Property-Assessed Clean Energy

Property-Assessed Clean Energy (PACE) represents one of the [newest mechanisms available](#) for financing energy efficiency and renewable energy improvements. This program allows property owners to borrow against their property taxes to fund energy efficiency improvements. Between 2009 and 2010, 24 states authorized programs that allow local governments to create PACE financing programs. To date, only a few have [taken advantage](#) of this tool.

The loans are repaid primarily through assessments on the property under a contract between the local unit of government and the property owner. By allowing participating property owners to pay for energy improvements to their properties via a bond tied to a special assessment allows property owners to reduce energy costs with no upfront investment. In case of nonpayment, any interest or penalty on an assessment would constitute a lien against the property until paid in full. PACE assessments are secured by a lien on property and typically have the same priority as real estate taxes or are one step below, making them senior to any non-tax liens, including claims of the mortgage holder.

The largest benefit of the PACE program is that payments are bundled with a familiar bill (the property tax bill), which is a good indication of payment history. Also, longer repayment terms reduce the bill and the debt can even be structured to stay with the property through new ownership.

Drawbacks to the PACE program include the Federal Housing Finance Agency (FHFA) determination on lien status and mortgage industry resistance. In 2010, FHFA decided that programs with first liens (PACE would take priority over a mortgage in the event a homeowner defaulted on the assessment) were ineligible because they were contrary to the

HERO program uses PACE as finance option for energy efficiency upgrades

Officials in California's Western Riverside County looked for affordable and reasonable ways to help homeowners finance energy efficiency upgrades and retrofits. The Western Riverside Council of Governments created the [HERO Financing Program](#) as a way for homeowners to finance and pay off energy upgrades over time. The program allows private property owners to pay for permanently affixed energy and water efficient products and renewable energy systems over time through their property taxes. This is possible because energy efficient upgrades improve home and property values, thus they are paid as an assessment on the



The PACE-funded HERO program has a successful track record.

property through the homeowner's tax bill over five to 20 years. The HERO program has a proven track record of successfully financing clean energy improvements. It is reportedly the largest and most successful privately funded residential PACE program in the country and has received more than 10,000 applications from homeowners, created 2,000 construction jobs and approved more than \$194 million in financing.

Fannie Mae-Freddie Mac Uniform Security Instrument. That decision put the program on hold in many PACE states. The terms of the Fannie Mae/Freddie Mac Uniform Security Instruments prohibit loans that have senior lien status to a mortgage.

In May 2011, the Vermont legislature modified its PACE program. In response to the FHFA determination on PACE liens, [the legislation specified](#) that PACE liens are subordinate to existing liens and first mortgages but superior to any other liens on the property recorded after the PACE lien is recorded (except for municipal liens, which also take precedence over the PACE lien). The legislature also created a

state PACE reserve fund to reduce risk for potential investors interested in investing in a municipality to finance a PACE district. An amount equal to 5% of the assessment (not to exceed \$1 million) is transferred from Regional Greenhouse Gas Initiative/Forward Capacity Market funds to an escrow account managed by the Vermont state treasurer. This is expected to provide funds to cover 90% of losses due to defaults of participating properties not covered by the reserve account.

Table 11: Summary Characteristics for Property-Assessed Clean Energy Programs

Characteristic	Score
Source of capital	Local government
Number of parties	2: The local government and the homeowner borrowing against property taxes
Ease of financing	4 - moderately difficult: Requires significant coordination and additional monitoring upon completion of the voluntary assessment to be added to tax bill
Duration of financing	Short to medium term
Risk to investors	4 - moderately high risk: Assessment ties to property on which a lien can be placed for nonpayment of the debt, but recent legal developments have raised concern on the order of PACE lien
Risk to borrowers	4 - moderately high risk: Homeowner faces the added costs from assessment which if not paid can lead to loss of the home
Tax implications	Not applicable
Source of repayment	Property owner repays the debt on the bond usually in fixed payments as part of the tax bill on the property on which the improvements are being made
Advantages	Provides a tool for local governments to finance smart energy project loans using the homeowner's home equity as collateral
Disadvantages	Confusion in legislation over the lien order has dampened interest in this tool for the time being

11. Greenhouse emissions allowance auctions

Recognizing climate change as a significant environmental problem for which traditional markets were not internalizing the costs, nine states — Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont — decided to confront the issue by joining the [Regional Greenhouse Gas Initiative](#) (RGGI) cap-and-trade program launched in 2009.

The states pool their total emission allowances and sell them in an auction format, thus becoming a market-based entity for regulating greenhouse gas emissions. By capping power plant emissions and selling those emissions through auctions, the costs from pollutants are better internalized in the operations of the plants (and subsequently to the consumer through higher prices). By introducing the pricing for the negative externalities of the pollution into the energy product, producers have incentives to lower their emissions. States use revenues generated from the auctions to finance clean energy programs to offset and lower net pollutants.

In [Delaware](#), approximately 65% of auction proceeds were used for a household and business sustainable energy program called Sustainable Energy Utility. In [Connecticut](#), nearly \$2 million went to sustainable and renewable energy programs. According to the [RGGI](#), it has made a \$617 million investment in the region's energy future by reducing energy bills, helping businesses become more competitive, accelerating the development of local clean and renewable energy sources and limiting the release of harmful pollutants into the air and atmosphere, while spurring the creation of jobs.

Western Climate Initiative crosses national boundary with cap-and-trade program

California's Air Resources Board launched the state's cap-and-trade program to help curb greenhouse gas emissions. Compliance with emission guidelines began in 2013. Still in the early stages, California has already joined with Manitoba, Quebec, Ontario, and British Columbia in the Western Climate Initiative (WCI). Its goal is to align the cap-and-trade programs from each jurisdiction to establish a wide area covered by a standard program. These jurisdictions have formed a nonprofit to coordinate the trading programs in each area. California and Quebec's were aligned as of October, 2013. The work with the other jurisdictions in the WCI continues.



California's program takes aim at greenhouse gas emissions.

Table 12: Summary Characteristics for Greenhouse Emissions Allowance Auctions

Characteristic	Score
Source of capital	Private firms paying for allowances
Number of parties	2: Firms buy the allowances; states collect revenues which can then be utilized to fund other projects
Ease of financing	2 - relatively easy: Challenge is establishing the auction market initially
Duration of financing	Quick: Auction sales can be done very quickly
Risk to investors	1 - very low risk: This is more of a mechanism to raise capital from polluters to pay for alternatives; there really are no investors per se
Risk to borrowers	1 - very low risk: The firms buying the allowances are not technically borrowers as this is just a purchase
Tax implications	Not applicable
Source of repayment	No loan to repay; proceeds from auction are used to fund consumer assistance programs and other renewable energy initiatives
Advantages	This is a market-driven method for capturing negative externalities associated with pollution to build funding for programs to combat pollution; a relatively easy program to implement logistically
Disadvantages	Challenging to implement politically as high-polluting industries make an unfairness argument; lack of information on how revenues will be utilized due to quickly evolving state legislative efforts

12. User fees

User fees allow cities and other local jurisdictions to impose fees to cover the cost associated with funding services and enhancements to increase the quality of life and cover administrative and regulatory processes. Not to be confused with taxes, user fees are paid by choice, for example, paying a toll to drive in highway express lanes. Taxes, on the other hand, are compulsory and support government operations across the board.

In addition to assigning project costs to project beneficiaries, the attractive thing about user fees is that they can be used to secure financing to fund all or parts of large capital projects.

According to the National Association of State Budget Officers, states brought in an additional [\\$1.5 billion in user fees](#) from 2010 to 2013. The benefits of user fees are obvious; the more fees that municipalities collect, more enhancements can be made to city infrastructure tied to those user fees.

However, user fees often face criticisms. Some citizens disagree with the idea that the individual who uses a road, for instance, should be the one to pay a toll (as opposed to the road being paid for by the community as a whole and thus subsidizing his/her individual usage costs). Given the positive externalities of many infrastructure projects, user fees raise some challenging issues. And not all citizens have the ability to pay, which can pose another challenge for cities promoting implementation of smart technologies.

User fees help Toronto reduce \$500 million budget deficit

In 2009, the city of Toronto experienced a \$500 million budget deficit. Under Canadian law, cities cannot run a budget deficit, so the city had to either increase revenues through taxes and fees, or cut expenditures to balance its budget.

After considering other options, city leaders decided to implement user fees on a set of city services. In 2010, residents had to pay user fees for:

- The convenience of paying a parking ticket by phone or online. Residents paid \$2 for the service — 50 cents more than the previous fee.
- Residents who bought a new home and needed to create a property tax account were charged a \$50 fee.
- Residents with existing property tax accounts were charged \$50 to make changes to their



Toronto raised user fees for renting city facilities to help reduce a budget deficit.

- property tax bill, which was \$15 more than it cost to [make billing changes](#) in 2009.
- The cost of taking a city-run program or renting a city-run facility cost about 3.7% more, and was projected to bring in \$396.3 million in [extra revenue](#).

Other [fee increases](#) included a \$50 registration for families signing up for city recreation programs, gym rental fees and drop-in swim fees.

Table 13: Summary Characteristics for User Fees

Characteristic	Score
Source of capital	Public
Number of parties	2: Public jurisdiction effectively shoulders the costs of service/infrastructure investment and dedicates the fee stream from private users to repayment
Ease of financing	1 - very easy: Jurisdiction uses available resources to effectively make the upgrade investment and then replenishes the costs by collecting user fees
Duration of financing	Scalable
Risk to investors	2 - relatively low risk: As long as the jurisdiction is confident revenues from fees will be sufficient, then the upfront funding can be recouped over time after the costs of the upgrade
Risk to borrowers	1 - very low risk: Users are not technically borrowing, they are paying for a service or use of infrastructure outside the tax system so no risk to them
Tax implications	Not applicable
Source of repayment	Users of the financed asset
Advantages	Ease of administration; speed of implementation; benefits principle as users see better the true costs of their services
Disadvantages	User fees need to be sufficient to repay upfront costs; ability for lower-income citizens to pay may raise fairness issues

Chapter 4: Development Exactions



Government-based financing tools are the most common for funding unproven smart technologies, but they are not the only options available for capital projects. A second set of financing tools highlight the regulatory power of governments to force developers to pay for the infrastructure services their developments will utilize. These developer exaction tools consist of conditions or financial obligations imposed on developers that help local governments cover the marginal cost increases and load burdens caused by the development. Some of the additional revenue can also be used to provide additional public facilities or services required due to the new growth.

With exactions, the intent is to protect the public from the negative effects associated with growth. Exactions also protect the community from the increased cost of providing infrastructure by passing a portion of the cost on to the developer at the time of development to synchronize the payment of infrastructure.

Cities are [increasingly relying on exactions](#) to help finance the impacts of new growth on public

facilities due to budget shortfalls, cuts in state aid and taxpayers' unwillingness to increase tax rates. Studies have indicated that many of the fees and increased costs developers pay are ultimately passed on to consumers.

All exactions are types of impact fees that require developers to pay for the impact their new development has on the community. Impact fees can also serve as a strategy to implement new policies and plans for sustainable growth. For example, the state of Florida is considering mobility fees which essentially reward developments that are located closer to urban centers. Those farther out will pay more and ideally those fees will contribute to the future development of sidewalks and bus service in areas targeted for increased density.

Although there are a number of ways to extract fees from developers, there are limits to local government exactions. There are numerous examples of developers suing jurisdictions over excessive fees. The onus is on local governments to demonstrate the need for and impact of any fee they want to impose

on a developer. Jurisdictions must also have a standard way to measure the impact of such fees.

It's important to understand the unintended consequences of exactions. For instance, inter-generational inequity can occur if developers are disproportionately paying for long-term facilities. In other words, newcomers may not be paying enough in fees and the developers may be paying too much. To have successful impact fee programs, jurisdictions must ensure that they are considering the long-term needs of their community and adequately estimating how to meet them.

In this chapter we'll look at four types of exaction fees:

1. Developer dedication requirements
2. Tap fees
3. Linkage fees
4. Impact fees



There are a number of examples of developers suing governments over excessive fees.

Notable cases put exaction laws on trial

Laws surrounding development exactions in the U.S. have been largely contested and continue to evolve as more individuals litigate issues of adjudicative or legislative exactions. The most commonly cited rulings are [Nollan v. California Coastal Commission](#) and [Dolan v. City of Tigard](#) in which both plaintiffs questioned whether certain exactions were constitutional under the [Fifth Amendment's Takings Clause](#) and if certain exactions [are improper or excessive](#).

In the case of *Nollan v. California Coastal Commission*, California's Coastal Commission allowed the replacement of a small beach-front bungalow by landowners but required them to grant a public easement across their property on the beach. The Commission argued the new, larger house would interfere with visual access and create a "psychological barrier" to using the beach. The Supreme Court found that the condition was unconstitutional in that it had no logical connection to the harm the Coastal Commission sought to address by requiring an easement to provide access to people already on the beach.

In the case of *Dolan v. City of Tigard*, Dolan was the owner and operator of a plumbing and electrical supply store. She applied for permit approval to expand her business, but approval was conditioned on her 1) dedicating a portion of her land to a greenway for drainage along a creek because her property was in a flood plain and 2) developing a bike path the city said was needed to ease traffic congestion. The Supreme Court agreed with the city that there was a connection between the drainage and pathway; however ruled the exaction unconstitutional, suggesting the city failed to show that the conditions were "roughly proportional" to the negative impacts caused by expanding her business.

These are just two of many exaction cases that have gone to court with mixed outcomes.



A Tigard, Oregon exaction fee dispute went all the way to the Supreme Court.

1. Developer dedication requirements

Dedication requirements are commonly found in city and town ordinances as part of the land use and zoning regulations for new development. Typically these ordinances require developers to donate land and/or facilities for public use. For example, a city might make approval of a new subdivision contingent on the developer creating a new park, dedicated open space, sidewalks or cash-in-lieu of these costs.

The thinking on dedications is the city's existing residents should not subsidize developers who bring in new residents. Rather, the additional infrastructure costs demanded by the new subdivision should fall to the developer and its new residents.

This logic suggests that dedication requirements could extend to smart growth technologies. For instance, a city could require that streets within a development be constructed with specific kinds of materials, that the development not exceed a certain threshold of non-permeable ground cover (to mitigate stormwater runoff), or that water reclamation systems be installed in the homes in water-challenged areas so gray water could be recycled for watering public spaces. These requirements internalize the environmental impact costs associated with new development. They could go even further to require (as opposed to simply incentivizing) smart, green and/or intelligent design technologies in new residential and business developments.

How two jurisdictions impose developer dedication requirements

Dedication requirements vary across communities and states. Here are two examples of their use:

Colleyville, Texas set a goal of 12.93 acres of park land for every 1,000 new residents. As a result, the city requires one acre of park land be dedicated to the city for every 25 new residential dwelling units. [Colleyville also requires](#) that non-residential developments provide dedicated parks and/or reserved open space at a ratio of one acre of park land for every 56 non-residential gross acres of development or prorated portion thereof.

Douglas County, Colorado requires all adjacent roads around a new development be paid for by the developer. In addition, the county requires



Governments often use dedication requirements to obtain additional parks.

the dedication of park space (or cash-in-lieu) at a rate that achieves [the county's goal](#) of 15 acres/1000 population:

- Local park = Dwelling units x 0.015 acres/unit
- Regional park = Dwelling units x 0.030 acres/unit
- Total = Dwelling units x 0.045 acres/unit

Table 13: Summary Characteristics for Developer Dedication Requirements

Characteristic	Score
Source of capital	Private developers and new residents
Number of parties	2: Local jurisdiction receiving the dedication and the developers that provide the dedication
Ease of financing	3 - medium easy: Once ordinances are in place the tool is easy; getting the ordinances in place is challenging due to resistance from the developer community
Duration of financing	Quick: Dedication available during development
Risk to investors	3 - medium risk: Those investing in the new development risk higher prices per unit due to the dedication demands and this can push the price point up on new housing and slow sales
Risk to borrowers	1 - very low risk: Approval of new developments are contingent on the delivery of the new asset to the jurisdiction; not tied to the success of the development
Tax implications	None relative to any borrower, though the land dedicated to public use may be removed from the tax rolls and represent foregone tax revenue
Source of repayment	No repayment; the dedication of additional land for public use is an additional cost for the developer who will likely pass it along to buyers
Advantages	An easy tool to use once adopted as a local land use practice; codifies a balance between development and growth goals with amenity and infrastructure needs
Disadvantages	Often meets with resistance from developers; can interfere with growth plans if nearby communities do not have similar requirements

2. Tap fees

Tap fees are another option local jurisdictions use to force upfront payments to cover costs associated with growth. These utility connection fees are used to fund capital improvements and recover the cost of integrating new development into existing infrastructure. The primary use of tap fees is to cover the cost of tying water meters for new connections to existing lines. Some jurisdictions also use tap fees to cover the cost of sewer line inspections.

The amount charged for tap fees vary. In South Carolina, the Charleston Water System charges a \$500 tap fee for a ¾" water line tap (typical for most residential homes) and \$200 for a sewer line tap of six inches or smaller.

Other communities use flat fees or fees scaled by unit size or scaled by lot size. Avon, Colorado uses a combination in which all residential units pay a tap fee of \$4,000 for a 3,000 square foot home and an additional \$2 per square foot is tacked on after that.

Michigan city waives tap fees to spur residential development

City council members in Tecumseh, Michigan went along with a recommendation from their city manager to temporarily [waive sewer and water tap fees](#) as an incentive to residential builders.

"It would be kind of an experiment, because I don't believe we've ever done this before and not too many communities have," City Manager Kevin Welch said in a Tecumseh Herald report. "I'd like to suggest that we offer this program whether it's a construction company or a homeowner who builds a new residential home."

Noting the city has incentives for industrial development but not residential, he suggested waiving fees is one of the few things Tecumseh can offer to help stimulate development.



Kevin Welch

Fee waivers began in April 2013 and will continue through June, 2016. For one year after that they would be 50% of what they were before the waiver and then effective July 2017 the tap fees will revert to what they were in March 2013.

Table 14: Summary Characteristics for Tap Fees

Characteristic	Score
Source of capital	Private developers and new residents
Number of parties	2: Local jurisdiction receiving the fee and the developers who pay it
Ease of financing	3 - medium easy: Once ordinances are in place the tool is easy; getting the ordinances in place is challenging due to resistance from the developer community
Duration of financing	Quick: fee available during development
Risk to investors	3 - medium risk: Those investing in the new development risk higher prices per unit due to the tap fee demands and this can push the price point up on new housing and slow sales
Risk to borrowers	1 - very low risk: Approval of new developments are contingent on the delivery of the tap fee to the jurisdiction; not tied explicitly to the success of the development
Tax implications	Not applicable
Source of repayment	No repayment; the cost of the tap fee is an additional cost on the developer who will likely pass it along to buyers
Advantages	An easy tool to use once adopted into local land use practice; codifies a balance between development and growth goals with amenity and infrastructure needs
Disadvantages	Often meets with resistance from developers; can interfere with growth plans if nearby communities do not have similar requirements

3. Linkage fees

A third type of developer exaction is the linkage fee, which has been a tool in use across many communities for over 20 years. With this approach, the city charges developers a fee for a new development, usually based on percentage of sales price.

Unlike dedications and tap fees that pay costs directly related to the development project, linkage fees pay for the secondary effects of development. Examples might include charging housing developers to offset traffic increases or commercial developers to help fund affordable housing so the people who work in the new buildings can afford to live in the community.

Linkage fees are commonly (though not always) collected from large-scale commercial, industrial and multi-family developments. Some cities do not use linkage fees as a way to keep costs down to attract new development. Others use them aggressively.

In November, 2013, the San Diego (California) City Council voted to [increase linkage fees fivefold](#) over a three-year period to raise capital to develop affordable housing, which the city lacks.

Boston linkage fees: “One of the best tools we have for creating affordable housing in the city”

Boston, Massachusetts began collecting a linkage fee in 1984 after grassroots organizations in the city pushed for them out of growing frustration with inequities between the city’s downtown/big business area and its neighborhoods.

It requires new commercial developments over 100,000 square feet that require zoning relief to pay linkage fees that support the Neighborhood Housing Trust and the Neighborhood Jobs Trust fund. In 2001, then-Mayor Tom Menino [called the linkage fee](#) “one of the best tools we have for creating affordable housing in the city.”

Despite legal challenges early on that forced



Boston linkage fees support affordable housing and jobs.

the Commonwealth of Massachusetts to pass legislation allowing the fee to be implemented, the program has been a success, [collecting \\$45 million](#) for affordable housing and jobs since its implementation.

Table 15: Summary Characteristics for Linkage Fees

Characteristic	Score
Source of capital	Private developers and business owners
Number of parties	2: Local jurisdiction receiving the fee and the developers that provide the fee
Ease of financing	3 - medium easy: once ordinances are in place the tool is easy; getting the ordinances in place is challenging due to resistance from developers
Duration of financing	Quick: Fee available during development
Risk to investors	3 - medium risk: Those investing in the new development risk higher prices per unit due to the linkage fee demands and this can push the price point up on new housing and slow sales
Risk to borrowers	2 - relatively low risk: Approval of new developments are contingent on the delivery of the fee to the jurisdiction; not tied explicitly to the success of the development
Tax implications	Not applicable
Source of repayment	No repayment, though the cost of the linkage fee is an additional cost on the developer who will likely pass it along
Advantages	An easy tool to use once adopted into local land use practice; codifies a balance between development and growth goals with amenity and infrastructure needs
Disadvantages	Often meets with resistance from developers; can interfere with growth plans if nearby communities do not have similar requirements

4. Impact fees

As with other developer exactions, impact fees impose a fee on developers to fund additional service capacity required by the development. The intent is to offset the additional costs to a community caused by new growth.

This tool has been around since the middle of the 20th century but its use has steadily increased in recent decades as federal support to local governments decreased. Initially designed to offset environmental costs associated with new development – sewer capacity increases and storm water runoff, for example – impact fees have evolved. Over time their use has expanded to cover the cost of new roads, additional public safety staff, more schools, etc. that are needed as a result of new development.

The size of these fees varies across communities. Some do not charge impact fees. Other communities charge significant impact fees. But in most places, the fee is capped at the maximum cost to provide the infrastructure targeted by impact fee enabling legislation passed by state government. Even within a state's cap, impact fee structure varies widely among communities.

Legislation also typically limits impact fees to infrastructure (broadly construed) and not to other public programs or city operating costs. However, conversion costs to smart and green technologies that are part of a city's broader initiative to implement advanced technologies for infrastructure upgrades would likely apply.

Philadelphia levies impact fees for stormwater program

Traditional methods of levying fees for public works have changed in recent years to align with more environmentally sustainable policies. In 1972, the U.S. Congress passed the Clean Water Act (CWA), which regulates the discharge of pollutants in water. The CWA made municipalities responsible for preventing stormwater runoff from polluting rivers and streams. This launched stormwater programs across the country.

The city of Philadelphia, Pennsylvania, for example, sought to capture rainwater before it enters the city's 3,000-mile sewer network. So Philadelphia implemented a parcel-based stormwater billing practice. It stopped charging property owners by their water usage and [began assessing fees](#) based on the ratio of the property's impervious surface area that either constricts or prevents water absorption into the soil (roofs, paved area, hardscapes, compacted dirt, gravel) to its absorbent surface (grass, rain gardens, ponds). To lower fees, business owners were encouraged to retrofit their properties to qualify for a credit available to property owners who could demonstrate management or retention of the first inch of stormwater.

The program didn't go over well in Philadelphia's business community, which experienced



Philadelphia implemented parcel-based stormwater billing.

skyrocketing fees and no upfront funds to retrofit their property. [One business owner](#) saw his stormwater management bill jump from \$15,000 to \$120,000.

So the Unified Business Owners Association of Philadelphia proposed changes in the stormwater billing program, namely capping fee hikes at 10% annually. That didn't solve all of the problems though. Some business owners lacked the capital to retrofit their properties and couldn't qualify for credits. New initiatives often require a number of attempts to strike an appropriate balance – and along the way they provide valuable "lessons learned" for others.

Table 16: Summary Characteristics for Impact Fees

Characteristic	Score
Source of capital	Private developers and home buyers
Number of parties	2: Local jurisdiction receiving the fee and the developers that provide it
Ease of financing	2 - relatively easy: Once ordinances are in place the tool is easy; getting the ordinances in place is challenging due to resistance among the developer community
Duration of financing	Quick: Fee available during development
Risk to investors	3 - medium risk: Those investing in the new development risk higher prices per unit due to impact fee demands and this can push the price point up on new housing and slow sales
Risk to borrowers	2 - relatively low risk: Approval of new developments are contingent on the delivery of the fee to the jurisdiction; not tied explicitly to the success of the development
Tax implications	Not applicable
Source of repayment	No repayment, though the cost of the impact fee is an additional cost on the developer who will likely pass it along
Advantages	An easy tool to use and one that has become commonplace in the development community; codifies a balance between development and growth goals with infrastructure and service needs
Disadvantages	Developers argue that these fees hurt their bottom line and limit their ability to do additional developments, thus undermining local economic development efforts

Chapter 5: Bringing the Public and Private Sectors Together



Between federal government support waning and lingering effects of the global financial crisis, [fiscal strain has become a mainstay](#) for many public agencies. Yet the increasing challenges of urbanization make it imperative that the public sector find creative ways to finance smarter, more sustainable cities.

With this fourth type of financing option we shift from the coercive role of government jurisdictions to a more collaborative approach where public sector and private sector interests work together on a shared project.

This partnering approach has received increasing attention over the last 25 years. Public officials recognize that the private sector traditionally has access to larger pools of capital — human, knowledge and financial. And working with the public sector has distinct advantages for the private sector in terms of zoning and access to public spaces.

Today the challenge in many areas is determining which services or parts of service delivery are best

managed by the public sector and which might be better managed by private or nonprofit partners.

New arrangements involving partnerships with the private sector, nonprofits and international non-governmental organizations are emerging with increasing regularity. Here are two examples:

- The Philippines established the Public Private Partnership Center as an extension of the national government to aid in the formation of government-private sector collaborations for public infrastructure delivery. One project has transportation officials working with private vendors to replace a magnetic-based ticketing system for collecting transit fares on light rail lines with contact-less smart card technology.
- The Republic of South Africa created a Public Private Partnership Unit as part of the National Treasury to support collaborations between private vendors and government units. For instance, the city of Johannesburg partnered with a local firm for the procurement and operation of an alternative waste treatment facility.

We'll look at four public-private financing vehicles in this section:

1. Public-private partnerships
2. Pay for performance
3. Securitization and structured finance
4. Catastrophe bonds

1. Public-private partnerships

Public-private partnerships – sometimes referred to as PPP or P3 – are agreements between a public agency (federal, state or local) and a private-sector entity that uses the specific skills and assets of each sector for the delivery of a service for the general public. P3s are probably the most complicated and least understood financing tool available to cities, but one that more and more cities are embracing.

These partnerships can take many forms, but they generally seek to balance responsibilities, risks and rewards among all parties involved. They align the public good with commercial objectives designed to enhance the private sector's bottom line.

Cities interested in investing in smart technologies, for instance the contact-less transit ticketing system mentioned earlier, face substantial upfront costs. For most jurisdictions this poses a challenge due to constrained budgets. Yet partnerships with private sector companies are particularly useful because they can offer technical support, capital funding and oversight of operations. This was the case when the city of Dallas Water Utilities (DWU) partnered with Ameresco, an energy efficiency and renewable energy company, to open an [innovative biogas energy recovery facility](#). Dallas expects to save at least \$1.5 million annually, and offset approximately 60% of the electricity that the DWU pulls from the grid.

P3s are not without challenges. They require sound financial management, project evaluation, clear procedures and responsibilities and allocation of risk. When those elements are lacking, P3s can fail. Consider Mexico's P3 venture on an ambitious road concession program widely regarded as a [dramatic failure](#). Between 1987 and 1995, it awarded 52 concessions totaling over 3,293 miles of toll road. By 1993, many of the concessions had to be renegotiated and in 1995, the government was forced to take over 23 of them, creating a large and immediate financial burden. This was caused in part by construction costs that ran 25% over budget and revenues that ran 30% below forecasts. In the end, lack

How Quincy is using creative problem solving to revitalize its downtown core

One of the oldest cities in the U.S. – Quincy, Massachusetts – formed a public-private partnership to revitalize the city's declining central business district into a model of the future. The city's partner, Street-Works, is a development firm that specializes in the creation of mixed-use districts and public spaces. [Quincy partnered with Street-Works](#) with a vision of financing the infrastructure improvements through new income generated by development-specific revenue and supplemented with parking garage revenues.

Targeted to begin construction in 2015, Street-Works expects completion in 2020. The \$1.6 billion development with \$340 million of public improvements includes 700,000 square feet of retail space, 1,400 residential units, over 1 million square feet of office space, and two hotels.

Prior to entering the partnership, Street-Works spent more than \$18 million purchasing land. The firm also assumed the upfront risk for permitting and building the public improve-



This rendering shows Quincy's ambitious downtown project.

ments, securing rights to all private land in the development area, guaranteeing a 4-to-1 ratio of private-to-public dollars in the overall project, and leasing tenant space in advance.

This is a non-traditional approach; typically municipalities pay for public improvements before the private sector starts construction. Instead, Quincy will purchase the infrastructure from Street-Works for \$289 million. This public-private partnership has enabled both entities to acquire financing for the public improvements sooner and more easily than they could have on their own.

Strong leadership and a trust relationship between both entities is a hallmark of this public-private partnership. Yes Quincy assumes some risk, but the benefits that will accrue from this public-private partnership outweigh it.

of supervision over the partnerships undertaken in the toll program resulted in a government bailout that cost the country \$9.9 billion. Clearly, upfront planning and ongoing oversight are critical factors for successful public-private partnerships.

Table 17: Summary Characteristics for Public-Private Partnerships

Characteristic	Score
Source of capital	Combination of public and private funding
Number of parties	2 or more: Partnerships can involve at least one government and at least one private or nonprofit entity
Ease of financing	5 - very difficult: Striking a balance between all parties in terms of risk exposure and shared benefits can be a lucrative endeavor but challenging to bring together with high oversight requirements
Duration of financing	Varies: Usually short- and medium-term arrangements
Risk to investors	Varies: Depends on the source of the funding each party brings to the joint project; risk should be determined by those finance options combined with an assessment of the likelihood the partnership will succeed
Risk to borrowers	Varies: Depends on the source of the funding each party brings to the joint project and the exposure to risk if the partner fails to succeed in their contribution to the project
Tax implications	Not applicable
Source of repayment	P3s typically do not involve loans requiring repayments but are more often characterized by contractual arrangements that specify possible fees for service
Advantages	Well-structured P3s can provide public entities good access to private capital and talent; can have political value
Disadvantages	Structuring P3s is challenging in trying to spread risk; public entities must recognize private motivations and must include costs for overseeing the project

2. Pay for performance

Pay-for-performance contracts (or performance contracts) are similar to the social impact bonds discussed in Chapter 3. They are commonly used today for energy-related projects. Performance contracts usually involve a private-public partnership where the private sector works with the public sector to implement a new more efficient or more sustainable technology. In most cases, the private sector business will offer financing for equipment, repairs and new developments. In exchange, both entities enter into a performance contract where the private partner identifies and recommends efficiencies that can be paid for through the savings realized. Typically upgrades are guaranteed to the point that savings will meet or exceed annual payments and cover all project costs. Should the anticipated savings not materialize, then the private partner pays the difference.

Pay-for-performance contracts can be very beneficial for both public and private partners. The contracts provide financing as well as project development and implementation costs. The owner gets the immediate advantage of savings from reduced consumption without making a capital investment or assuming debt.

But there are drawbacks to performance contracts. Projects financed with performance contracts are more expensive and less capital efficient. The owner will pay higher (non-tax exempt) interest rates – two to three times higher than tax-exempt rates by relying on performance contract financing.

In 2012, the World Bank convened the Methane Finance Study Group to examine pay for performance as a potential financing mechanism to incentivize

Unexploited solar potential leads to \$1 billion in international investments

Developers of commercially unproven technologies can find it difficult to enter into their respective competitive market. Assistance furthering such technologies largely comes from government subventions and private investments. According to the International Energy Agency, concentrated solar power (CSP) technology has enormous unexploited potential as a reliable source of renewable energy. This is especially true in the Middle East and North Africa region, which has plentiful solar resources and good proximity to European Union energy demand.

The government of Morocco, a group of development banks and private-sector developers came together to develop the first phase of a 500mW, \$1.3 billion CSP facility. The partner-



Morocco's CSP facility will be one of the world's largest.

ship's contractual arrangements require in part that the facility achieve specific performance benchmarks in terms of solar contribution to the plant's overall power generation. The World Bank, African Development Bank, European Investment Bank, Germany's KfW and the Clean Technology Fund are all supporting Morocco's solar plans with loans over \$1 billion. When complete, the full complex will be one of the largest [CSP systems](#) in the world.

reductions in methane emissions. Its report highlights numerous opportunities for [structuring these programs](#) to lower capital costs and achieve lower emissions with funding from international development banks with or without public sector participation.

Ameresco, an energy efficiency and renewable energy company, signed an [Energy Savings Performance Contract](#) (ESPC) with the Kalispell (Montana) School District in 2013. School administrators want-

ed upgrades to the district's cooling and heating systems but did not want to impact taxpayers. As part of the ESPC, Ameresco agreed to install over \$3.29 million worth of energy efficiency improvements in 12 public school buildings. The district expects annual savings of \$140,569 as a result. In this arrangement, Ameresco coordinated the upfront project costs and the district will repay that investment with its energy savings over time.

Table 18: Summary Characteristics for Pay for Performance

Characteristic	Score
Source of capital	Public funds project with projected savings and private partner covers difference if savings fail to materialize
Number of parties	2: One government and at least one private or nonprofit entity
Ease of Financing	2 - relatively easy: Uses other public financing for capital but back-stops payback from private partner if savings from investment project fail to cover debt payments
Duration of financing	Varies: Determined by source of primary public funding
Risk to investors	3 - medium risk: Depends on the source of the primary public funding but is mitigated somewhat with the performance guarantee from the private partner to ensure debt payments if the jurisdiction cannot pay from the project savings
Risk to borrowers	2 - relatively low risk: Public's risk is mitigated by partnership with private partner; private partner's exposure is on the estimation of the savings expected to the public jurisdiction from which it pays the debt
Tax implications	Not tax exempt
Source of repayment	Savings from the improvements being financed are supposed to cover the repayment costs, but if the savings fail to reach that point, the borrower covers the difference
Advantages	Can lower risk from public's perspective while providing public entities good access to private capital and talent
Disadvantages	Estimates of expected savings from the investment needs to be realistic in order to establish primary public financing; such contracts are usually more expensive sources of capital

3. Securitization and structured finance

Evidenced by the 2008-2009 global financial crisis, financing projects can pose a significant risk to public and private investors alike. Increasingly today investors are mitigating their risks by using financing instruments that secure their investments and lessen their risk. This can be done a number of ways but a key instrument is securitization through structured financing.

Though this method of financing carries significant risk when not regulated properly, it's an option that states, municipalities and private sector investors can select to support clean technologies. In 2011, [Barclays and Accenture estimated](#) that \$1.9 trillion in financing could be created for low-carbon technology (LCT) through securitization of long-term LCT loans and leases as asset-backed securities. (See Green Bonds section in Chapter 3.)

Structured finance is a complex financial transaction by entities with financing needs that do not match traditional loan structures. A popular structured finance tool is securitization. Securitization is the pooling of various revenue-generating assets and selling shares to investors. After the mortgage collapse of 2008 and 2009 and the ensuing financial crisis, [securitization was heavily criticized](#) for its inherent complexity and limited ability for investors to monitor risks, thus playing an integral role in the U.S. subprime mortgage crisis.

The concept behind securitization is that similar investments such as commercial mortgages, credit card debt or auto loans can be packaged in a larger portfolio to generate immediate revenue from long-term revenue streams as well as diversify risks. This is a particularly useful instrument in implementing new technologies because the cost of individual investments may be too much, but a group of invest-

ments together makes more financing sense. For example, the renewable energy industry's enormous need for capital offers an attractive investment opportunity and solar securitization could be the right solution for investors.

Securitization typically requires a package of loans that meet a certain monetary threshold (e.g., \$100 million). Meeting the threshold can be difficult for technology projects, unless one is considering large-scale development of new cities. For instance, real estate developers Soroush Real Estate of Abu Dhabi marketed a \$1.9 billion securitization of future contract receivables to monetize future cash flows from the [sale of real estate plots](#) to fund the eventual development of 28 mid- and high-rise residential, commercial, hotel and serviced apartment buildings.

If there is not sufficient project volume to create robust pools of projects, then investors are not able to leverage those pools. Also, venturing into asset-backed securities is new for individuals in the sustainability business. As a new asset class, there is little default or foreclosure experience to rely on in developing an expected loss proxy. Also, understanding and consensus on methods of accurately rating new technologies can impede securitization. Even once there is a consensus on rating new technologies, the question becomes whether there will be buyers. Other concerns include risk of default, system underperformance, low rate of return from new systems, market fluctuations and trouble designing financial practices that cover multiple technologies.



Solar securitization could be an attractive option for investors.

Table 19: Summary Characteristics for Securitization and Structured Finance

Characteristic	Score
Source of capital	Private investors
Number of parties	Multiple: Groups of jurisdictions working with developers and at least one investment bank to pool the similarly classed investment opportunities
Ease of financing	5 - very difficult: Primarily this is a reflection of the risks, but also there is no known market for this approach at this time
Duration of financing	Varies: Likely good for short- and medium-term arrangements
Risk to investors	4 - moderately risky: This is somewhat high risk due to the still-new technologies being financed with this tool since some will likely fail; but by packaging multiple similar projects the risk of complete failure is mitigated
Risk to borrowers	4 - moderately risky: Risk for public and private borrowers derives from the newness of the technologies being funded; if a specific project fails then the securitization for that project could be lost and taxpayers would be exposed
Tax implications	Varies based on the specifics of the structured arrangement
Source of repayment	Varies based on the specifics of the structured arrangement
Advantages	This tool represents an opportunity to tap deep pools of capital for investment while spreading the risk associated with each individual project
Disadvantages	These will be complex instruments and given the problems they exhibited in the home mortgage crisis will require significant oversight

4. Catastrophe bonds

In the early 1990s, catastrophe bonds were developed by insurers in response to increasingly damaging hurricanes that were striking highly urbanized areas in southern Florida. Insurers were not willing to take on the risk so, as an alternative to traditional reinsurance where risk is spread to a secondary insurer, insurers issued catastrophe bonds to private investors willing to assume the risk of losing their investment for the opportunity to earn substantial interest.

Catastrophe bonds have not been issued for smart infrastructure projects, though it may be a consideration for developers of utility-scale projects. As the number of natural disasters increases worldwide and as large-scale renewable energy development expands into new geographic areas, more large-scale developers and utilities may look to catastrophe bonds to address large risk concentrations while implementing smart grids and other infrastructure improvements designed to bolster resilience to natural and man-made threats.

Pension funds impact catastrophe bond market

The \$30 trillion global pension fund industry is starting to infringe on traditional reinsurers seeking to finance protection against natural disasters as interest rates near record lows. Pension funds provide alternative capital to the insurance industry. While many nations seeking to spread disaster burdens welcome capital from pension funds, a [Bloomberg report details](#) how pension investment is pushing down prices at the same time reinsurers are pushing for higher rates to compensate for the increase in extreme weather events.

New Zealand's Superannuation Fund (or pension fund) announced in 2013 that it will double its holdings in catastrophe bonds and other insurance-like assets. Other employee pension funds such as the Royal Bank of Scotland Group Plc and PGGM NV in the Netherlands will also increase their reinsurance investments.

Ontario, Canada's Teachers' Pension Plan has



Catastrophe bond returns can vary from 2% to 15%.

been [investing in catastrophe bonds](#) since 2005.

Reinsurance is so appealing to pension funds because of their low correlation to equity and bond markets. Catastrophe bond returns can vary from 2% to 15% — some customized contracts can yield as much as 40%.

Table 20: Summary Characteristics for Catastrophe Bonds

Characteristic	Score
Source of capital	Private investors
Number of parties	2 or more: Currently these are tools used primarily by insurers working with an investment bank to issue the bonds
Ease of Financing	4 - moderately difficult: The bonds have a high cost and are risky, though if no catastrophe strikes during the coverage period then the payout is high to the investors
Duration of financing	Short- and medium-term
Risk to investors	5 - high risk: If a catastrophe strikes during the coverage period then the insurance company that sold the bonds will take the proceeds to pay claims not covered by the premiums of those insured and investors could get nothing
Risk to borrowers	2 - relatively low risk: The point of catastrophe bonds is to spread the risk of an event overwhelming the assets and premiums of the company though they must be able to pay off the bonds at maturity if no event occurs
Tax implications	The bonds are issued by the insurer which is typically created as a nonprofit entity and therefore the bonds are often tax-exempt
Source of repayment	If there is no catastrophe requiring the payout of the insurance, then the insurer that issued the bond repays at the fixed rate with funds collected from the investment of the bond money
Advantages	Spreads risk for borrowers
Disadvantages	High risk for investors

Chapter 6: Tapping the Private Sector



Government-led financing, development exactions and public-private partnerships are all groups of financing tools in which public sector money plays a significant role. The challenge in recent years has been attracting more private investment dollars into the finance market for smart infrastructure projects.

Leveraging private sector funds, which are potentially larger pools of finance capital, can be useful for financing projects that will improve livability and have long-term impacts on a city's economy.

State governments often invest in private sector funds as a way to diversify their investment portfolios.

For the private investors, investing in new technologies can improve their company's bottom line by attracting consumers and reducing costs.

It's important to note that there can be some unintended consequences in leveraging private sector funds, such as excessive or unbalanced risk exposure or insufficient returns.

In this chapter we'll discuss 11 finance tools that tap the private sector:

1. Loan Loss Reserve Fund (LRF)
2. Debt service reserves
3. Loan guarantees
4. On-bill financing
5. Pooled bond financing
6. Pooled lease-purchasing finance
7. Value capture
8. Tax increment financing
9. Philanthropic opportunities
10. International non-governmental organizations
11. Thinking more broadly: combining financing options

1. Loan Loss Reserve Fund (LRF)

Under the Dodd-Frank Wall Street Reform and Consumer Protection Act, President Obama signed the Loan Loss Reserve Fund (LRF) in 2009. Although LRFs are not a new banking concept, LRFs help improve under-banked consumers' small-dollar loan options by expanding the number of responsible lenders and products available in the marketplace.

LRFs are useful in markets where financial institutions make a series of small loans for projects such as energy efficiency improvements. One example is Oregon-based Clean Energy Works Portland, which set a 10% loan loss reserve for its energy efficiency retrofit program. Between spring 2010 and spring 2011, Clean Energy Works granted 500 homeowners long-term, low-cost loans to retrofit their homes. With a small amount of state funds to safeguard against risk, the private and public sector partnered to [create a pilot loan portfolio](#) of \$8 million that resulted in 450 home retrofits with an expected combined life of 30 years for the energy improvements.

New York City gets creative to hit energy and climate action goals

To support its energy and climate action goals, the [New York City Energy Efficiency Corporation](#) (NYCEEC) began administering a credit enhancement program through a public-private partnership in 2011. One of NYC's action goals was to finance energy retrofits for properties in various NYC real estate sectors. NYCEEC was seeded \$37.5 million in federal stimulus money granted under the Department of Energy's Energy Efficiency and Conservation Block Grant (EECBG) program, as well as some private sector and philanthropic capital.

NYCEEC utilized its seed funds partially as a loan loss reserve with the intent of leveraging a portion of the \$37.5 million to raise several hundred million dollars in debt and equity financing for energy efficiency retrofits in the city.

Using a credit enhancement approach allowed NYCEEC to reduce the risk and cost of capital associated with unsecured lending to commercial real estate owners. This approach was the simplest strategy to draw investment from commercial lenders while abating their reluctance to invest capital in efficiency retrofits with payback based solely on future energy savings as collateral. This method provided lenders with the



NYC found a creative way to finance energy retrofits.

comfort they needed to finance energy retrofits which, in turn, created a track record of project performance with energy savings and financial returns that began laying the groundwork for increased future lending in the energy efficiency sector.

Table 21: Summary Characteristics for Loan Loss Reserve Funds

Characteristic	Score
Source of capital	Public sector and private banks
Number of parties	3: Public jurisdiction funds back private loans from banks to individuals seeking loans for certain activities
Ease of financing	2 - relatively easy: Public jurisdiction back stopping primary loan means banks can take slightly more risk in awarding the relatively small loans for these kinds of projects
Duration of financing	Medium and long-term
Risk to investors	2 - relatively low risk: Public covers any losses from the fund if borrower fails to pay the debt, thus leveraging additional capital looking for lower risk options
Risk to borrowers	3 – medium: Individual consumers must still make the payments on the terms of the loan; most technology upgrades will not see net savings for several years while the debt is being repaid by the borrower
Tax implications	Not applicable
Source of repayment	Borrowers repay the loan generated for the improvements, often through the utility bill
Advantages	Public participation lowers the risk for private investors and increases their tolerance for these small loans
Disadvantages	Removes money from jurisdiction while in the reserve fund; public assumes some of the risk in exchange for incentivizing more efficiency investments by homeowners

2. Debt service reserves

Debt service reserves allow states and local jurisdictions to set aside cash reserves to guarantee the payment of the principal and interest of a bond. Much like a loan loss reserve fund for private loans, this service is useful for bond issuers who want to boost the security of their bonds and states or local jurisdictions that want to expand the market for their bonds while reducing the bond coupon rate.

Under the Energy Tax Incentives Act of 2005, debt service reserves can be applied to bonds such as Clean Renewable Energy Bonds (CREB) and the Qualified Energy Conservation Bonds (QECB) (see Chapter 3). Federal law has allowed the Federal Transit Administration to allow its grant recipients to use federal transit funding to reimburse up to 80% of the deposits in a debt service reserve if created for financing transit capital projects. The goal, as with other leveraging tools, is to help borrowers get better bond ratings and lower the costs of capital.

Kansas City finally gets a green light on its streetcar project

After a year's delay caused by lawsuits over how Kansas City, Missouri's 2.2-mile streetcar line would be funded, in January 2014 the city council approved issuing up to \$124.5 million worth of special obligation bonds. Of that, as much as \$71.5 million would go to the downtown streetcar project in a Series 2014A fund that will pay to acquire and construct the streetcar system. It will also fund a [debt service reserve fund](#) for the bonds and pay certain costs related to the issuance of the bonds, according to the Kansas City Business Journal.

As outlined in the KC Business Journal, the city's plan for financing the streetcar line — which aims to create jobs and boost business opportunities in the region — includes:

- \$62.9 million of special obligation bonds for construction with the remaining \$8.6 million, if needed, toward the cost of issuance and as a reserve fund for debt services.
- Kansas City's Water Services Department will contribute \$14 million to help pay for water utility relocation under the streetcar route.
- Federal grants including Kansas City's \$20 million Transportation Investment Generating
- Economic Recovery (TIGER) grant will total



Kansas City's streetcar, rendered here, will be backed by a variety of financing mechanisms.

\$37.1 million.

The [federal TIGER grant](#), announced in August 2013, targets major national and regional transportation projects that are often difficult to pursue through other government funding programs, according to U.S. Senator Claire McCaskill, who represents Missouri. Selected projects must foster job creation, show strong economic benefits, and promote communities that are safer, cleaner, and more livable.

Added McCaskill: "This streetcar project will encourage housing, construction, and business development in the city — and that will mean more jobs across the region."

The streetcar project is expected to be operational by late 2015 or early 2016.

Table 22: Summary Characteristics for Loan Loss Reserve Funds

Characteristic	Score
Source of capital	Public sector and private banks
Number of parties	3: Public jurisdiction funds a reserve to back private bonds from banks to individuals seeking capital for certain targeted and qualifying activities
Ease of financing	2 - relatively easy: Public jurisdiction back stopping bond debt means banks can take slightly more risk in selling bonds targeted at qualifying projects
Duration of financing	Medium and long-term
Risk to investors	2 - relatively low risk: Public covers bond debt if needed, thus lowering risk to private investors and encouraging lower cost capital availability; risk to public of losing capital reserve money if issuer defaults on the bonds
Risk to borrowers	3 – medium: Normal risk for bond issuers as long as revenue stream covers bond payment; backing by public runs risk of moral hazard though there is no systematic evidence of this
Tax implications	Depends on the bonds that are being secured (with other bonds)
Source of repayment	Bond issuer repays, but at lower cost due to the use of the reserve
Advantages	Public participation lowers the risk for private investors and increases their tolerance for those buying these bonds and providing capital for targeted smart and green projects
Disadvantages	Removes money from jurisdiction while in the reserve fund; public assumes some of the risk in exchange for incentivizing more efficiency investments by bond issuers

3. Loan guarantees

One method that U.S. states and many nations use to minimize risk for private investments is guaranteeing the repayment of a loan in case of default. Similar in logic to the loan loss reserve funds, loan guarantees allow the federal government to work with private companies and lenders to mitigate the financing risks associated with new projects.

The U.S. Department of Energy (DOE) has awarded billions of dollars in loan guarantees for a wide variety of clean energy projects. Among them was BrightSource Energy's Ivanpah project – a solar thermal plant in the desert of Southern California. The 392 megawatt project [officially opened in early 2014](#) and its three large-scale solar towers are providing enough energy to Southern California Edison and Pacific Gas & Electric to power 140,000 homes per year, according to BrightSource.

The DOE provided a \$1.6 billion loan for the Ivanpah project in 2011 and the effort also drew backing from Google and NRG Energy. Bechtel, a Council Lead Partner, constructed the massive facility.

The DOE loan guarantee program has its share of critics. After several companies that received loans went bankrupt, the department was taken to task for lack of oversight. But the program continues.

Loan guarantees support innovative SMEs around the world

The European Investment Fund and BPCE Group in France agreed to a \$410 million loan agreement for innovative small and medium-sized enterprises (SMEs) in 2013. The agreement uses the Risk Sharing Instrument (RSI) launched by the European Commission and European Investment Bank Group to ease access to financing for SMEs and increase competitiveness.

In 2013, the African Guarantee Fund (AGF) committed to a \$2.3 million loan guarantee with the Commercial Bank of Kenya and the Pan African SME Fund in Nairobi. AGF regards SMEs as a source of economic growth across Africa and as a strong driver of the country's economic vision of achieving 10% growth



Loan guarantees boost economic growth.

annually in its underperforming economy.

Malta Enterprise will provide loan guarantees of up to \$100,000 for SMEs that can provide collateral to cover 10% of their investment. And Romania's government passed a \$613.85 million loan guarantee for SMEs to ensure that businesses have access to capital.

Table 23: Summary Characteristics for Loan Guarantees

Characteristic	Score
Source of capital	Federal government and private lenders
Number of parties	3: Public jurisdiction funds a reserve to back private loans from lenders to other firms seeking capital for certain targeted and qualifying activities
Ease of financing	2 - relatively easy: Public jurisdiction back-stopping loan guarantee means banks can take slightly more risk in providing loans targeted at qualifying projects
Duration of financing	Medium- and long-term
Risk to investors	3 - medium risk: Funding large-scale new technologies carries relatively high risk, mitigated somewhat with the loan guarantee from the federal government, thus lowering risk to private investors and encouraging lower cost capital availability; risk to public of losing capital reserve money if borrower defaults on the loan
Risk to borrowers	3 – medium: Normal risk for loan borrowers as long as revenue stream covers loan payment; backing by public runs risk of moral hazard though there is no systematic evidence of this
Tax implications	Not applicable
Source of repayment	Borrower is responsible for repayment, though this is backed by a government agency that has issued the guarantee
Advantages	Federal participation lowers the risk for private investors and increases their tolerance for the size of the loans necessary to bring new technologies to scale
Disadvantages	Public assumes some of the risk in exchange for incentivizing innovations to bring new technologies to scale through private borrowing; risk through federal government spread over entire population

4. On-bill financing

When smart cities encourage their citizens to adopt new green technologies, public-private partnerships can often be leveraged for the best possible outcome. Yet citizens are often slow to adopt new technologies due to lack of upfront funds to pay for them, reluctance to adopt something unfamiliar, unforeseeable savings and high financing costs. In such cases, two types of programs are available to citizens to accelerate adoption: utility-enabled financing and repayment and user fees, which were discussed in Chapter 3.

On-bill financing (also known as utility-enabled financing and repayment) allows the local utility to decide the best upgrade package that can be reasonably financed. The utility then oversees the upgrades and customers are assessed a fixed monthly charge on their utility bills to pay for the upgrade.

The Rural Energy Savings Program based in South Carolina is one such program. Its aim is to alleviate problems rural communities face in saving energy and cutting household utility bills. By reducing greenhouse gas emissions through residential energy efficiency improvements, the Rural Energy Savings Program [financed low-cost loans](#) to residents that they repaid through on-bill financing.

National Grid uses on-bill financing to offer multiple customer incentives

National Grid is a British multinational utility that delivers electricity and gas to Britain and the Northeastern United States (and a Smart Cities Council Lead Partner). The utility's on-bill financing (OBF) program goes well [beyond traditional OBF incentives by](#) helping customers finance big-ticket energy conservation upgrades and overcome financial barriers.

National Grid pays 40% to 70% of the project cost and the customer pays the rest over a period of one to 24 months, with the amount appearing as a line item on the customer's utility bill. The interest rate is 0%, and for small business customers, the utility discounts the amount by 15% if the business repays the loan in one month.



National Grid helps customers finance energy upgrades.

Since billing is on the regular monthly utility bill there are lower instances of defaults. Also, offering the loan at 0% decreases the complexity of the transaction. And finally, loan repayment is not secured by the property so default will not result in a lien against the property.

Table 24: Summary Characteristics for On-Bill Financing

Characteristic	Score
Source of capital	Public, private, or nonprofit utility
Number of parties	2: Utility provides upfront costs for upgrades and bills the customer
Ease of financing	1 - very easy: Utility uses available resources to effectively make the upgrade investment then replenishes the costs by billing the consumer directly
Duration of financing	Short- to medium-term
Risk to investors	2 - relatively low risk: As long as the utility can guarantee a customer will be paying, then the funding can be collected over time after the costs of the upgrade
Risk to borrowers	2 - relatively low risk: Customer is not technically borrowing so credit scores are not at risk any more than the risk of not paying one's utility bill; still it is a cost that customers must plan for
Tax implications	None
Source of repayment	Homeowner repays through utility billing
Advantages	Ease of administration; speed of implementation
Disadvantages	Customers must be aware of their options; not all green and smart technologies are available from every utility

5. Pooled bond financing

Pooled bond financing is another option that helps generate new capital. Predominantly for state and local governments, nonprofits and private companies can benefit from pooled bond financing too. With this tool, a sponsor sells an issue of bonds, the proceeds from which are used by a number of state or local jurisdictions, or other tax-exempt organizations.

The goal is usually to help smaller borrowers (e.g., small towns) get access to capital with lower costs than they might be able to on their own, given their credit ratings. The bond program features a common debt service reserve fund, which is funded from proceeds from each bond sale and kept at a level equal to 5% of the principal amounts on each individual loan. The common debt service reserve fund is meant to enhance the credit strength of the program so that it is greater than the credit of individual borrowers.

Using bond insurance, premiums are allocated to each borrower based on their credit strength, so no borrower is subsidizing any other borrower. In 2004, the Virginia Municipal League and the Virginia Association of Counties jointly sponsored an issue of \$40.5 million in tax-exempt revenue bonds. Pooling the resources into a single offering helped keep the borrowing costs low for participating jurisdictions due to the pool bond program's triple-A rating.

Program pools funds for Czech Republic cities

Created in 1994, the Municipal Finance Company (MUFIS) was a part of a USAID municipal infrastructure finance program. The program was designed to catalyze the integration of municipal infrastructure finance in capital and financial markets where municipalities and townships lacked sufficient funds and knowledge of how to build capital for projects.

MUFIS served as a joint stock company where shares in MUFIS were owned by the Ministry of France (49%), the Czech and Moravian Guaranty and Development Bank (49%), the Association of Czech Municipalities and the Union of Towns and Communities (2%).

MUFIS borrowed \$44 million from U.S. inves-



Pooled funds support Czech Republic housing projects.

tors backed by U.S. government guarantees and subsequently lent the funds to commercial banks. Municipalities then borrowed funds from the banks for periods between 7 to 15 years to finance housing-related infrastructure projects.

Table 25: Summary Characteristics for Pooled Bond Financing

Characteristic	Score
Source of capital	Private bond buyers
Number of parties	3 or more: At least two borrowing entities and one sponsor to issue the pooled bonds
Ease of financing	2 - moderately easy: Coordination with the sponsor issuing the bonds and ensuring the fairness
Duration of financing	Medium-term
Risk to investors	2 - relatively low risk: Pooling the bonds from multiple borrowers has the effect of pooling the risk that any one borrower defaulting would hurt the overall package
Risk to borrowers	2 - relatively low risk: As long as funding from each participant in pool reasonably projects to generate sufficient revenues to meet their debt obligations
Tax implications	Depends on the ultimate issuer of the bonds; if a government, then the bonds are tax-exempt
Source of repayment	Government recipient of bond proceeds (usually a smaller jurisdiction that is part of the pool) must repay the bond which is usually a basic revenue bond
Advantages	Provides a low cost fixed-rate option for jurisdictions, nonprofits and certain businesses to secure capital and can be tailored for smart infrastructure projects
Disadvantages	Pool of participants needs to be diverse in order to make sure payments are made and protect the rating of the sponsor that issues the bonds

6. Pooled lease-purchasing

With pooled-lease purchase financing, a government agency purchases property or equipment on an annually renewable contract. Financing can come from either a financing institution or the government may issue certificates of participation where investors can purchase a share of the lease revenues. At the end of the lease, the agency that issued the debt can sell the property or equipment to the jurisdiction for a minimal amount.

This financing mechanism is particularly beneficial to states because smaller projects can be combined to receive longer loan terms and lower interest rates. However, forming a pooling agreement can be difficult when attempting to combine projects at the same time for financing.

TVA uses \$1 billion lease purchase for Tennessee plant

In 2012, The Tennessee Valley Authority (TVA) completed a [\\$1 billion lease-purchase](#) transaction for a natural gas-fired plant in Rogersville, TN. The transaction provided financing support for the development of the plant and cleaner energy. Financing for the lease purchase included a \$100 million equity investment and a \$900 million bond issue, both of which were secured by TVA's rental payments. Morgan Stanley, Bank of America, Merrill Lynch and Barclays Capital served as lead underwriters. TVA will lease the plant to John Sevier Combined Cycle Generation LLC, for which it will receive \$1 billion in proceeds.



Pooled-lease purchasing supports cleaner energy.

Table 26: Summary Characteristics for Pooled Lease Purchasing

Characteristic	Score
Source of capital	Public sector or private investors
Number of parties	4 or more: The purchasing agency, at least two leasers, and at least one private purchaser of shares of the lease revenues
Ease of financing	4 - moderately difficult: Coordination costs are relatively high setting up the purchase and lease arrangements in addition to selling shares of the lease revenues
Duration of financing	Short- to medium-term
Risk to investors	2 - relatively low risk: Leases are for fixed periods which lowers uncertainty of the debt payment
Risk to borrowers	3 - medium risk: Sponsoring agency must ensure adequate leasing to meet repayment obligations
Tax implications	Not applicable
Source of repayment	Borrowing jurisdiction repays though it may have the option of selling the asset at the end of the lease period
Advantages	Does not affect statutory debt limitations of public sector participants; lowers borrowing costs due to use of tax exempt funds; smaller equipment that is not normally fundable can be financed
Disadvantages	Relatively few; no guarantee to participants on price of equipment at end of lease period

7. Value capture

Guided by the principle that those who benefit from public infrastructure should pay for it, value capture is the identification and capture of increased land value from resulting public investment in infrastructure.

Local governments have widely used value capture instruments to incentivize and/or invest in infrastructure improvement in blighted areas where private investment risk would be high. Using special taxes and community improvement fees, local jurisdictions can capture part of the value created for private investors as a result of the jurisdiction's investment in improvements.

For instance, an improvement in a city's public transit system that upgrades the system's efficiency and accessibility is a benefit to neighboring properties. This benefit is the increase in higher land values and, perhaps, an increase in business for property owners. Since they benefit from the improvements made to the transit system, they should pay for receiving those benefits through the city's choice of assessment, which could be an imposition of public transit impact fees, land-value taxation or capture of property tax increments through TIFs (which are explained in the next section).

Value capture drives Virginia transportation improvements

Counties in Virginia have been using value capture to support their transportation infrastructure for nearly 25 years. In the 1980s, Fairfax and Loudoun Counties established special assessments on commercial and industrial property to upgrade Route 28 to a grade-separated highway. That enabled the development of retail centers as well as improved access to Dulles International Airport.

In the 1990s, Virginia funded highway and bridge projects, Metrorail expansions and station access improvements using recordation taxes (also known as a transfer tax). These are taxes imposed by the state for the privilege of recording an instrument in the Land Records.

Major successes include:

- The Dulles Corridor Metrorail project, the Silver Line, is funded by special assessments on commercial and multi-family residential property and increased toll charges. The first phase of the Silver Line opened in 2013 costing Fairfax County \$400 million.



Dulles Corridor Silver Line is funded by special assessments.

- The City of Alexandria used a multi-faceted value capture program that included the use of special assessments and bonds to fund the Potomac Yards Metrorail Station near Ronald Reagan Washington National Airport, which was projected to cost \$240 million in 2010.
- The Tysons Corner Local Transportation Development Program in Fairfax County will receive \$3.1 billion in funding for new roads and transit via creation of a service district that covers 6,000 commercial and residential properties.

Table 27: Summary Characteristics for Value Capture

Characteristic	Score
Source of capital	Local government initially, recouped from taxed private activity in the benefits catchment area
Number of parties	2 or more: The local jurisdiction and at least one private entity in the benefits catchment area
Ease of financing	4 - moderately difficult: Special assessments and special tax district creation can be highly political
Duration of financing	Short- to medium-term
Risk to investors	3 - medium risk: The local jurisdiction can make the upfront investment in the new infrastructure and may rely on another funding mechanism initially, dedicating the revenues from an assessment or special tax as the repayment; public officials face potential political costs
Risk to borrowers	3 - medium risk: Though not technically borrowers, those living in the assessment/tax district may face unexpected high increases in taxes with a lagged benefit to their property value from the infrastructure investment
Tax implications	Not applicable
Source of repayment	Not applicable
Advantages	Addresses the fundamental fairness principle that those deriving the greatest benefit from a service should pay the most for it
Disadvantages	Drawing the district that derives the benefits from such infrastructure investments can be challenging and open to alternative interpretations from those along the edges

8. Tax increment financing

Tax increment financing (TIF) is a public financing method that essentially finances debt in anticipation of future tax revenues. TIFs allow cities to begin infrastructure and community improvement projects with borrowed funds with a promise to pay those funds back with additional tax revenues generated from the increased property value in the area around the development.

In many areas where TIFs are used, the area of proposed improvement is categorized as underdeveloped, blighted and as a site with [potential to save and/or bring in money](#) if developed. TIFs usually pay for streets, sewers, parking facilities, land acquisition, planning expenses, job training, demolition and clean-up costs. In most cases, cities consider TIF projects a viable option because the proposed development of the area is anticipated to spark an increase in property values. The logic of this form of financing can be applied to smart infrastructure projects as well.

The most lauded benefits of TIF loans is that they do not cost the taxpayer anything upfront, they attract private investments, strengthen the tax base and increase economic activity. The repayment comes solely from revenue generated through new taxes from within the new development area. When areas are developed or re-developed, new property taxes are generated. The original property taxes on the area before development are paid to the city and the balance goes into a special fund that [subsidizes portions of the new development](#). TIFs offer cities flexibility in times of financial hardship.

In the U.S., 49 states have approved the use of TIFs — Arizona being the lone hold-out — but there are

Walmart TIFs in Missouri

Missouri is one of many states where Tax Increment Financing (TIF) is authorized to combat blight and [foster economic development](#) due to its ability to take new taxes that new developments generate and direct a portion to repay the cost of the project itself.

TIFs encourage developers to undertake projects in areas that need a stimulus and allow the local government to reimburse developers for some of their project's cost. This was the case in two suburbs in St. Louis: Saint Ann and Bridgeton. In 2010, Walmart announced it would close two stores located in those suburbs and open a new store in Bridgeton. This move allowed Bridgeton to capture money through a TIF that would have gone to other tax entities — in this case, to subsidize the Walmart replacing the existing Walmart. Additionally, Walmart had the possibility of capturing \$7 million in subsidies that were projected to be diverted away from public schools and other taxing districts.

many who oppose TIFs. Among other arguments, detractors see them as a means of gentrification and of unduly condemning private property under eminent domain statutes. They argue that TIFs can actually cost a city more money because of the need for increased public services that new developments bring. They also point to the risks if developers become insolvent or otherwise drop the ball, which does happen.



Cities can use TIFs as an economic development tool.

Meanwhile, in 2013 the city of Shrewsbury, MO [voted not to allow a TIF](#) to help pay for a new Walmart (\$15 million over 23 years). Detractors noted that \$3 million of those funds would typically go to area schools and that a Walmart would take business away from other shopping. Those in favor asserted that the proposed new Walmart site was located in a blighted area and that it could bring in \$62 million in sales in its first year, thus increasing sales tax and attracting other business.

In *Kelo vs. the City of New London* heard by the U.S. Supreme Court in 2005, the city of New London, Connecticut used eminent domain laws to [seize private property](#) for redevelopment to create jobs and increase tax revenues. And the developer of the project abandoned it midstream without financing, which left the property a temporary dump.

Table 28: Summary Characteristics for Tax Increment Financing

Characteristic	Score
Source of capital	Local government initially, recouped from private property owners
Number of parties	2 or more: The local jurisdiction and at least one property owner in the benefits catchment area
Ease of financing	1 - very easy: Upfront costs to start a project are minimal and the tax increment can be collected starting immediately
Duration of financing	Medium- to long-term
Risk to investors	3 - medium risk: The local jurisdiction can make the upfront investment in the new infrastructure and may rely on another funding mechanism initially, dedicating the revenues from the tax on the incremental increase in property value as the repayment; public officials face low political costs since the tax is only on any increased value; infrastructure may not generate increased property values
Risk to borrowers	2 - medium risk
Tax implications	If the jurisdiction reimburses developer, there are no tax benefits; if the jurisdiction issues TIF bonds to provide the upfront financing, those buying the bonds receive tax-exempt status on the interest
Source of repayment	Developer repays usually through the increased taxes generated by the increased property value
Advantages	Low upfront costs; spreads payment over an area; relies primarily on those that benefit the most as measured by their increased property value created by the infrastructure
Disadvantages	May encourage gentrification in certain areas. Though not technically borrowers, those living in the area affected by the increased value from the infrastructure improvements may face higher property taxes and be forced to relocate if unable to pay

9. Philanthropic opportunities

Many of the previous financing options have highlighted the role of the private sector as a source of capital needed to implement smart technologies in municipal settings. But there is a growing interest among philanthropic organizations — both local and global — to participate in smart city investments from the municipal level down to the individual homeowner level.

Private foundations as well as a range of nonprofit organizations are developing funding pools from which homeowners, community groups and entire municipalities can compete for grants or other philanthropic gifts aimed at helping achieve more sustainable cities. As cities deliberate financing options, they should consider competing for these awards as yet another funding option or as a component of a funding package. These funding sources can be idiosyncratic and may focus their financial awards in a relatively narrow field within the environmental sustainability arena. Others may have wider interests and field multiple asks.

One example is the [Funders' Network for Smart Growth and Livable Communities](#). It partnered with the Urban Sustainability Directors Network to create a Local Sustainability Matching Fund. Launched with help from several other foundations, it provides a funding pool available on a competitive basis to communities able to raise additional funds to help with the project, thereby allowing resources to stretch further. Projects must achieve the goal of advancing specific sustainability goals (with demonstrated community support and engagement) in line with the Fund's focus on energy-efficient retrofits, green design (related to LEED certifications) and urban sustainability planning.

Another example is [Enterprise Community Partners](#),

which is a nonprofit foundation whose primary mission centers on providing affordable low- to moderate-income housing options in cities. Unlike most other housing groups, however, Enterprise integrates its commitment to green buildings into the projects they support. The homes they help finance must meet certain energy-efficiency standards. In 2012, Enterprise invested \$2.4 billion in the financing of over 16,800 affordable homes.

With smart technology financing — and public infrastructure financing more generally — the greater the risk with the investment, the more challenging it can be to locate a funding source. Green buildings and energy efficient homes are important components in continuing the move towards greater sustainability in urban areas, but the more cutting-edge technologies in development require funders with greater tolerance for risk than most community foundations can manage. In these situations, some smart technology investments have sought and secured financing from corporate philanthropies.

One great example of this: The IBM International Foundation's [Smarter Cities Challenge](#). This initiative, seeded initially with \$50 million, was designed to help cities inventory their current smart assets and develop plans to move to smarter operations with the aid of IBM's support teams. Over the initial three-year life of the Challenge, IBM provided support to 100 municipalities in over two dozen nations and has announced the much-heralded initiative will continue beyond its initial three-year timeframe. IBM is a Smart Cities Council Lead Partner.

Microsoft, another Council Lead Partner, is best known for its software and co-founder Bill Gates for his foundation's philanthropic efforts to improve access to healthcare in developing nations. But Mic-



Private sector companies are increasingly engaged in investments that encourage more alternative energy.

rosoft Corporation is also investing in sustainability. In late 2013 the [company announced](#) it would buy all of the output from a Texas wind farm for 20 years to help power one of its data centers. In fact the Environmental Protection Agency recognized Microsoft as the second largest purchaser of green power in the U.S. in 2013 and the company doubled its purchase of renewable energy from 1.1 billion kWh to 2.3 billion kWh. The company was also an investor in a \$1 billion green bond from the International Finance Corporation that aims to support “climate smart” investments in emerging markets.

IBM and Microsoft are just two examples of how the private sector is playing a significant role not only in the financing of smart technologies, but also in direct investments to further alternative energy, increased energy efficiencies and overall sustainability practices. Municipalities should consider partnering with such organizations or their philanthropic arms when looking for creative and innovative ways to advance a smart city agenda.

10. International non-governmental organizations (NGOs)

While not a finance tool specifically, there has been significant growth in the number and size of environmental, sustainability and climate change focused organizations around the world. Led by efforts such as those at the World Bank, the Organization for Economic Cooperation and Development (OECD) and the Climate Investment Funds (CIF), these non-governmental organizations (NGOs) are providing financing for the development of a wide range of sustainable practices, alternative energies and smart technologies in highly industrialized urban centers to remote regions of underdeveloped nations. They are also providing technical expertise to governments and communities around the globe on how best to implement these changes in ways that integrate local customs and practices.

The World Bank is probably the best known of these organizations. And while it is not a bank in the traditional sense of the word, the World Bank does provide extensive assistance in pulling together significant levels of financial support for projects across an array of issue areas (including economic and environmental development). It provides or helps facilitate various financing options through its various partnerships with other trust funds based on bilateral and multilateral donors. Many World Bank projects include co-financing with the host nation's government, private sector partners and export credit agencies.

But the World Bank is only one such actor on the international stage. CIF is another group focused on the developmental support of alternative energies and sustainable practices, particularly in the developing world. Like the World Bank, CIF works with partner nations and multilateral development banks to pool funds targeted at projects centered on

climate change practices. The support is both financial and technical, and one of CIF's primary goals is disseminating best practices in these areas to other developing countries. CIF is based on two different trust funds. The first is the Clean Technology Fund designed to support scaled-up projects in countries where gains are likely in reducing greenhouse gases. The second is the Strategic Climate Fund, which finances three district piloting programs: the Forest Investment Program, the Program for Scaling up Renewable Energy in Low-Income Countries, and the Pilot Program for Climate Resilience. CIF uses grants, concessional funds and various risk mitigation tools that help leverage additional financing from private investors, development banks and other financial partners. The pay-for-performance solar project in Morocco discussed earlier is an example of an initiative involved the World Bank, CIF and others as technical and financial partners.

Besides all of the NGOs operating around the world, many nations also are home to private or quasi-governmental export credit agencies (ECAs). These organizations often serve as a line of credit to local exporters. Some also provide guarantees and insurance for exported items. The goal of these organizations is to mitigate the risk to exporters when operating on international markets, taking a premium for assuming that risk. Again, this isn't the same type of tool featured in this chapter. But using or establishing an ECA to support local businesses engaged in trade with international partners for materials related to smart technologies and sustainable practices could have positive spillover effects in the local economy and help promote their use.



NGOs are providing financing for the development of a wide range of sustainable practices, alternative energies and smart technologies in highly industrialized urban centers to remote regions of underdeveloped nations.

11. Thinking more broadly: combining financing options

Those in the financial industry are aware that many projects actually rely on multiple funding sources. This is more likely to be true depending on two primary considerations: the number of disparate components making up the asset, and the expected longevity of each of those components. Airlines, for example, are financed through a complex array of sources. Seats are financed with relative short-term debt instruments because they face significant wear and tear and are replaced more often. The fuselage, on the other hand, has a very long life expectancy and is financed over a much longer period of time. Avionics, wiring, landing gear are similarly financed separately. Airplanes are not generally financed as one unit.

Similarly, many smart technologies and sustainability initiatives being contemplated by cities around the world have multiple components. Public transit systems have a multitude of components, such as buses, rail and rail cars. But each has different life expectancies. Buses are depreciated based on a 12-year lifecycle. Light rail cars have a 25-year expected lifespan. Heavy rail cars have a 35-year life expectancy. And rail lines themselves are financed based on a 100-year life cycle. Even the components within each of these could be financed on a shorter schedule than that used for the overall unit. Components in a smart power grid may be quite amenable to creative component financing as well.

Local administrators and elective representatives should consider not only the sum of the parts of their projects, but the parts themselves. Communities may be able to achieve significant savings when breaking down the components and financing them



Cities may achieve significant savings by breaking down project components and financing them discretely.

discretely as opposed to lumping short-term components in with long-term components and paying for such items far beyond their lifespan, or paying for long-term components on too short a payback schedule for optimal efficiency.

Combinations of financing tools may provide additional flexibility to local officials. These combinations could include a number of the tools presented in this guide, from direct payments by government units from taxes, to some form of bond, to a development exaction, to a public-private partnership, to a grant or other source of private or philanthropic support. Smart technologies are at the forefront of innovation and local administrators need to think creatively to use the many financing tools at their disposal.

Chapter 7: Conclusions and Additional Resources



Governments around the world are coming to terms with the realities associated with the population explosion on the way and the urbanization it will spawn. Innovations in technology will dramatically improve the livability, workability and sustainability of tomorrow's cities. New ideas for matching solutions to problems through partnerships between the public, nonprofit and private sectors are emerging every day.

The challenges presented by increased urbanization are not insurmountable, but do require entrepreneurial approaches that bring to bear the creativity of the private sector with the commitment of public officials. As we've emphasized, the single greatest barrier to meeting these challenges is financing.

In this report we focused on 28 financing tools available to decision makers looking for the right financing option for their project. Not every tool is available in every jurisdiction around the world, but the collection serves as a starting point for exploring options. And city leaders will need to consider some of the nontraditional financing arrangements that may prove a better fit for the kinds of smart technologies they want to see in their communities.

Like hammers and screw drivers, these tools are good for different kinds of investment activities. Some require several partners and more coordination. Others rely on the coercive powers of government. Still others try to tap the deeper reservoirs of private capital to help build the smarter infrastructures needed for tomorrow's cities.

ADDITIONAL RESOURCES

Infrastructure Financing Options for Transit-Oriented Development: Developed for the Environmental Protection Agency by Council Associate Partner CH2M HILL, this guide focuses on financing infrastructure needed to support the denser development enabled by the extension of transit lines. Most of the 30 financing options addressed can more broadly support other types of smart cities development as well. [Learn more >](#)

Self-Funded Public-Private Partnership Model for Citizen Services Delivery: To help governments improve service delivery, Council Associate Partner Imex Systems Inc. is pioneering a public-private partnership model where governments can obtain multi-channel service delivery infrastructure at no cost or minimal capital and operating costs. [Learn more >](#)

Finance and procurement tools: Visit the Smart Cities Council website for more on procurement strategies, vendor strategies, contract tips, project management techniques and other recommendations. [Learn more >](#)



APPENDIX

On the pages that follow, learn about the authors of this Guide and about the work of the Smart Cities Council and its partner companies and advisors who rank among the world's foremost experts on smart cities.

About the Authors

The Smart Cities Finance Guide was developed for the Smart Cities Council by the Center for Urban Innovation at Arizona State University.



Kevin C. Desouza serves as the Associate Dean for Research at the College of Public Programs (COPP) and is an associate professor in the School of Public Affairs at Arizona State University. He is also serving as the

Interim Director of ASU's Decision Theater. Immediately prior to joining ASU, he directed the Metropolitan Institute in the College of Architecture and Urban Studies and served as an associate professor at the Center for Public Administration and Policy within the School of Public and International Affairs at Virginia Tech. From 2005-2011, he was on the faculty of the University of Washington (UW) Information School and held adjunct appointments in the UW's College of Engineering and at the Daniel J. Evans School of Public Affairs. At UW, he co-founded and directed the Institute for Innovation in Information Management (I3M); founded the

Institute for National Security Education and Research, an inter-disciplinary, university-wide initiative, in August 2006 and served as its director until February 2008; and was an affiliate faculty member of the Center for American Politics and Public Policy. He holds a visiting professorship at the Faculty of Economics, University of Ljubljana. He has held visiting positions at the Center for International Studies at the London School of Economics and Political Science, the University of the Witwatersrand in South Africa, the Groupe Sup de Co Montpellier (GSCM) Business School in France, and the Accenture Institute for High Business Performance in Cambridge, Massachusetts (USA). Desouza has authored, co-authored, and/or edited nine books, the most recent being *Intrapreneurship: Managing Ideas within Your Organization* (University of Toronto Press, 2011). He has published more than 125 articles in prestigious practitioner and academic journals. His work has also been featured by a number of publications such as *Sloan Management Review*, *Harvard Business Review*, *BusinessWeek*,

and *Computerworld*, among others. Desouza has advised, briefed, and/or consulted for major international corporations, non-governmental organizations, and public agencies on strategic management issues ranging from management of information systems, to knowledge management, competitive intelligence, government intelligence operations, and crisis management. Desouza has received over \$1.4 million in research funding from both private and government organizations. For more information, please visit: <http://www.kevindesouza.net>



David Swindell is the Director of the Center for Urban Innovation and an associate professor in the School of Public Affairs at Arizona State University. Dr. Swindell is an advocate of the metropolitan mission concept through

which the intellectual resources of the university are focused on developing new solutions to the challenges confronting citizens in urbanized areas. Before joining ASU, he served seven years as director of the interdisciplinary Ph.D. in Public Policy Degree Program at the University of North Carolina. Prior to that, he was director of the UNC-Charlotte Master of Public Administration program as well as MPA director at Clemson University. Swindell received his doctorate from Indiana University in Public Policy. His primary research and teaching interests focus on community and economic development, especially public financing of sports facilities, the contribution of sports facilities to the economic development of urban space, the role of nonprofit community and neighborhood-based organizations as mechanisms for service delivery, and citizen satisfaction and performance measurement standards for public management and decision making. His research has been published in *Public Administration Review*, *Economic Development Quarterly*, *Journal of Urban Affairs*, *Social Science Quarterly*, the *American Review of Public Administration*, *Public Productivity and Management Review*, *Public Administration Quarterly*, the *Journal of Sports Management*, *Johnson's Minor League Baseball* and *Local Economic Development*, *Rosentraub's Major League Losers*, and *The Brookings Institution's Sports, Jobs, and Taxes*. Swindell's other sport-related activities have included working with local communities to understand the implications of such public investments. He has testified to federal, state, and local legislative bodies on a range of issues related to community and economic development. Swindell's other technical policy studies include numerous citizen satisfaction survey reports, models for involving various nonprofits in urban service delivery, various public program evaluations,

estimation methodologies for light rail ridership from special event generators, and business retention strategies for local governments.



Jonathan GS Koppell is the Dean of the College of Public Programs and the Lattie and Elva Coor Presidential Chair in the School of Public Affairs. Koppell has focused on preparing students for lives of community engagement and public service

while promoting use-inspired research by faculty and research centers aimed at making our communities more prosperous, healthy and resilient. He has emphasized the transcendent focus on "public goods" that unifies the specializations of college's four distinct schools (criminal justice, community development, public administration and policy, and social work) while connecting the college to the broad range of relevant ASU programs. Koppell's research and writing broadly examines the design and administration of complex organizations in the public, private and nonprofit sectors. His book *World Rule: Accountability, Legitimacy and the Design of Global Governance* reveals the hidden world of "global governance organizations" such as the World Trade Organization, the International Organization for Standardization and the International Accounting Standards Board that have more effect on our daily lives than we might imagine. Both his academic articles and previous book, *The Politics of Quasi-Government* address many of the key policy issues of the moment; including government involvement in for-profit enterprise, regulation of financial institutions and corporate governance. Koppell joined Arizona State University in 2010 as Director of the

School of Public Affairs, from the Yale School of Management where he also directed the Millstein Center for Corporate Governance and Performance. In addition to scholarly publications, Koppell has written numerous opinion pieces for the *New York Times*, *Wall Street Journal*, *Washington Post* and other leading publications. He holds a doctorate in political science from the University of California, Berkeley and a Bachelor of Arts degree from Harvard. In 2012, he was inducted as a Fellow of the National Academy of Public Administration (NAPA).



Kendra Smith is a Ph.D. student in the School of Community Resources & Development at Arizona State University (ASU). She is a research associate within the College of Public Programs. With a research focus on higher

education partnerships, Kendra investigates research partnerships between higher education and K-12 schools. Prior to coming to ASU, Kendra worked in her home state of Oklahoma on a variety of community-education projects that revolved around community engagement, greater higher education access and health policy. Kendra Smith holds a Bachelor of Arts degree from the University of Central Oklahoma and a Masters in Public Administration from the University of Oklahoma.



About the Center

The Center for Urban Innovation at Arizona State University develops new ways for public officials, private entrepreneurs, nonprofit agencies, and citizens to work together in addressing the challenges that confront metropolitan areas around the nation, from the neighborhood to the regional level. The primary research mission addresses questions of public leadership, meaningful democracy, and the reform of governance through new structures and processes such as regional cooperatives and neighborhood empowerment. Bringing together urban scholars, policy practitioners, and graduate students, the Center designs innovative and sustainable solutions for today's practical applications, but that are flexible to serve tomorrow's needs.

The Center serves as Arizona State University's focal point for research on urban affairs in the School of Public Affairs and the College of Public Programs. The center seeks to accomplish its goals through basic and applied research in books, journal articles, research reports, and public testimony, as well as through training and development activities for local government officials. The Center is committed to innovative education and training, critical research and community involvement in the continuing effort to assist communities establish their collective goals, mobilize the necessary resources, implement the policies to achieve their goals and deliver services effectively and efficiently that improve the quality of life.

For more information about the Center, visit:

<http://urbaninnovation.asu.edu>

About the Smart Cities Council

There is no other organization like the Smart Cities Council. We act as a market accelerator and advisor to cities – advocating for the transformation of urban areas into more livable, workable and sustainable communities. The Council is a coalition of leading technology companies with deep expertise in areas such as energy, water, communications and transportation. We have come together to provide a collaborative, vendor-neutral framework to guide cities through their smart city planning and implementation. We envision a world where technology and intelligent design are harnessed to create smart, sustainable and prosperous cities. We work to create cities that exemplify our three core values: livability, workability and sustainability. Visit www.smartcitiescouncil.com to learn more.

Smart Cities Council® is a registered trademark owned by Smart Cities Council LLC.

Global Alliances

In 2015 the Council introduced the [Global Alliances of Smart Cities Councils](#) – an opportunity for regional stakeholders everywhere to affiliate with the Council and leverage our best practices. The first licensee, [Smart Cities Council India](#), launched soon thereafter. To discuss becoming a Global Alliance licensee, please contact Council Executive Director Philip Bane: Philip.Bane@smartcitiescouncil.com

Council Partners

On the pages that follow, you will meet our partners and advisors. We invite you to join with us too. Learn more by contacting Council Chairman Jesse Berst. Jesse.Berst@SmartCitiesCouncil.com

INTRODUCING SMART CITIES COUNCIL LEAD PARTNERS

Cities seeking expert guidance regarding their smart city initiatives
will discover valuable partners in the companies
featured on the pages that follow.

[IBM](#)
[Itron](#)
[Alstom](#)
[Microsoft](#)
[GE](#)
[Cisco](#)
[S&C Electric Co.](#)
[Bechtel](#)
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[MasterCard](#)
[Enel](#)
[Ooredoo](#)
[Daimler](#)
[Cubic Transportation Systems](#)
[Allied Telesis](#)
[Schneider Electric](#)
[Verizon](#)

Partners are listed according to the date they joined the Council; longest-standing members appear first.



As a leading producer of smart technologies and services, IBM is pleased to lend its expertise to the Smart Cities Council's efforts to support and educate city leaders, planners and citizens.

Cities everywhere are reinventing themselves to better integrate across functions and collaborate with new partners to create and nurture the strong, differentiating identities that attract new citizens and businesses.

Combining world-class business, industry and technology expertise, IBM is able to apply innovation to help cities achieve their objectives. Drawing on thousands of client engagements across virtually every industry, only IBM offers the experience that today's challenges demand.

IBM smarter cities resources:

- [Smarter Cities press kit](#)
- [Smarter Cities web page](#)
- *White Paper:* [Smarter, More Competitive Cities](#)
- [People for Smarter Cities](#)
- [Smarter Cities You Tube Channel](#)

IBM worked with the city of Madrid to improve city life for three million citizens through a project that will use IBM's Smarter Cities technology to improve the efficiency of city services and provide citizens new tools to interact and communicate with the city council.



Leveraging big data and analytics, IBM helped Madrid transform its supplier management model by allowing the city to manage and pay each service provider based on the attainment of service levels. The platform integrates information provided by citizens with other data streaming in from sensors, devices, cameras, inspectors and suppliers as well as data from human resource management, job scheduling and geographic information systems to provide a comprehensive view of city services.

By helping Madrid manage an inventory of more than five million assets – ranging from park swings to traffic cameras – and the contracts of service suppliers, the project will deliver results for citizens by improving the management of public services such as street maintenance, lighting, irrigation, trees and green spaces and waste management.



“By enabling cities to better manage energy and water resources, Itron believes that, with collaboration and innovation, we can help cities not only adapt to address challenges, but also thrive. By drawing on today’s best minds and technology, the Smart Cities Council and its members are committed to achieving just that.”

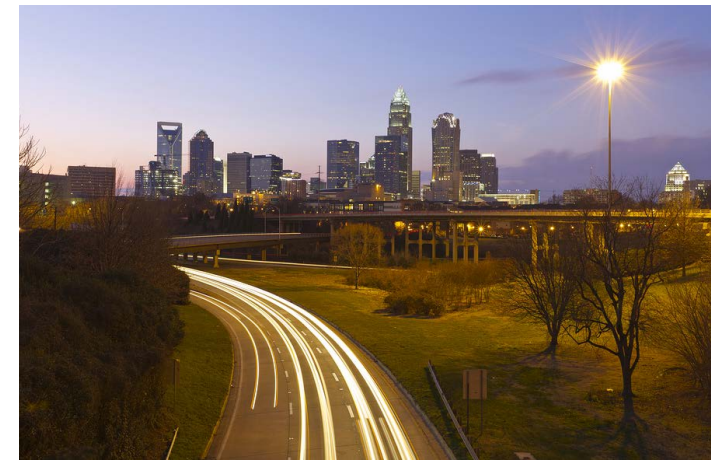
– Russ Vanos, Itron’s senior vice president of strategy and business development

Itron is a world-leading technology and services company dedicated to the resourceful use of energy and water. We provide comprehensive solutions that measure, manage and analyze energy and water. Our broad product portfolio includes electricity, gas, water and thermal energy measurement devices and control technology; communications systems; software; as well as managed and consulting services. With thousands of employees supporting nearly 8,000 customers in more than 100 countries, Itron applies knowledge and technology to better manage energy and water resources. Together, we can create a more resourceful world. Join us: www.itron.com

As a founding member and lead partner in the Smart Cities Council, Itron is helping to advance Smart City initiatives at a time when it is critical to take action. We believe Smart City initiatives will be incredibly important in the 21st century. Currently, more than half of the world’s population lives in towns and cities for the first time in history, which puts a strain on energy and water resources. In addition to the strain on resources, there is also an incredible amount of energy and water lost due to waste – approximately 30% of all treated water is lost and electricity losses cost utilities \$24B per year. In order to ensure sustainability and viability of our cities for future generations, smart technology needs to be utilized to reduce waste and empower people to manage and conserve resources.

Itron is collaborating with Microsoft to provide actionable data to help cities meet their objectives to reduce their carbon footprint and lower energy consumption. [Learn more >](#)

Smart City innovation has turned Uptown Charlotte into a living laboratory. Envision



> *Envision Charlotte: Itron teams up with partners to connect consumers with water usage and conservation information.*

[Read article >](#)

Charlotte Executive Director Amy Aussieker shares insights about the project. [Learn more >](#)

Itron’s water AMI solution helps the City of Kalgoorlie, Australia to manage resources more effectively and provide greater control over water wastage. [Learn more >](#)

Itron’s Mobile AMR solution allowed Alabama Gas Corporation to reduce CO2 emissions with fewer vehicles while gaining greater meter reading efficiency. [Learn more >](#)



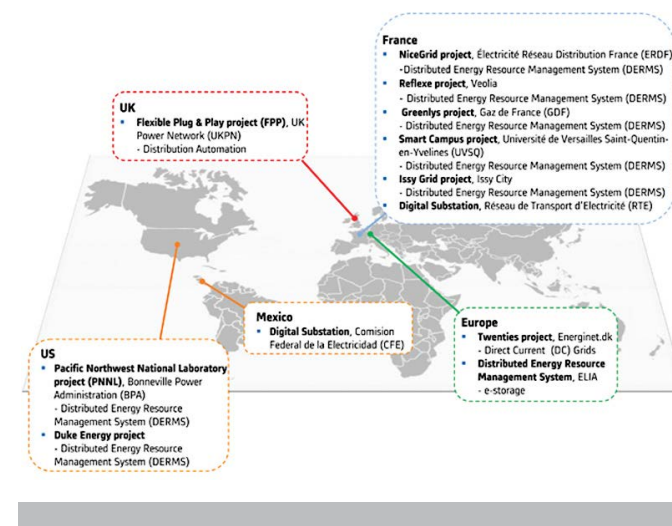
As a leading producer of smart technologies and services, Alstom Grid is pleased to lend its expertise to the Smart Cities Council's efforts to support and educate city leaders, planners and citizens.

To meet today's increasing global energy demands and challenges, networks must evolve and become smarter. Alstom Grid enables an efficient transmission and distribution of electricity and supports the development of Smart Grids and Supergrids with engineered solutions for applications in utility and industry settings; updating existing grids, integrating and customizing solutions such as alternating current and direct current substations, from medium up to ultra-high voltages. Alstom Grid is a key player in developing and implementing solutions to manage electric grids in the new era of increasing renewable energies and distributed energy resources, by enabling real-time, two-way management of electricity and information.

> *Alstom developed a number of demonstration projects in leading smart grid countries, in partnership with governments, utilities, industries, academic and research institutions.*

At the heart of the Smart Grid revolution, its solutions provide immediate benefits in many eco-city projects, thus enabling end-consumers to benefit from better energy consumption. Alstom Grid's knowhow is displayed in over 30 large scale demonstration projects in the US and Europe, with partners from both the public and private sectors.

The North Carolina Smart Grid Project in the USA led by the US Department of Energy (DoE) is designed to integrate distributed energy resources into the electrical grid efficiently in order to help the DoE reach its smart grid targets for 2030, including a 40% improvement in system efficiency. The NiceGrid smart district project developed with the French Distribution System Operator ERDF, located in the city of Nice (French Riviera), aims at developing several microgrids with integrated renewable energy sources and electricity storage with a scalable and cloud-based IT platform.



Clean grid

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Global grid

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Smart grid

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Electrical network systems

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Video overview

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Founded in 1975, Microsoft is the worldwide leader in software, services, devices and solutions that help people and businesses realize their full potential. Microsoft CityNext is an extension of that vision with a people-first approach to innovation that empowers government, businesses and citizens to shape the future of their city. People-first means harnessing all the ideas, energy and expertise of a city's people as it creates a more digital, healthy, educated, safe, and sustainable place to live.

With a broad suite of platform and productivity solutions for a mobile-first, cloud-first world, a vast global network of partners, and a history of successful education and social programs, Microsoft CityNext helps cities find the right answers for their local challenges and opportunities.

With Microsoft CityNext's partners, we are committed to helping cities:

- **Transform operations and infrastructure** with Microsoft CityNext and our partners' solutions by connecting systems, data, and people across departments to make information more accessible and services more affordable
- **Engage citizens and businesses** by enabling real-time communication services through devices and apps to provide additional value to citizen services, reach a broader population of citizens, and engage citizens and businesses more deeply with intelligent experiences. This includes connections between governments and citizens, governments and businesses, and other governments.

- **Accelerate innovation and opportunity** through programs that prepare youth to become the next generation of highly skilled workers, nurture entrepreneurs' bold ideas, and create jobs that help cities compete in the global marketplace by delivering excellent education, use data from the Internet of Things to develop new services and businesses, and attract talent and new business with a modern infrastructure.

Through a people-first approach and strategic partnerships, cities can enable sustainable cycles of innovation, opportunity, and progress for years to come.

Find out how Microsoft CityNext and our partners are enabling cities worldwide to harness the new era of innovation.

[Learn more ->](#)

Microsoft CityNext helps city leaders turn their smart city vision into reality.

[Learn more ->](#)

Connect with us on [Twitter](#), [Facebook](#), and [YouTube](#) to receive updates on new customer stories, partners, and more.

Learn more about how Microsoft CityNext and our partners are helping cities become smart with a people-first approach at <http://microsoft.com/citynext>





Imagine a world that connects data to people to machines, making lives better in the cities where people work, live and explore. It's a world where city leaders

could tap into endless intelligence to eliminate costly redundancies and develop a more workable and livable community.

That world is here, and it's powered by [Predix™](#), GE's cloud platform for the Industrial Internet. Through GE's Intelligent Environments for Cities solution, communities around the world will experience pioneering solutions from such businesses as [GE Software](#), [GE Lighting](#), [GE Healthcare](#) and [GE Power & Water](#). At GE, we look at innovation through a broad lens. By taking breakthroughs in one business and applying them to others, we push expectations and change the idea of what's possible – all for the benefit of cities around the globe.

[GE Software](#) is bringing the Industrial Internet to life by connecting minds and machines through innovative technology. In building our applications and GE [Predix](#), we combine decades of experience manufacturing industrial machines with cutting-edge data science and analytics expertise. The Predix platform has helped our developers save both GE and our customers

time, energy and money, and now we are releasing it so that your developers can leverage its advanced computing power and built-in integrations to develop innovative applications across industries. We have transformed our business and invite you to join us on this path as we ignite the next Industrial Revolution together. Learn more at [gesoftware.com](#) and [predix.io](#).

Seeing More than Light

One of GE's Intelligent Environments for Cities solutions uses LED street lighting and wireless sensors to connect, collect and analyze data, harnessing the power of the Industrial Internet to solve countless challenges facing cities and communities across the globe.

Cities on both U.S. coasts are piloting the Intelligent Cities technology to help solve these challenges and enhance the quality of life for residents and visitors. In San Diego, California, sensor technology has been added to existing GE LED streetlights, with a focus on parking solutions in its urban core. The city of Jacksonville, Florida is piloting the solution to access real-time data and focus on increasing efficiency through energy savings and better asset management of street lights.

From curbing street-lighting costs to improving traffic monitoring, enhancing pedestrian crosswalk detection, mitigating illegal dumping and monitoring adverse weather conditions, the



> *GE works on things that matter. The best people and the best technologies taking on the toughest challenges. Finding solutions in energy, health and home, transportation and finance.*

potential solutions from this technology are endless. [Learn more about the pilot programs.](#)

GE supports the Smart Cities Council's vision to transform urban areas into more livable, workable and sustainable communities. As a technology company, sustainability is embedded in GE's culture and business strategy. Working to solve some of the world's biggest challenges inspires our thinking and drives our actions.

Visit [www.ge.com](#) to learn more.



As world populations shift to urban areas, community leaders are pressed for answers to related problems. These include overcrowding, pollution, budget and resource constraints, inadequate infrastructures and the need for continuing growth.

Cisco Smart+Connected Communities solutions use intelligent networking capabilities to bring together people, services, community assets and information to help community leaders address these world challenges. By connecting the unconnected, we can do amazing things to address these real world challenges and create a more sustainable environment.

Cisco Smart+Connected Communities -- help transform physical communities to connected communities and achieve economic, social and environmental sustainability.

[Transforming communities >](#)

Retrofitting existing cities with smart solutions is the urban challenge of the 21st century.

[Learn more >](#)



> *City transforms economic sustainability with public cloud.*



S&C ELECTRIC COMPANY

Excellence Through Innovation

S&C proudly supports the Smart Cities Council in advocating the evolution toward smart, sustainable cities.

S&C Electric Company's innovative solutions for distribution automation and power delivery are helping cities around the world transition to cleaner and more reliable supplies of electricity required in the 21st century. S&C's groundbreaking technologies can reduce the length and frequency of power outages, improve energy efficiency, support advanced

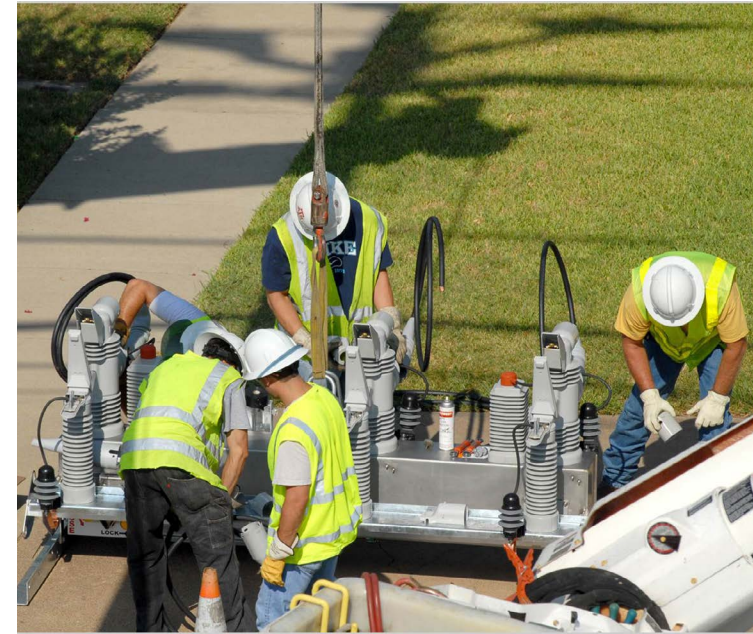
microgrids and grid-scale energy storage, and make it practical to use such variable renewable-energy sources as wind and solar power on a larger scale.

With its unmatched heritage of innovation and performance, S&C delivers both products and services to address not only today's power grid challenges, but tomorrow's as well.

Additional information is available at sandc.com.

Additional resources:

- Reducing Momentary Outages for Florida Power & Light: [Press release](#) [Video](#)
- S&C Ties California Utility's 2-MW Solar PV Project to the Grid: [Case study](#)
- Oncor's Microgrid Solves Electrical Distribution Challenges: [Video](#)
- Energy Storage to Smooth Solar Power: [Case study](#)
- Utility-Scale Energy Storage System Islands Remote Town During Outages: [Video](#) [Case study](#)
- Improving Reliability by more than 50% with Self-Healing Technology: [Case study](#)
- What do outages cost cities? [Video](#)
- Microgrids: An Old Idea with New Potential: [White paper](#)
- The Role of Energy Storage in Smart Microgrids: [White paper](#)
- Smart Microgrid at Illinois Institute of Technology: [Case study](#)



> Chattanooga, USA deployed S&C's self-healing smart grid solution to improve power reliability. The system is exceeding outage reduction goals of 40%.



Bechtel is pleased to support the Smart Cities Council's aspirations to foster the creation of smarter cities around the world by sharing our experience delivering major infrastructure projects and knowledge of planning, financing and sustainable solutions.

As a company, we work hard to build a more sustainable world. In our work with cities and governments we enhance local communities and improve the quality of life for people around the world. Time and again our work has demonstrated that the only limits on human achievement are those that we place on ourselves.

Bechtel is a global leader in engineering, procurement, construction and project management. Bechtel's diverse portfolio encompasses energy, transportation, communications, mining, oil and gas and government services.

We have been privileged to contribute towards some of the most significant urban infrastructure projects around the world, including the Channel Tunnel, Hong Kong International Airport, the Athens Metro system and work on more than 20 new cities and communities. In order to deliver projects of such magnitude successfully, we combine smart planning, technical know-how and an integrated approach to make visions become a reality. We look forward to sharing the benefits of this experience and our knowledge of planning, financing and sustainable solutions, to support the Council's aspirations to foster the creation of smarter cities around the world.

Since its founding in 1898, Bechtel has worked on more than 22,000 projects in 140 countries on all seven continents. Today, our 53,000 employees team with customers, partners and suppliers on diverse projects in nearly 50 countries. We stand apart for our ability to get the job done right - no matter how big, how complex or how remote. www.bechtel.com



Bechtel is the co-manager of the U.S. Department of Energy's Los Alamos National Laboratory. The lab provides advanced research in supercomputing and virtual reality with significant applications to Smart City issues such as energy, transportation, the environment and resilience.



Qualcomm Incorporated is the world leader in 3G, 4G and next-generation wireless technologies. Qualcomm Incorporated includes Qualcomm's licensing business, QTL, and the vast majority of its patent portfolio. Qualcomm Technologies, Inc., a wholly-owned subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of Qualcomm's engineering, research and development functions, and substantially all of its products and services businesses, including its semiconductor business, QCT. For more than 25 years, Qualcomm ideas and inventions have driven the evolution of digital communications, linking people everywhere more closely to information, entertainment and each other. Qualcomm innovation and technology can be used by cities worldwide to provide smart, efficient and sustainable services, including:

Cellular Grid Connectivity – ubiquitous consumer coverage, high bandwidth and real-time communications of 3G and LTE cellular networks that enable critical smart grid functionality such as advanced smart metering, demand response, distribution automation, and outage management.

Home Area Connectivity – unsurpassed whole home coverage, performance and reliability in an energy efficient manner.

Connected Vehicle – anywhere/anytime emergency assistance services, remote monitoring and diagnostics, advanced driver assistance features, GPS and GLONASS-enabled position-location features and services.

Wireless Electric Vehicle Charging – a simple, no fuss way to charge your electric vehicle. No cables, no wires, just park and charge.

Mobile and Wireless Health – broadband technologies enabling mHealth devices and services for chronic disease management, remote patient monitoring, diagnostic care, as well as products associated with general health, wellness, fitness, and aging.

Mobile Learning – mobile broadband technologies enabling personalized experiences within collaborative communities, transforming the work of teachers/students in K-20 schooling.

> For local, state and federal government personnel, good situational awareness can help save lives and better protect assets.



Qualcomm leverages its wireless expertise, innovative technologies and vast industry reach to provide capabilities and services that enable government customers – federal, state, and local.

[Learn more >](#)

Smart cities

[Learn more >](#)

Internet of Everything

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Wireless technologies

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MasterCard shares the Smart Cities Council's vision of a world where digital technologies and intelligent design are harnessed to create smart, sustainable cities with high-quality living and high-quality jobs.

MasterCard is a global payments and technology company. We operate the world's fastest payments processing network, connecting consumers, financial institutions, merchants, governments, cities and businesses in more than 210 countries and territories.

Our products and solutions are advancing the way consumer and business cardholders around the world shop, dine, travel, and manage their money, enabling transactions that drive global commerce and improve peoples' lives.

Passionate about innovation, MasterCard is constantly seeking to develop and test new payment channels and digital solutions that are safe, simple and smart.

Payments touch every aspect of our lives. Removing cash from the economy creates far-reaching and cumulative benefits for all participants — citizens, merchants, tourists and government —improving life for the city at-large.

Cities are becoming smarter, and whether it is to simplify internal processes, facilitate micro payments (transit, commerce...), optimize collection of funds or improve disbursement methods, MasterCard is developing inventive ways to support Cities digital strategy, drive local business growth, fuel commercial development, increase citizen's satisfaction and reduce costs.

Special and Unique Offers with MasterCard Priceless Cities. www.priceless.com

> *London bus passengers speed up their journey times with contactless card payments.*

[London bus cards >](#)



The global journey from cash to cashless: boosting economic growth and advancing financial inclusion.

[Learn more >](#)

Digital sharing and trust project: understanding the five online personas.

[Learn more >](#)



Enel is a multi-national power company and a leading integrated player in the world's power and gas markets, with a particular focus on Europe and Latin America. The Group operates in over 30 countries across four continents, generating power from over 90 GW of net installed capacity and distributing electricity and gas through a network spanning around 1.9 million km. Enel, with its 61 million end users worldwide, has the largest customer base among its European peers and is among the leading power companies in Europe in terms of installed capacity and reported EBITDA.

Enel was the first utility in the world to replace the traditional electromechanical meters with smart meters, making it possible to measure consumption in real time and manage contractual relationships remotely. Today, around 32 million Italian retail customers are equipped with smart meters developed and installed by Enel. The Group is deploying an additional 13 million smart meters to its customer base in

Spain as well as running pilot tests for the smart cities of Búzios (Brazil) and Santiago (Chile). This innovative tool is key to the development of smart grids, smart cities and electric mobility.


Enel is strongly committed to renewable energy sources and to the research and development of new environmentally friendly technologies. Enel Green Power (EGP) is the Group's publicly listed renewable energy generation company, operating over 9.8 GW of net installed capacity of hydro, wind, geothermal, solar, biomass and co-generation sources in Europe, the Americas and Africa. Enel Green Power is, technology-wise, the most diversified renewable company among its global peers.

[Enel website >](#)

[Enel on sustainability >](#)

[Enel on innovation >](#)



 *Strongly committed to renewable energy sources.*



Headquartered in Doha, Ooredoo is Qatar's leading communications company and is dedicated to supporting the Qatar National Vision 2030.

Ooredoo has an active strategic and supportive role in shaping the telecom and ICT strategies in Qatar as part of its goal to make the country one of the best-connected nations in the world. The "smart city" concept is central to the long-term development vision of Qatar, placing technology at the heart of new projects to enable a smart economy, smart mobility, a cleaner environment and smart governance.

To support this vision, Ooredoo has developed and launched a host of next generation technology from smart infrastructure (4G+ and Fibre), smart entertainment, connected cars, next-generation education, health and workplace solutions, intelligent transport and smart stadiums, demonstrating the company's leadership in driving the latest and the best technology.

Ooredoo is spearheading this technological boost by working with a number of leading enterprises including KT Corporation of Korea

> *Ooredoo is a leading communications company providing services in the Middle East, North Africa and Southeast Asia.*

and Lusail Real Estate Development Company, to ensure the development of smart city technology.

Ooredoo is becoming a leader in the provision of the network infrastructure required to build the Smart Cities of the future, and is leading the efforts for the first-ever Smart City in Qatar – the state-of-the-art Lusail City – which will be supported by Ooredoo's faster and bigger network. Residents and businesses will have access to a variety of smart services powered by a citywide Ooredoo Fibre network and managed through a centralised control centre.



The company has introduced a host of cutting-edge Ooredoo Machine to Machine (M2M) services to Qatar, enabling companies to connect business assets directly with each other or with a central command centre, removing the need for human involvement, and introducing new solutions directly into homes and businesses.

Ooredoo has also launched The Smart Living-Baytcom Project – a 'Proof of Concept Demo House' filled with smart living concepts.

[Ooredoo website >](#)

DAIMLER

About Daimler AG:

Daimler AG is one of the world's most successful automotive companies. With its divisions Mercedes-Benz Cars, Daimler Trucks, Mercedes-Benz Vans, Daimler Buses and Daimler Financial Services, the Daimler Group is one of the biggest producers of premium cars and the world's biggest manufacturer of commercial vehicles with a global reach. Daimler Financial Services provides financing, leasing, fleet management, insurance and innovative mobility services.

The company's founders, Gottlieb Daimler and Carl Benz, made history with the invention of the automobile in the year 1886. As a pioneer of automotive engineering, we continue to shape the future of mobility today. Our focus is on innovative and green technologies as well as on safe and superior automobiles that appeal to and fascinate our customers. For many years now, Daimler has been investing continually in the development of alternative drive systems with the goal of making emission-free driving possible in the long term. So in addition to vehicles with hybrid drive, we now have the broadest range of locally emission-free electric vehicles powered by

> *As a pioneer of automotive engineering, we continue to shape the future of mobility today.*

batteries and fuel cells. This is just one example of how we willingly accept the challenge of meeting our responsibility towards society and the environment.

Daimler sells its vehicles and services in nearly all the countries of the world and has production facilities on five continents. Its current brand portfolio includes, in addition to the world's most valuable premium automotive brand, Mercedes-Benz, the brands smart, Freightliner, Western Star, BharatBenz, Fuso, Setra, Thomas Built Buses, moovel and car2go. The company is listed on the stock exchanges of Frankfurt and Stuttgart (stock exchange symbol DAI). In 2014, the Group sold 2.5 million vehicles and employed a workforce of 279,972 people; revenue totaled €129.9 billion and EBIT amounted to €10.8 billion.



About Business Innovation:

Since 2007 the Business Innovation department has been Daimler's lab for innovative business ideas that reach out well beyond the company's core business of automotive manufacturing. Business Innovation tracks current trends and monitors technological, social and cultural developments with a view to developing new and profitable business solutions. Numerous pilot projects initiated in recent years have already led to the establishment of successful corporate units such as car2go, moovel or the Mercedes-Benz Driving Academy. There are now Business Innovation teams based all over the world. As well as at the headquarters office in Stuttgart, they are to be found in Istanbul, São Paulo, Beijing, Buenos Aires and Sunnyvale, California.



Cities around the world are facing the growing problem of aging and overburdened infrastructure, needing to carry more people but without the ability to move those people effectively. What's the answer? Cubic is doing this through NextCity, our vision for the future of urban mobility.

At Cubic, we love to solve problems and help travelers pay their fares quickly and safely through the revenue management and Intelligent Transport Systems (ITS) systems and tools we deliver to choose the smartest and easiest way to travel and pay for their journeys.

We also enable transportation authorities and agencies to manage demand across the entire transportation network – all in real time.

Today, all of our payment and information technology and services have been merged into an overarching vision called NextCity. Through NextCity and its subsystems, we are able to extract the data from our electronic payment systems and other system sensors. This data becomes actionable information for transportation operators to understand what their ridership is doing – where they come from, where they go, the routes they take and the times at which they travel. Better understanding of demand allows for better understanding of supply and capacity needs.

This data also empowers the travelers with information they can use to choose the best mode of travel as well as to know what and where the slowdowns or service alerts are to aid their journey planning.

Transport for London in partnership with Cubic is transforming the payment experience in one of the world's biggest cities. [Learn more >](#)

NextCity takes us further than we've ever been before. [Learn more >](#)



> *Innovative solutions for intelligent travel.*




Allied Telesis maintains a long history of helping cities implement their visions of interconnected, smarter operations on a city-wide basis.

Using the Company's resilient switching products and sophisticated network monitoring services, cities around the world have deployed IP video cameras, and made hospitals and homes smarter and more livable. Allied Telesis wireless solutions allow cell-based or blanket technologies to cover anything from small businesses to large venues with exceptional bandwidth and service.

We are at the start of a revolution with Smart Gigabit Cities around the globe. Cities that enable people to communicate at gigabit speeds on wireless and wireline networks are well positioned to attract the best and brightest business leaders, while enabling economic prosperity. The Internet of Things (IoT) and Smart Gigabit Cities are synonymous, and represent key aspects of any city revitalization process.

Smart Gigabit Cities deploying integrated safety solutions from Allied Telesis are able to



 **Smarter solutions for a smarter planet.**

protect and serve their communities by integrating a plethora of sensor types, providing a geospatial representation of their installed area, and taking the operations of a municipality to a new level of efficiency and safety. Using Allied Telesis EtherGRID solutions, city planners can fully integrate historical data about operations in their cities with sensor inputs, give a real-time view of current events, and utilize advanced spatial analytics. These capabilities provide planners and city managers the tools needed to elevate planning and decision-making to a new level of effectiveness.

Allied Telesis website
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Communications solutions
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As a leading provider of smart city solutions and services, Schneider Electric is pleased to lend its expertise to the Smart Cities Council's efforts to support and educate city leaders, planners, and citizens.

A global specialist in energy management with operations in more than 100 countries, Schneider Electric offers integrated solutions across multiple market segments, including leadership positions in Utilities & Infrastructures, Industries & Machine Manufacturers, Non-residential Buildings, Data Centres & Networks and the Residential sector. The group is focused on making energy safe, reliable, efficient, productive and green, through an active commitment to helping individuals and organisations make the most of their energy.

Schneider Electric delivers urban efficiency. The group is a trusted partner in cities around the world and works collaboratively with visionary city leadership, engaged stakeholders, and a dynamic network of partners to address each city's unique challenges. With solution and services expertise in the critical infrastructure areas of energy, buildings, water, transportation, public services and integration, Schneider Electric is able to effectively bridge traditional information silos. The group's innovative solutions and pragmatic integration capabilities combine both operational and information technology, for impactful implementations that deliver the short-term, visible, maximum return on investment results that cities need.

[Learn more](#) about Schneider Electric's smart city solutions.

Schneider Electric helps to advance a smart city at the foot of the Sierra Nevada mountains

[Learn more >](#)



German city consolidates building management and cuts energy use with Schneider Electric solutions

[Learn more >](#)

White papers:

- [Urban Mobility in the Smart City Age](#)
- [The Smart City Cornerstone: Urban Efficiency](#)



[Verizon's Smart Cities solutions](#) empower municipalities to solve some of today's biggest challenges -- including public safety, traffic and energy management, intelligent transportation and precision agriculture -- using a powerful combination of advanced networking, cloud computing, security and device management. By making cities "smarter," local governments, in collaboration with Verizon, are able to become more efficient, resilient, address aging infrastructure, generate more revenue and better protect the local communities they serve.

[Verizon's Smart Cities solutions](#) help municipalities quickly and cost-effectively support initiatives for managing buildings, roadways, utilities and transportation systems. Using applications such as fleet and asset management, smart lighting, condition-based maintenance and smart grid technology -- enabled by Verizon's network and cloud infrastructure -- Verizon helps city planners develop sustainable platforms to use resources more efficiently. The goal is to help generate non-tax city revenue, create safer municipalities, engage constituents and promote urban renewal -- all of which can attract businesses, residents and workers.



Verizon smart cities and Internet of Things resources:

- News article: [Verizon Accelerates Move to Smart and Sustainable Cities](#):
- Video: [Verizon on Smart Cities](#)
- Webinar replay: ["The Art of Smart Cities"](#)
- Case study: [Building Smarter and Safer Communities](#)
- Case study: [Helping the City of Charlotte Envision a More Sustainable Future](#)
- Case study: [City of Napa Improves Visibility and Efficiency with Networkfleet](#)
- Infographic: [Moving to a Smarter City](#)
- News article: [Verizon Delivers Smart Energy As-A-Service](#)
- News article: [The Future of Smart Grid Technology](#)

On the Verizon website:

- [Verizon Smart Cities Solutions](#)
 - [Solutions for State & Local Government](#)
 - [Solutions for Public Safety Services](#)
- [Verizon Grid Wide Utility Solutions](#)

INTRODUCING SMART CITIES COUNCIL ASSOCIATE PARTNERS

Council Associate Partners are leaders in their sectors.
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Partners are listed according to the date they joined the Council; longest-standing members appear first.



ABB strongly supports the Smart Cities Council's goals of livability, workability and sustainability"

"Cities today are home to over 50 percent of the world's population and account for 80 percent of global GDP. By 2050, an additional 2.9 billion people will be living in cities, and urban dwellers will represent 70 percent of the world's population. About 90 percent of this growth will be in developing economies as people are drawn to urban areas by the perceived economic advantages. These cities will need new and intelligent infrastructure to meet the needs of their citizens and businesses.

Other cities that are not facing dramatic population increases are setting goals to ensure their long-term prosperity. With businesses and workforce becoming increasingly mobile, they are shaping their futures around competitiveness, liveability and sustainability.

An effective way to support these city goals is by using technology to more intelligently monitor, optimize and control key systems and infrastructure. In other words, to operate as a 'smart city'.

Many intelligent power and automation solutions already exist to enable cities to automate their key public and industrial services in the areas of:

- City Communication Platforms
- Electricity Grids
- Water Networks
- Transport
- Buildings
- District Heating and Cooling

ABB's heritage in power and automation is one of continued innovation and delivery on behalf of our customers, spanning over 125 years. Our products and solutions are at the heart of a city's critical infrastructure, relied upon for everything from the supply of power, water and heat, to the automation of factories and the buildings we live and work in."

ABB Smart Cities portal: [Smart Cities >](#)

ABB Smart Grids portal: [Smart Grids >](#)



As a leading producer of smart technologies and services, Alphinat is pleased to contribute to the Smart Cities Council Readiness Guide and other materials to help accelerate the move to smart, sustainable cities.

Alphinat is a software editor of SmartGuide® the leading "one stop" Web, Mobile and Cloud Solution Development Platform that enable cities to easily create, deploy and manage intelligent personalized web applications.

With our partners we are looking to give client cities constituents a simpler user experience that can, guide them to an optimal experience in a mobile or traditional browser-based environment. SmartGuide provides organizations and other software editors with the agility to quickly deliver efficient online services to their stakeholders unleashing the full value of existing IT assets. An Alphinat partner is delivering intelligent e-services for municipalities in the Netherlands in SaaS and on-premises modes incorporating SmartGuide® into their suite giving municipal clients the ability to quickly deploy intelligent online services. Citizens no longer need to fill in data already known to the government. Furthermore, these online services are accessible on Smartphone or tablets.

SmartGuide allows municipalities to deliver e-services with personalized, real time data exchange. With these intelligent e-services, municipalities greatly enhance the quality of their online service delivery and increase citizen satisfaction. The e-services offered automatically determine whether a citizen is entitled to a particular service such as a tax refund or a parking permit. These complex real-time validations delivered by the digital service bureau result in tremendous time savings for citizens and the community.

Alphinat technology can benefit city of all sizes by helping them modernize, automate and render cost-effective a many business processes at a fraction of the cost associated with conventional customized solutions. Alphinat is headquartered in Montreal, Quebec, with offices in Paris, New York and Zurich.

For more information, visit:

- [Alphinat website >](#)
- [Alphinate DGME case study >](#)

SUNGARD® PUBLIC SECTOR

SunGard Public Sector is a leading provider of software and services for local governments, public safety and justice agencies and nonprofits. More than 150 million citizens in North America live in municipalities that rely on our products and services.

For more than 30 years, SunGard Public Sector has leveraged ground-breaking technology and our innate understanding of the needs of the public sector toward the development of public administration and public safety software. SunGard Public Sector's products enable our customers to experience the future happening today. Visit us online at www.sungardps.com.

SunGard Public Sector's software products not only enhance the way municipalities, public safety and justice agencies, and nonprofits conduct business – they redefine the way citizens and employees interact with government.

The City of Oviedo, Florida has been a SunGard Public Sector customer since 1995. In 2004, the city switched its implementation to SunGard Public Sector's Horizon Government Cloud, a powerful resource for local governments seeking to do more with less. Prior to switching to Horizon, the City of Oviedo found the cost of equipment, expertise and time to maintain their existing premise-based computer system challenging. When financial resources became limited, the city began seeking alternative solutions. The switch to Horizon has ultimately helped Oviedo become smarter with the way they do business. [Read more >](#)

Located just a few miles northeast of Atlanta, Johns Creek, Georgia can go an entire winter without seeing snow. But that changed in January 2014, when the entire Atlanta area was rattled by ice storms and heavy snow. To keep residents of Johns Creek apprised of the situation, the local police department started centrally distributing information through its Facebook and Twitter accounts on a regular basis. Johns Creek Police Department is a customer of SunGard Public Sector and a user of SunGard Converge Police-to-Citizen (P2C), which allows the department to share public information with citizens in a central way and lets citizens search police records and download reports. The proprietary P2C system, called JCPD4Me, is interoperable with social media platforms like Twitter and Facebook, which means that citizens can get this information and interact with the police department through the platforms they already know. [Read more >](#)



At CH2M, we naturally take pride in the projects we deliver, but we never forget what our work is really about: clean water to drink, affordable energy, sustainable cities for families now and in the future, more closely connected communities and so much more. Every project we take on is a chance to move the world forward one more step, and we think that's an incredible privilege.

We're excited by tough challenges — the tougher they are, the more excited we get. We love to take on our clients' most complex infrastructure and natural resource problems, turning them upside down and inside out, solving them in ways nobody has thought of before. Together, we create new pathways for human progress, breathing fresh life, energy and enterprise into every community we touch.

Our partners and clients include governments, cities and businesses in more than 50 countries. To meet their biggest engineering challenges, we tap deeply integrated capabilities across our organization — in transportation, water, environmental, nuclear, oil & gas, industrial and urban environments. And we draw on the exceptional skills and creativity of 25,000 teammates with an outstanding track record of expertly executing projects both big and small.

We love what we do, but we care just as much about how we work. Deep respect for our family of employees, our clients and the communities we serve guides us at every step. We aim to meet each day with integrity, an adventurous spirit, and dedication to the well-being of people in our lives and work.

Read all about some of our projects in these sectors:

- [Energy >](#)
- [Transit & Rail >](#)
- [Water >](#)



Imex Systems helps build the next generation of smart governments and smart cities that are livable, workable, sustainable and prosperous. Imex Systems integrates city government, city infrastructure and citizens to create a smart city that improves the quality of life for citizens, enhances economic development, and fosters sustainability.

Our iGov technology platform and services enable governments to provide “Any Time, Any Where, Any Device and Any Channel” convenience for citizens to access government services, while helping governments automate and optimize business processes to improve internal operations. iGov helps measure and manage performance, find bottlenecks, and continuously improve service delivery to reduce costs. Other benefits include:

- Leveraging common re-usable technology components to reduce costs of smart city implementation and maintenance.
- Breaking down departmental silos to create a centralized collaborative approach.
- Increased engagement with citizens through web and social media channels.
- Proactively communicating with citizens during emergency situations through multiple channels.
- Integrating infrastructure – water/sewage, waste, power, transportations and buildings for smart operations.
- Providing transparency through open data.
- Enhancing financial and digital inclusion.
- Reducing governments’ carbon footprint.

The miGov mobile service delivery platform puts the government at citizens’ finger-tips by providing real-time messaging and service delivery. Governments can communicate instantly and effectively with their citizens on a wide range of topics, from a change in service, to an emergency situation.

Our payment systems help governments manage their revenue using a variety of payment methods and technologies, from traditional cash transactions to cutting-edge mobile payments. We offer pre-paid credit cards to efficiently manage benefit payments while reducing costs, and providing greater citizen convenience.

Our on-premise and cloud solutions are affordable for small towns and scalable, to meet the needs of large governments in both emerging and advanced markets.

Visit our website at www.imexsystems.com to learn more about our products, solutions and services.



Neptune Technology Group Inc. is a pioneer in the development of automatic meter reading (AMR) and advanced metering infrastructure (AMI) technologies for more than 47 years.

Neptune has continually focused on the evolving needs of utilities – revenue optimization, operational efficiencies and improved customer service. The company offers a fully integrated migration path for its utility customers to meet their needs now and in the future.

Each utility has its own unique needs, based on size, geography, infrastructure and other factors. Neptune makes it a point to understand your specific needs so that we can offer a solution that suits you the best. That’s how we strive to become your **most valued partner.**

Once we understand the challenges that your utility is facing, our people are trained to help you determine the best meter reading systems and tools that can be used to meet those needs, maximizing accuracy and efficiency while reducing costs and labor. And while providing for your present needs, Neptune helps utilities to always keep an eye toward the future not only with advanced technology but also with systems that allow for easy migration to adapt to changing requirements.

At Neptune, we have a rich history of innovation in meter reading systems on which we continue to build.

See/read about how Neptune is helping water utilities keep an eye on the future:

- [Indio Water Authority General Manager, Brian Macy, uses Neptune’s R900 System to help reduce Non-Revenue Water](#)
- [Neptune Territory Manager, Andy Bohn, helped Indio Water Authority share data through all their department](#)
- [Read more about Indio as well as other case studies](#)

Learn more at: <https://www.neptunetg.com>



The megatrends urbanization, climate change, globalization and demographic change will shape the future of cities. With the need to improve the quality of life and economic competitiveness, cities have to become more resource-efficient and environmentally friendly.

Technologies are major levers and base for further sustainable city development. An effective infrastructure contributes to economic prosperity, improving quality of life. Urban residents need clean air, potable water as well as security. They need efficient buildings, a reliable power grid and capable mobility solutions.

The complexity involved requires a holistic view and sustainable solutions for cities. Siemens has the portfolio, know-how and consulting expertise to make cities more livable, competitive and sustainable.

Infrastructure is the backbone of our economy. It moves people and goods, it powers our lives, it fuels growth. Across the world, more and more people are struggling with systems that are aging or overwhelmed. Siemens offerings include:

- Total integrated power solutions for safe, reliable, efficient power distribution
- Smart grid technologies that balance supply and demand, prevent power outages and integrate renewable power cost-effectively
- Integrated mobility solutions that move people and goods faster, safer and with fewer resources
- Smart building technologies that drive energy efficiency, reduce costs, and protect and secure all assets

[Siemens website >](#)

[Infrastructure & Cities Sector >](#)



Enevo is pleased to support the Smart Cities Council and contribute to its Readiness Guide.

Enevo brings together software and telecommunication engineers, data analysts, network gurus and seasoned waste management experts to create smart logistics optimizations solutions for the waste management and recycling industry. We help both commercial waste management companies and public organizations to operate more resource efficiently.

Until now collecting waste has been done using static routes and schedules where containers are collected every day or every week regardless if they are full or not. Our flagship solution Enevo ONE changes all this by using smart wireless sensors to gather fill-level data from waste containers. The service then automatically generates schedules and optimised routes which take into account an extensive set of parameters (future fill-level projections, truck availability, traffic information, road restrictions etc.). New schedules and routes are planned not only looking at the current situation, but considering the future outlook as well.

Collection based on Enevo's smart plans significantly reduces:

- Costs
- Emissions
- Road wear
- Vehicle wear
- Noise pollution
- Work hours

Enevo ONE provides organizations up to 50% in direct cost savings in waste logistics. And that's not all. Reducing the amount of overfull containers means less litter and happier customers! Enevo ONE provides a significant increase in efficiency across the whole value chain.

[Visit the Enevo website >](#)

[Learn more about Enevo ONE >](#)



OSIsoft provides an open infrastructure to connect sensor-based data, operations and people to enable real-time intelligence. The flagship product, the PI System, enables your organization to capture and leverage sensor-based data across the enterprise to improve efficiency, sustainability, quality and safety.

The PI System empowers organizations across a range of industries in activities such as exploration, extraction, production, generation, process and discrete manufacturing, distribution and services to leverage streaming data to optimize and enrich their businesses. For over thirty years, OSIsoft customers have embraced the PI System to deliver process, quality, energy, regulatory compliance, safety, security and asset health improvements across their operations. Founded in 1980, OSIsoft is a privately held company, headquartered in San Leandro, California, U.S.A, with offices around the world.

"Sensor-based data is different and requires different approaches to manage and process before it can be used reliably, efficiently and continuously within big data analysis. Sensors can deliver continuous or fragmented time series data streams in immense volumes and high frequency. Whether batch processing or streaming sensor data for big data analytics sensor data needs manipulation, indexing, aggregation, contextualization and governance before delivering to big data analytics engines. It's essential to get this right otherwise the value of the data will be lost."

Richard Beeson
Chief Software Architect and CTO
OSIsoft

Read the Gartner/OSIsoft white paper:

[Architecting an Industrial Sensor Data Platform for Big Data Analytics: Continued](#)

Additional resources:

- [City of Calgary: Using Data to Predict and Mitigate Floods](#)
- [JuiceBox Charging Solution Leverages Data from Connected EV Network for Smart Charging and Grid Optimization](#)
- [Itochu's Innovative Cloud-Based Services Connect Japan's New Energy Ecosystem](#)

[OSIsoft website >](#)



Saudi Telecom Company (STC) is the largest telecommunication services provider in the Middle East and North Africa. It is the leading operator within the Kingdom of Saudi Arabia, and its international presence extends to nine countries.

The company is working continuously to fulfill and satisfy the market requirements, keeping pace with the emerging technologies in the telecommunications sector and satisfying its customer's needs. STC has put in its consideration that this is the way to reinforce its position and identity in view of a changing world where the role and usage of telecommunications became more significant.

STC offers mobile, landline, television and Internet services. Its goals include becoming the next-generation leader in broadband.

Saudi Telecom Company is a member of the Telecom Council of Silicon Valley. The Council connects companies and individuals involved in the communications technology industry with one another for business development, collaboration and education. STC is the first telecom company in the Middle East to join the Council, which has over 100 member companies

[Saudi Telecom website >](#)



Black & Veatch is an employee-owned, global leader in building critical human infrastructure in the Energy, Water, Telecommunications and Government Services sectors. Since 1915, we have helped our clients improve the lives of people in more than 100 countries through consulting, engineering, construction, operations and program management.

In keeping with our Building a world of difference® mission, Black & Veatch is committed to the innovation and adoption of advanced technology solutions to build more sustainable cities and communities. Black & Veatch is at the forefront of the movement toward smarter, more integrated infrastructure systems that extend beyond company and industry boundaries. We deliver new sources of value through the integration of distributed infrastructure, smart sensors, communications networks, automation systems, and big data and analytics. These Smart Integrated Infrastructure (SII) solutions increase system-wide intelligence to improve the efficiency, reliability and resiliency of the fundamental services we rely on every day.

Black & Veatch SII solutions for Smart Cities include:

- **Design & Construction:** In addition to engineering, procurement and construction (EPC) services for core Energy, Water and Telecom infrastructure, we provide EPC services for distributed infrastructure systems including stationary storage, Electric Vehicle (EV) charging stations, microgrids and distributed generation systems.
- **System Integration:** As consultant, program manager and integrator, we combine our own expertise with our world-class partner network to plan and implement turnkey smart city solutions.
- **Smart Analytics:** Leveraging our ASSET360™ analytics platform and third-party technologies, we provide community-scale data management and analytics solutions that enable integrated management of resources such as energy, water and gas.
- **Operations Support:** We help clients with the ongoing lifecycle management of their smart systems – maintaining overall performance and supporting individual community participant needs.

Learn more: [Smart Integrated Infrastructure](#)

Related links:

[Peoria, Arizona - Butler Water Reclamation Facility](#)

[Los Angeles: Echo Park Lake Rehabilitation](#)

[SDG&E Sunrise PowerLink project](#)

Video: [Powering the Charge for Electric Cars](#)



Organic Energy Corporation is an advanced municipal solid waste (MSW) separation and re-purposing company. OEC specializes in maximizing the recovery and diversion of recyclables and resource feedstock from landfill bound MSW.

OEC currently holds five patents on the MaxDiverter™ sorting process and has numerous additional patents pending.

OEC is also the driving force and lead partner for EcoHub, an innovative collaboration of premier organizations working together to reclaim discarded resources to achieve a waste free society.

Using proven technology that has been organized and utilized in innovative ways, EcoHub allows for every piece of the waste stream to be collected using “one bin” and accurately sorted into separate resource categories. EcoHub’s manufacturing partners then re-purpose these resources into new, viable products (e.g., paper products, building products, natural gas, etc) that can be distributed to the local community – a true closed-loop solution for the world’s growing waste disposal problem.

With long-term access to the waste stream, OEC/EcoHub can help partner cities reduce costs, catalyze economic development and generate improved environmental outcomes.

[Learn more about Organic Energy Corporation >](#)

[Learn more about EcoHub >](#)



Urban Integrated Inc., part of The Urban Institute® group, is a leading software and consulting company for Smart City Solutions. In particular, [ui!] offers integrated cloud based services that bring together the various data sources across the city into one platform.

UrbanPulse consolidates and readies data from the various sources across the city into actionable intelligence, using big data analytics and algorithms for decision-making and automation. Users are the city government, businesses, utility providers and citizens. The solution is presented as an open cloud based platform and is available for others to build on top.

The Urban Institute was established in Germany to help cities define and realize their smart city strategies in line with the European Union directive Euro 2020., that foresees a 20% reduction in energy usage, 20% reduction in emissions, and a 20% increase in the use of renewables by 2020.

Making cities even smarter :

- [Urban Integrated website](#)
- [The Urban Institute website](#)
- [Case Study City of Darmstadt, published by Microsoft](#)



Space-Time Insight helps asset-intensive organizations make faster, more-informed decisions. Our real-time visual analytics applications correlate, analyze, and visualize large volumes of business, operational and external data, spatially, over time and across network nodes. Our award-winning software powers mission-critical systems for some of the largest organizations around the world, helping them reliably, efficiently and economically deliver services and rapidly plan for and respond to a full range of operating events.

Space-Time Insight provides solutions for utilities and government, among others.

Utilities: Space-Time Insight's breakthrough situational intelligence applications for utilities provide unprecedented 360-degree operational and planning insight by correlating, analyzing and visualizing IT, OT and external (XT) data sources spatially, over time and across network nodes. Our applications deliver greater capital and operational efficiency, safety, and reliability in a matter of months. Space-Time Insight's software helps some of the largest utilities around the world reduce costs, uncover revenue opportunities and deliver more reliable services to their customers. [Learn more >](#)

Government: Cities need a smarter way to work together across functional and organization divides to plan, justify, and allocate capital efficiently in support of building, operating, and maintaining the digital infrastructure of the Smart City. To deal with major events, either planned or unplanned, cities require a single, shared view of the situation they face. Space-Time Insight helps break down governmental organization and data silos by ingesting disparate data sources into its patented in-memory system, correlating the data across space, time, and node, and extracting the key information or events that become the basis for better, more informed decision making. [Learn more >](#)

[View video](#) about Space-Time Insight at Sacramento Municipal Utility District

Visit spacetimeinsight.com



As the new hallmark for a more sustainable future, smart communities start with a smart grid. They are the heartbeat that powers the community's critical infrastructure and the foundation for enabling power, water, transportation, public safety and other services to function in harmonious, mutually supportive concert. And when it comes to smart grid, Elster provides the solutions needed to vitalize our communities by bringing smart meter data to the people and processes that depend on it.

With smart grid and AMI solutions, plus street and area lighting, Elster is a one-stop shop for smart community solutions and is helping public power utilities everywhere unlock the value of their meter data.

In an Elster-enabled smart community, power demand and consumption are automatically controlled to reduce peak demand. Smart sensors monitor and control streetlights based on brightness and time. Municipal broadband communications platforms underpin smart grid operations – and also provide the community with free Wi-Fi. Utilities proactively notify customers about leaks before they become a problem.

When communities are smart, energy intersects with traffic control, electric vehicles, solar power, security systems – the list has no limits. The result? Happier customers, improved system reliability, enhanced operational efficiency and better environmental sustainability.

This is the smart community future. And it's enabled by Elster – today.

Learn more about Elster:

[Elster Solutions website](#)
[Connexo: Simplifying the utility journey](#)
[Advanced Meter Fort Collins](#)

Videos:

[Transformer Optimization](#)
[Leak Detection](#)
[Nontechnical Loss](#)
[Outage Management](#)
[Smart Communities](#)



Bit Stew Systems is the creator of the market leading platform for Software Defined Operations for the Industrial Internet.

Bit Stew's revolutionary information processing engine, Mlx Core™ enables complex event processing, advanced analytics and sophisticated machine-intelligence. The Mlx Core technology has proven scalability to provide end-to-end operational visibility for billions of connected devices and trillions of data points—making it the ideal platform for the Industrial Internet. This same Mlx Core technology can also be embedded in devices, gateways and routers for intelligence and automation directly at the edge of the network.

Bit Stew's flagship product solution, Grid Director™ is built on Mlx Core and designed specifically to meet the exacting demands of the utility industry. Grid Director offers customers complete visibility and control of their networks enabling more agile and informed decision-making that improves reliability, efficiency and performance. Grid Director provides real-time analytics, pattern recognition, dynamic event management, and rapid integration across enterprise systems and applications.

Incorporated in 2009, Bit Stew Systems is a venture-backed private company that is headquartered in Canada with offices in the USA, Australia and Europe. Bit Stew was named on the Gartner Cool Vendors in Energy & Utilities list for 2014 and the Frost & Sullivan Entrepreneurial Company of the Year – North American Service Solutions for Utilities.

[Visit the Bit Stew Systems website >](#)



Silver Spring Networks is a leading networking platform and solutions provider for smart energy and smart city networks. Silver Spring's pioneering IPv6 networking platform, with more than 20 million Silver Spring enabled devices worldwide, is connecting critical infrastructure around the globe to help improve energy reliability, enable cities to provide better services to citizens, and unlock the next generation of applications for the Internet of Things.

Silver Spring's innovative solutions enable utilities and cities to gain operational efficiencies, improve grid reliability, and empower consumers and citizens. Silver Spring's major utility customers include Baltimore Gas & Electric, CitiPower & Powercor, Commonwealth Edison, CPS Energy, Florida Power & Light, Jemena Electricity Networks Limited, Pacific Gas & Electric, Pepco Holdings, Progress Energy and Singapore Power, among others.

Silver Spring connects smart city infrastructure in cities on 5 continents including Bristol, Chicago, Copenhagen, Glasgow, Melbourne, Miami, Paris, Sao Paulo, San Francisco, Singapore and Washington, D.C. Silver Spring is partnering with Florida Power & Light for the world's largest connected lighting project, nearly 500,000 networked street lights across South Florida.

Silver Spring's smart city platform helps municipalities deploy canopy networks connecting critical infrastructure assets such as public lighting and others. These intelligent lighting systems dramatically improve system reliability, increase energy efficiency, lower operational costs, and enhance citizen safety and quality of life. Silver Spring's open, standards-based network also enables cities to establish a platform for future smart city applications and services such as traffic management, environmental sensors, smart parking, electric vehicle charging, electricity metering, water conservation, and many others.

[***Learn more at our website >***](#)



Civic Resource Group International's mission – Fulfilling the Promise of Technology – is perfectly aligned with the Smart Cities Council's vision of “a world where digital technology and intelligent design have been harnessed to create smart, sustainable cities with high-quality living and high-quality jobs.”

CRG International is one of the world's leading providers of digital government solutions. The company develops innovative, highly secure digital solutions built on CRG's flagship product [CivicConnect™](#), a first-of-a-kind fully integrated Mobile/Cloud/Data Platform delivered in a SaaS model (Software as a Service) for the broad public sector. With its major focus on the key “smart” sectors, such as public transportation, environmental/utilities, tourism/economic development, regional planning/MPOs and health care, CRG's work touches every facet of citizens' lives. The company's “Smart” Offering – CivicConnect combined with CRG's CivicConnect business-specific line of products such as “Smart City,” “Water,” “Traveler Relationship Management (TRM)” “Parking,” “Geo-Social Mapping,” CivicAR™ (Augmented Reality for Public Sector) and “Community,” among others, have been developed to address fast-changing public sector needs resulting from the massive move to the emergence of the Internet of Things.

Since 2000, CRG has been “fulfilling the promise of technology” for clients in the broad public sector by leveraging the award-winning [CivicConnect™](#) Platform and deep domain expertise. CRG's impactful, engaging and cutting-edge products have a proven record of facilitating openness, transparency, safety and efficient service delivery for communities and their constituents. CRG is a new breed of company with a new approach, blending the best of technology, design and communications in the digital age to support Sustainable Communities, Efficient Public Services, Engaged Citizens and Overall Better Quality of Life.

In early 2015, CRG was named to CIOReview's [Top 20 Most Promising Government Technology Providers](#) list, recognizing CRG's role in leading the digital transformation of the broad public sector in both the U.S. and international markets.



Throughout the world, city leaders recognize LED lighting as the most efficient entry point on their journey to becoming a smarter city. Not only do LED lights deliver more than 50% in energy and operational savings, but this infrastructure upgrade can also provide a new network to support a wide range of smart city and smart grid applications, like enhanced public safety, air quality and traffic monitoring.

ProFieldLight, our award-winning mobile workforce management technology, helps ease the road to smart city implementation by effectively managing a variety of LED lighting initiatives. ProFieldLight ensures safety, reliability and on-time project completion so our customers reap the benefits of energy efficiency while protecting their bottom line.

No matter where you are on the road to Smart Cities, ProField® can light the way.

Visit: [Apex LED lighting solutions](#)



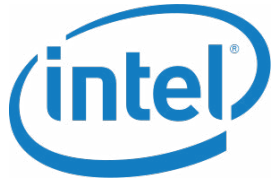
Around the globe, Veolia helps cities and industries to manage, optimize and make the most of their resources. The company provides an array of solutions related to water, energy and materials – with a focus on waste recovery – to promote the transition toward a circular economy.

Veolia's 187,000 employees are tasked with contributing directly to the sustainability performance of customers in the public and private sectors, allowing them to pursue development while protecting the environment.

To this end, the company designs and deploys specialist solutions to provide, protect and replenish resources while increasing their efficiency from an environmental, economic and social standpoint. Such initiatives are all part of Veolia's ongoing campaign to resource the world.

- [We turn waste into materials](#)
- [We work to save water and energy](#)
- [We work with municipalities around the world](#)

[Learn more at our website >](#)



Today the Internet of Things (IoT) has enormous potential to drive economic value and social change. But with 85% of things still unconnected and security threats pervasive, the industry has yet to tap IoT's enormous potential.

[The Intel® IoT Platform](#) breaks down these obstacles. It provides an end-to-end platform for connecting the unconnected – allowing data from billions of devices, sensors, and databases to be securely gathered, exchanged, stored, and analyzed across multiple industries.

Once largely a PC-oriented company, Intel® increasingly provides the vital intelligence inside a wide range of devices, from the lowest-power mobile devices to the most powerful supercomputers in the world.

Since introducing the industry's first commercially available memory chips in 1969 and the first microprocessor in 1971, Intel makes hardware and software products that power the majority of the world's data centers, connect hundreds of millions of cellular handsets and help secure and protect computers, mobile devices and corporate and government IT systems. Intel technologies are also embedded in intelligent systems including for automobiles, digital signage, automated factories and medical devices.

Related resources:

[San Jose and Intel leverage IoT innovations](#)

[Smart Cities UK: Imperial College and Intel IoT Project](#)

[Urban Growth and Sustainability: Building Smart Cities with the Internet of Things](#)

[Pecan Street Project: Smart Grid and Internet of Things](#)



West Monroe Partners is an international, full-service business and technology consultancy focused on guiding organizations through projects that fundamentally transform their business.

With the experience to create the most ambitious visions as well as the skills to implement the smallest details of our clients' most critical projects, West Monroe Partners is a proven provider of growth and efficiency to large enterprises, as well as more nimble middle-market organizations.

Our consulting professionals – more than 550 and growing – drive better business results by harnessing our collective experience across a range of industries.

West Monroe Partners is dedicated to helping cities leverage technology and update their processes to transform how they serve their citizens, optimize their physical assets, and how they partner with their employees.

- [Learn about our work in Energy & Utilities](#)
- [Learn about our work in Healthcare](#)
- [Learn about our Advanced Analytics](#)

[Visit the West Monroe Partners website >](#)



Spire Metering Technology is a leading manufacturer and global provider of flow- and energy-management solutions. Through continuous innovation, we transform cutting-edge technologies into affordable, reliable and simple-to-use tools for accurate utility measurement. SpireMT's technological innovations help cities, governments and industry leaders preserve our precious natural resources.

Water and energy usage have a significant impact on communities around the world. SpireMT's meters and metering systems help regulate water and energy consumption in commercial and residential buildings, along with municipal and government facilities.

Thanks to SpireMT's diverse product line, our partners can rely on our technology to overcome the challenges of measuring a variety of fluid types, including water, oil, electricity and chemicals. Our products satisfy all their project needs, from flow measurement to energy measurement to wireless telemetry systems, AMR/AMI systems and billing software for instantaneous results. By utilizing SpireMT's solutions, our partners are empowered to responsibly manage their resources. SpireMT's comprehensive utility metering systems help to ensure tomorrow by measuring today.

Spire Metering Technology provides a wide variety of flowmeter products to meet the demanding requirements of several applications, including:

- [Water and wastewater](#)
- [Utility management](#)
- [Building automation](#)

[Learn more at our website >](#)



For organizations striving to leverage big data to their competitive advantage, data science is the essential, but often unrecognized, ingredient. TROVE is a leader in this nascent and rapidly expanding field, going far beyond traditional analytics approaches to solve some of today's most complex data management problems.

The heightened levels of insight and knowledge enabled by this technology have never been more important to the world's cities as they are today. Becoming a smarter city and making informed decisions about growth, infrastructure and citizen services requires the ability to process vast – and ever-increasing – volumes of data – and to understand data relationships that are not intuitively obvious. That's where TROVE can help – by taking the guesswork out of important business decisions.

TROVE delivers [one-of-a-kind, data-powered predictive science](#) that delivers previously undiscovered insights and value by combining an organization's own data with TROVE's 2,000+ attributes of external third-party data and its patented data fusion algorithms. These are algorithms that have been used by the Department of Defense and other intelligence agencies to dramatically improve the accuracy and effectiveness of critical strategic and tactical decisions. The technology has been field-proven by the most accuracy-sensitive organizations in existence and is now available for the rest of the world to leverage.

The result? Startling predictive insights and new ROI value in unexpected places. Smart cities don't guess. They predict problems before they occur. They proactively address growth challenges and anticipate citizen demands. They look forward, not backward and make smarter decisions based on facts.

TROVE can show you how. Find out how TROVE and its data science as a service (DSaaS) model brings advanced technology previously available to only the largest corporations to any city seeking new levels of insight to fuel the next era of business productivity.

To learn more about TROVE, please visit our website at TroveData.com.



Since 1995, K2 Geospatial has been committed to bringing spatial information and analysis tools within everyone's reach by developing software solutions that provide effective visual aids to decision-makers. K2's Map-Based Solutions connect, consolidate and publish data which are managed and stored in silos in different systems. Employees and citizens can then easily access the information, analyze it and have a real-time ability to decide.

These solutions are designed for land, infrastructures, buildings management as well as for environmental and public safety purposes. They are used by cities, regional governments, ports, airports, road authorities, railways, public utilities and natural resources companies.

K2's solutions are powered by JMap, a map-oriented integration platform designed to connect silos and offer easy-to-use interfaces dedicated to non-technical users. Furthermore, for software developers, JMap can be easily embedded in their existing solutions.

JMap is deployed and used by hundreds of organizations in North and South America as well as in Europe. Each day, thousands of employees and citizens from different organizations, in different contexts and with different requirements, use JMap to access their spatial and non-spatial data (from GIS, databases, sensors, GPS, RFid, Web Services, videos, etc.) in order to get a global and a real-time overview of their operations.

With JMap, cities easily implement Spatially Smart Solutions which improves their operational and strategic decisions.

[Learn more about JMap >](#)

[Visit the K2 Geospatial website >](#)



At Clevest, we share the Smart City Council's vision of cities that are livable, workable and sustainable. As a leading provider of mobile workforce automation solutions for smart grid and smart city field operations, Clevest is proud to support and educate city leaders, planners and citizens in building sustainable cities.

Clevest provides the only complete solution for mobile workforce automation, smart grid and smart city operations exclusively for utilities and city operational departments. Over 150 customers worldwide have chosen Clevest to transform their field operations by harnessing the power of our software and deep domain knowledge of mobile computing and field operations.

We are specialists at enabling cities to transform their field operations by rapidly automating and optimizing field installation, operations and maintenance of new smart technologies. Our solutions improve worker and citizen safety, reduce the environmental impact of field work and increase operational efficiency to drive down the cost to serve citizens.

Clevest Smart City solutions are purpose-built for city operations departments to effectively deploy, operate and maintain new metering, monitoring and control, and network communications technologies within their smart city infrastructure. In the control room, our solution enables real-time insight to the location and status of field workers, trouble events and field work locations in the visual context of city infrastructure. This allows the quick identification of work to be completed, seamless appointment bookings, and the automatic scheduling and assignment of work. In the field, our streamlined workflows help field workers quickly complete work on a mobile device, view contextual data on maps and stay safe with support from nearby workers and alerts to the control room.

Clevest offers the complete solution for the smart city mobile workforce to help deploy, operate and maintain your smart city infrastructure.

[Learn more about Clevest](#)

[Learn more about our solutions](#)



Badger Meter's commitment to helping municipalities improve operational efficiency and conserve their precious resources, makes supporting the Smart Cities Council a natural fit.

Badger Meter offers end-to-end solutions that help water utilities generate needed revenue, monitor and conserve their resources and help them better serve their valued end water customers. Industry-leading smart water solutions include a comprehensive mechanical and electronic metering line, proven AMR/AMI technology and the powerful analytics tools that truly help in Making Water Visible® for thousands of cities.

Badger Meter smart water solutions:

- Increase visibility of water consumption through tools like [BEACON® Advanced Metering Analytics](#), providing faster leak detection, revenue management, water conservation clarity, and easier data collection for compliance reporting.
- Enhance customer service for citizens through powerful apps that provide greater water usage visibility directly to their PCs, tablets and smartphones.
- Minimize deployment and system maintenance through a managed solutions approach that reduces required operational management of AMI and analytics, allowing water departments to do what they do best—delivering high quality water to customers.
- Future-proof technology by working with cities to ensure their water system design keeps pace with technology advancements for the long term.

Founded in Milwaukee, Wisconsin in 1905, Badger Meter has earned an international reputation as an innovator in flow measurement and control products, serving water utilities, municipalities, and commercial and industrial customers worldwide.

[Learn more about Badger Meter Water Utility Solutions](#)



Entrigna's software enables cities to radically change the way they make real-time decisions. Entrigna is excited to support the Smart Cities Council and help contribute to building tomorrow's cities today. Our software sits squarely in the "crunch" function of a smart city.

With the infrastructure to collect and communicate data, tremendous opportunity exists to derive value from the data by making real-time decisions and taking immediate action without human intervention. Entrigna's software provides the smart city a central "brain" to enable this capability, which goes far beyond reports and dashboards.

The human brain processes data in real time from senses and memory and applies several techniques seamlessly in parallel and in series to make decisions and take an action – e.g., if it's Monday, then I will do xyz; if I have 10 items on my To-Do list, I will prioritize them in this order; based on similar prior experiences, I think xzy is the best decision. It's a complex and amazing process.

Just like a human brain, Entrigna's software can ingest data from a variety of sources streaming in real time. The data can be anything that is collected and communicated through the smart city infrastructure such as water meter reading, traffic conditions, geo location of an individual, data from wearable devices.

With maximum flexibility to combine in parallel and in series, decision frameworks are configured to make "brain-like" decisions. These frameworks automatically run in real time (milliseconds) and do not require manual intervention by a person.

Mathematical and algorithmic techniques are leveraged to mimic a brain, such as a rules engine, complex event processing, optimization, regression, clustering/classification, natural language processing, machine learning and artificial intelligence.

Because of Entrigna software's unique design and architecture, implementation delivers a full set of functionality but at less than 50% of traditional timeliness and less than 50% traditional costs.

To learn more, please visit our website: www.entrigna.com.

Smart Cities Council

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National Governors Association
Pew Charitable Trusts, American Cities Project
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International Organization for Standardization (ISO)
International Telecommunication Union (ITU)
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