

Combined Heat and Power (CHP) Financing Primer

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ICF



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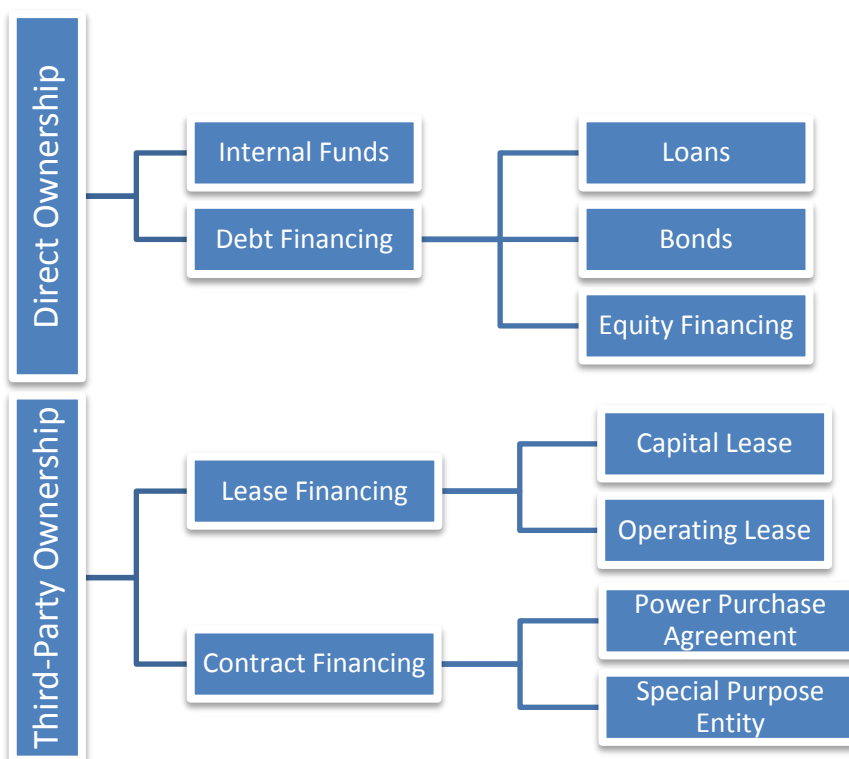
For more information about this report and the U.S. DOE CHP Deployment Program, visit us at www.energy.gov/chp, or contact us at CHP@ee.doe.gov.

Executive Summary

While the technical and economic benefits of combined heat and power (CHP) projects are well documented, the financing process is often misunderstood and frequently not given sufficient attention. CHP developers¹ must navigate a complex landscape of project financing alternatives and provide detailed project information in order to attract investors. Inadequate information can cause project delays, leading investors to offer less favorable financial terms, or even decline a CHP investment opportunity all together. CHP developers can increase the likelihood of getting a CHP project financed if they carefully plan and prepare, pay attention to detail, and build and maintain relationships with lenders and investors,

There are various financing options available to CHP end-users depending on the entity that will own the CHP system. **Figure ES-0-1** shows financing options covered in this primer, with each financing option having its own unique advantages and disadvantages. The ideal financing mechanism is unique to each customer and depends heavily upon available capital from the host/owner, the regulatory structure of the regional electricity market, and the host/owner's experience with CHP design and project development.

Figure ES-0-1 CHP Financing Options



¹ The CHP developer is the party that is seeking financing to develop the CHP system. The CHP developer could be the final CHP customer/end-user or a third-party developer that is installing the CHP system for an end-user.

Financial Metrics Used to Assess CHP

A number of financial metrics, other than internal rate of return (IRR), are also used to assess CHP projects. Often multiple methods will be used on a single project. Common economic evaluation methods include:

- Payback period
- Net Present Value (NPV)
- Benefit-Cost Ratio
- Equivalent Uniform Annual Net Value (NUV)

Source: NYSERDA²

This financing primer provides checklists of information that financiers need to evaluate CHP investment opportunities, and discusses how CHP developers can best tailor their financing approach to a specific project. CHP developers and prospective end-users should be well informed, and be able to evaluate and consider the potential impacts of all CHP financing decisions. If key information is prepared and presented properly, project developers can expedite the financing process and increase the likelihood of receiving favorable financing terms.

Lenders and investors typically decide to invest in a CHP project based on its perceived level of risk and expected financial performance. These groups focus solely on the expected monetary benefits, and typically do not consider environmental or other non-energy benefits from the project that may be

important to the end-user. Lenders tend to place a strong emphasis on the credit history of the facility owner and financial metrics (see sidebar).³ The expected financial performance of the project is evaluated using a *pro forma*, typically including an income statement, balance sheet, use of funds, and an analysis of projected cash flows over time. Investors are more inclined to seriously consider CHP projects where developers have made significant progress in completing engineering, design and implementation details. While investors typically do not expect CHP project developers to have an in-depth knowledge of financing options, developers that are informed and well prepared can proactively address many common financial challenges.

There is no standard approach to developing most CHP projects due to site specific details and unique project requirements. While there is no standard approach, this primer offers general strategies and steps that developers of CHP projects can follow to finance their unique project. In addition to describing a number of financing options and financial planning considerations, a due diligence

CHP Project Finance Due Diligence Checklist

- ✓ Letter of Intent from Host/Customer
- ✓ Engineering Feasibility Study and Financial Model
- ✓ Interconnection Agreement, Permits and Easements
- ✓ Engineering, Procurement & Construction (EPC) Contract
- ✓ Technology Warranty and Performance Guarantee
- ✓ O&M Agreement
- ✓ Fuel Supply Contract

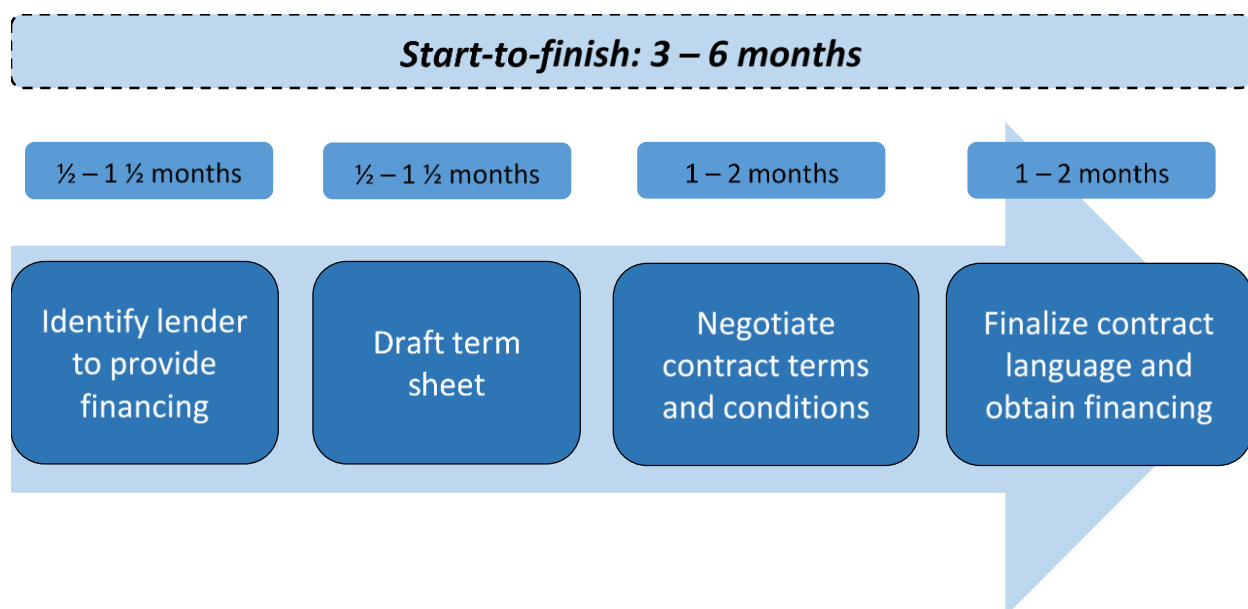
² <http://www.nyserda.ny.gov/-/media/Files/EERP/Commercial/Sector/Municipal-Water-Wastewater-Facilities/CHP-Economics-fs.pdf>

³ Other financial factors considered include the Net Present Value (NPV), and the Benefit-Cost Ratio.

checklist (see sidebar) for developers is provided, detailing what investors are typically interested in seeing for a strong investment prospect.

Provided that a developer can meet these checklist items and present a strong CHP project, the financing process can be efficiently executed in three to six months. **Figure ES-0-2** provides an outline of the financing process and timeline for each major step required to finance a typical CHP project. Investors tend to prefer working with developers with whom they have established relationships and with investors that can likely meet all due diligence requirements.

Figure ES-0-2. CHP Project Financing Timeline



Project financing is an important discussion topic for any CHP project that should be addressed early and often during project design and implementation, as well as throughout the project's lifetime. By being proactive in understanding and preparing financial information for their project, developers can accelerate investments in CHP projects.

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Glossary

Asset-Based Finance – Asset-based finance is when a project secures capital or a loan by pledging inventory, machinery, equipment, or real estate as collateral.

Bond – This is a debt instrument where the borrower uses funds for a defined period of time at a specific interest rate.

Build-Own-Operate (BOO) – BOO refers to an energy facility that is built, owned, and operated by a third party entity other than the host/customer. The host/customer purchases electricity and thermal energy at set rates from the third-party owner (typically an ESCO).

Capital Advisory Firm – A capital advisory firm is a company that provides advice on mergers, acquisitions, and debt and equity financing.

Capital Lease – An extended equipment rental from a vendor or third party that appears as an asset (rather than debt) on the company's balance sheet.

Due Diligence – This is the research and analysis of a company or organization done in preparation for a business transaction.

Energy Service Company (ESCO) – An ESCO is a project developer that works on all aspects of a project from design, financing, and installation to operational elements. This includes, but is not limited to, energy analysis, audits, energy management, project design, maintenance, operation, monitoring, financial evaluation, facility management, and financing of energy projects.

Energy Savings Performance Contract (ESPC) – The ESPC is best described as a “design-build” contract (typically 10-20 years at a predetermined price and quantity of electricity) whose financing elements may include operating leases and power purchase agreements (PPAs).

Engineering, Procurement & Construction (EPC) Contract – The EPC contract is the interface between the project construction and the developer/owner. It guarantees the completion and performance of the project over a certain period of time.

Hedge Fund – A hedge fund is a limited partnership that pools capital from a number of investors and invests it into securities and other instruments in order to achieve high gains.

Internal Rate of Return (IRR) – The IRR is a metric often used to compare the attractiveness of investment alternatives. The IRR is the discount rate that yields a net present value of zero given the project's expected cash flow.

Letter of Intent (LOI) – An LOI is an agreement that signals a host/customer's intention to install a CHP system on its site, and is the first step in a transaction. It reflects the project's specific engineering, contracting and financing characteristics.

Net Present Value (NPV) – NPV is a capital budgeting technique that accounts for the time value of money by discounting future benefits and costs in order to analyze the profitability of a project over time. It is the difference between the sum of all discounted cash outflows and inflows over the project life.

Operating Lease – An operating lease is an extended equipment rental from a vendor or third party that appears as an operating expense.

Operations and Maintenance (O&M) – O&M are the decisions and actions regarding the control and upkeep of property and equipment. These are inclusive, but not limited to: 1) actions focused on scheduling, procedures, and work/systems control and optimization; and 2) performance of routine, preventive, predictive, scheduled and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability, and safety.⁴

Original Equipment Manufacturer (OEM) – An OEM is a company whose products are used as components in another company's final product.

Power Purchase Agreement (PPA) – A PPA is an off-balance sheet contract between a power producer (seller) and a power consumer (buyer) whereby the buyer agrees to purchase all of the power that the CHP system produces at a rate that is typically lower or equal to the market rate of electricity from the local utility. The power producer is often a third-party owner of the system.

Private Equity – Private equity is funding from investors (typically large institutions or accredited investors) who commit large sums of money to an investment over a long period of time in exchange for partial or full ownership.

Project Finance – Project finance is the long-term financing of an infrastructure or industrial project. It is typically based upon the projected cash-flows of the project rather than the balance sheet of the stakeholders involved.

Return on Investment (ROI) – This is the gain or a loss on an investment over a specified period of time, often used to compare different investment opportunities within a portfolio.

Third-Party Ownership (TPO) – TPO is a financing structure that generally involves the host facility either leasing the CHP system or using a contract financing method, such as a power purchase agreement. TPO can take the form of a full lease, a capital lease, or an operating lease. It allows a private sector project owner to capture incentives, particularly tax incentives that a public sector host entity cannot.

⁴ Definitions from the Federal Energy Management Program's Operations and Maintenance (O&M) Best Practices Guide: Release 3.0. <http://energy.gov/eere/femp/downloads/operations-and-maintenance-best-practices-guide>.

1. Introduction

Combined heat and power (CHP) is an efficient and clean approach to generating electric and thermal energy from a single fuel source. Instead of purchasing electricity from the grid and producing thermal energy from an onsite boiler or furnace, a facility can use CHP to provide both energy services. Fuel is typically combusted to generate electricity in a prime mover (such as a gas turbine or reciprocating engine), while the energy stored in the hot exhaust is captured to provide heating or cooling for the site. CHP systems save money for their host facilities, leading them to be more competitive in their industries, and they can provide energy independence and resiliency, allowing them to continue operations during grid outages. CHP can also deliver benefits to utilities, including grid support and deferral of transmission and distribution system investments. CHP is a clean energy solution that directly addresses a number of national priorities, including improving U.S. competitiveness, reducing energy operating costs, enhancing our energy infrastructure, reducing emissions, improving energy security, and increasing energy efficiency.

CHP systems are capital intensive, often requiring an investment of several million dollars, with some projects requiring much more. As an example, a 10 MW CHP system, which is a representative size for many large commercial and industrial applications, may have an installed cost near \$20 million (\$2,000 / kW).⁵ Because capital costs are significant, financing decisions are a critical step in the development of any CHP project. A number of CHP projects do not move forward due to financing constraints, and financing for CHP is often stated as a barrier that impedes greater deployment.⁶

This report is intended to provide CHP stakeholders with a better understanding of CHP financing options and the type of information that firms need before committing capital. This report was developed based on publicly available resources and discussions with investors, developers, and manufacturers who are actively developing and financing CHP projects. The report is organized as follows:

1. **Introduction**
2. **Financing Options** –This section explains different mechanisms for financing a project and describes how differences in ownership of an asset are accounted for in a host/customer's accounting, primarily either as an on- or off-balance sheet item.
3. **Financing Considerations** – This section describes CHP financing considerations from the perspective of the CHP end-user and then describes what lenders look for in a CHP project developer or end-user before funding a CHP project.

⁵ U.S. Department of Energy, CHP Technology Factsheets. 2015 (publication pending). These factsheets show a cost of \$1,976/kW for a 10 MW gas turbine.

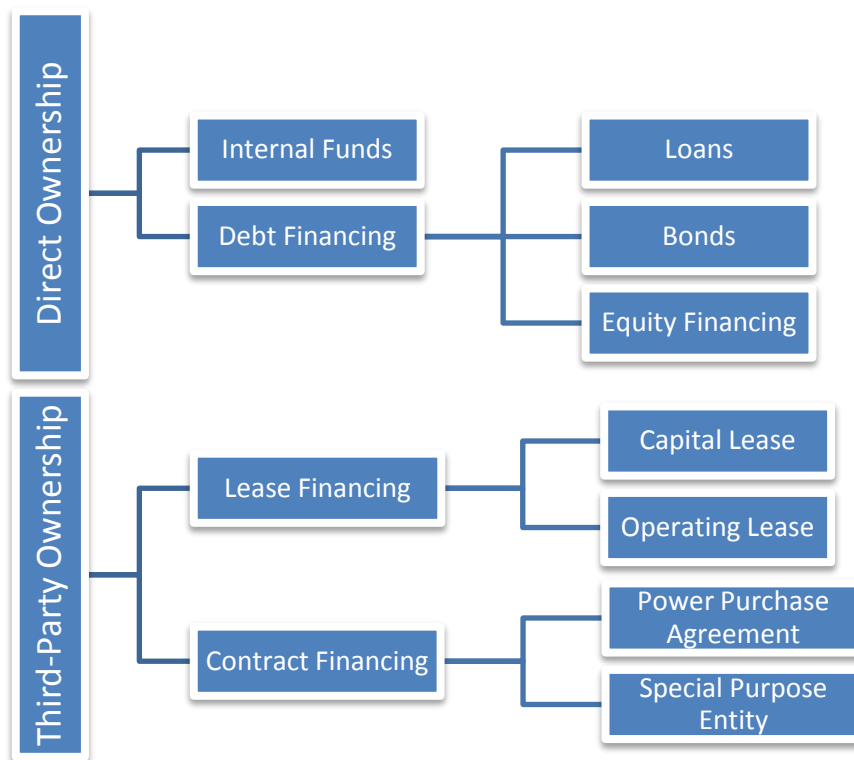
⁶ Chittum, Anna and N. Kaufman. 2011. "Challenges Facing Combined Heat and Power Today: A State-by-State Assessment," ACEEE
<https://www.iowaeconomicdevelopment.com/userdocs/documents/ieda/ACEEE2011statebystate.pdf>.

4. **Making the Business Case for CHP** – This section describes the essential elements of a strong presentation to potential financiers of a CHP project. This section also describes the due diligence process and includes a financing checklist that summarizes key steps in the process.
5. **Project Profiles** – This section describes four projects that illustrate how CHP projects have been financed.
6. **Conclusions and Recommendations** – This section discusses financing barriers and suggested actions that can help facilitate a timely CHP financing process.

2. Financing Options

This section describes different options for financing a CHP project and evaluating cash flows using various accounting practices. Direct ownership (see **Figure 2-1**) is discussed in Section 2.1, and Third-Party Ownership is discussed in Section 2.2. A comparison of different financing mechanisms is provided in Section 2.3.

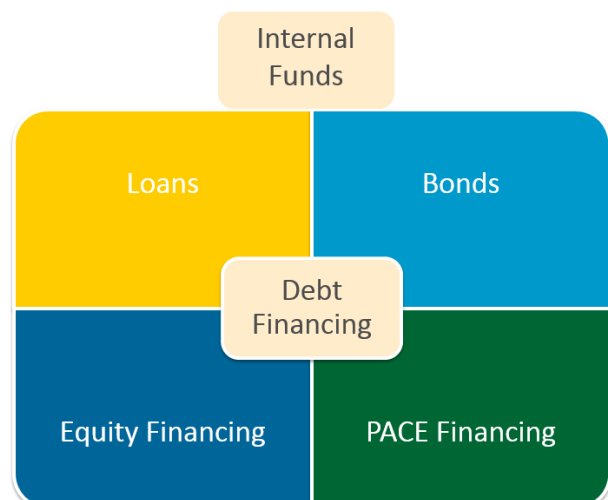
Figure 2-1. CHP Financing Options



2.1 Direct-Ownership CHP Financing Options

Internal Funds

End-users may choose to use internal funds from their own cash flow to finance a CHP project. For large, well-capitalized organizations (such as colleges and universities, see University of New Hampshire call-out box) and many governments, internal funds often represent the lowest “cost of



money.”⁷ However, a CHP project will frequently need to compete with other demands for internal capital.

University of New Hampshire’s (UNH) Self-Financed CHP System

UNH self-financed their CHP system at an estimated cost of \$28 million. The University’s system went on-line in 2006. In 2009, UNH launched the EcoLine project and partnered with Waste Management of New Hampshire to pipe purified gas from WM’s Rochester landfill to use as the primary fuel for the CHP plant. The project cost an estimated \$49 million, which was internally funded, and has an expected payback of 10 years. UNH is the first university in the country to use landfill gas as its primary fuel source. The University sells renewable energy credits (RECs) from EcoLine’s generation to help finance the capital cost of the project and to invest in additional energy efficiency projects on campus.

Source: University of New Hampshire, Cogeneration & EcoLine (Landfill Gas), <http://www.sustainableunh.unh.edu/ecoline>

Debt Financing (Loans & Bonds)

Debt financing is typically characterized by the existence of a loan agreement between the lender and borrower. A bond is a debt instrument where the borrower uses funds for a defined period of time at a specific interest rate, but with a few key differences from a conventional loan. There are various types of loans and bonds available:

LOANS

Commercial banks and other lenders often provide loans for CHP projects. These lenders tend to focus on the credit history and financial assets of the owner or developer as compared to the cash flow of the project. Lenders will commonly provide financing for up to 80 percent or more of a system’s installed cost. Loans are often paid back by fixed monthly payments (principal plus interest) over the period of the loan. Interest payments are treated as a cost to the owner and are tax deductible. Most loans for CHP projects are term loans issued by commercial banks (with a duration of up to 10 years),⁸ although loans are also available through other entities.

⁷ Costs associated with external financing such as interest paid on loans or bonds, or for a third-party ownership structure, can be significantly higher. Typically, higher risk for the lender means higher costs for the borrower.

⁸ ACEEE. “Deploying Combined Heat and Power (CHP) Projects,” <http://aceee.org/sector/local-policy/toolkit/chp>.

BONDS

Bonds are a long-term debt instrument. The issuer makes regular interest payments until the bond matures, at which point it repays the remaining principal amount. Corporate bonds are issued to finance corporate investment, expansion and operations and are typically offered to the general public. Other options are industrial development bonds (IDBs) for manufacturing companies and private placement bonds that are offered to a small number of investors. The terms for bond financing usually do not exceed the useful life of the facility, but terms extending up to 30 years are not uncommon.

University of Alaska Fairbanks CHP System

The University of Alaska Fairbanks (UAF) is planning to replace its existing boilers with a CHP plant. The proposed CHP plant would provide heat and power for over 3 million square feet of UAF's facilities. The project is scheduled for completion in 2018 at an estimated cost of \$245 million. The financing plan envisions a mix of general funds and bonds. The Alaska Legislature reviewed and approved state financing options for the project in 2014 – SB 218 provided UAF with \$157.5 million of revenue bond issuance authority for the project. UAF plans on contributing \$50 million in capital and has planned to make payments on the debt out of savings realized through roughly \$4.5 million in reduced annual fuel costs.

Source: Alaska Business Monthly, UAF CHP Plant, <http://www.akbizmag.com/Alaska-Business-Monthly/August-2014/Work-Begins-on-Upgraded-UAF-Heat-and-Power-Plant/>

Public entities can issue tax- exempt government bonds or private activity bonds to raise money for CHP. Bonds are most commonly used to fund public sector CHP projects (see the call-out box on the University of Alaska CHP system). This is because the debt accompanying government bonds has an interest rate that is usually one to two percent lower than commercial debt. In exchange, government bonds typically impose stricter requirements in terms of project eligibility, debt coverage and cash reserve requirements to preserve the financial stability of the issuer. These requirements may be more rigorous than those of most commercial banks.

A good example is the Commercial Property Assessed Clean Energy (PACE) bond financing method, which is voluntarily offered by certain local governments for energy efficiency, renewable energy, and water conservation upgrades to buildings. Under a PACE program, the local government forms special tax districts to finance energy retrofits for property owners wishing to improve energy efficiency or invest in renewable energy projects. PACE programs normally fund the entire capital and operational expenditures of CHP projects and require no up-front cost.

PACE Financing

In 2014, the YMCA facilities in Meriden and Milford, Connecticut received PACE financing to install 60 kW reciprocating engine CHP systems. With PACE financing, the YMCA was able to upgrade its facilities by paying for the CHP projects over time through increased property taxes instead of providing up-front capital.

Source: Tecogen,
<http://www.tecogen.com/news-events/press-releases/detail/9/tecogen-provides-chp-systems-for-connecticut-ymcas>

Instead, the building owner pays for the service through an assessment or charge that is added to the property tax. The value of the assessment or charge is determined by the local or municipal authorities. Under PACE financing, the loan is tied to the property itself, not the borrower. The assessment stays with the property owner and transfers with changes in ownership.

PACE financing can be attractive to companies because it increases property values and offers long-term financing, thereby allowing immediate positive cash flows (see Table 2-1 below). To qualify for PACE financing, the CHP project must take place in an area whose local government already permits PACE financing, which requires a

legislative act. In addition, the CHP unit must be installed on property that is owned by the end-user. Thirty-one states and the District of Columbia have passed legislation enabling local governments to offer PACE benefits.⁹

Table 2-1. Potential Benefits of PACE Financing

Investment Barrier	PACE Solution
Internal capital constraints	100% upfront financing frees up internal capital
Debt capacity allocated to strategic initiatives	Property tax obligations do not affect borrowing capacity in same way as long term debt
Available financing is expensive	Seniority of tax lien and negligible property tax default rate enable low interest rates
Available financing is short term	PACE term is equipment life up to 20 years
Available financing is burdened with restrictive covenants ¹⁰	The high security of the tax lien means restrictive covenants aren't needed
Owner limits capital investments to payback within expected holding period	The tax lien repayment obligation stays with the property in the event of sale
Split incentive: the disincentive of non-occupying owners to bear improvement costs while passing on benefits to tenants	Tax assessments qualify as an eligible pass-through expense under most triple net leases, allowing tenants to bear the improvement costs while enjoying the savings

Source: Table adapted from presentation prepared by Clean and Renewable Energy (CARE) Funding and Janas Associates, October 2014.

⁹ PaceNow, Financing Energy Efficiency, "What is Pace?," <http://www.pacenow.org/about-pace/what-is-pace/>.

¹⁰ A restriction on the use of land so that the value of adjacent land will be preserved

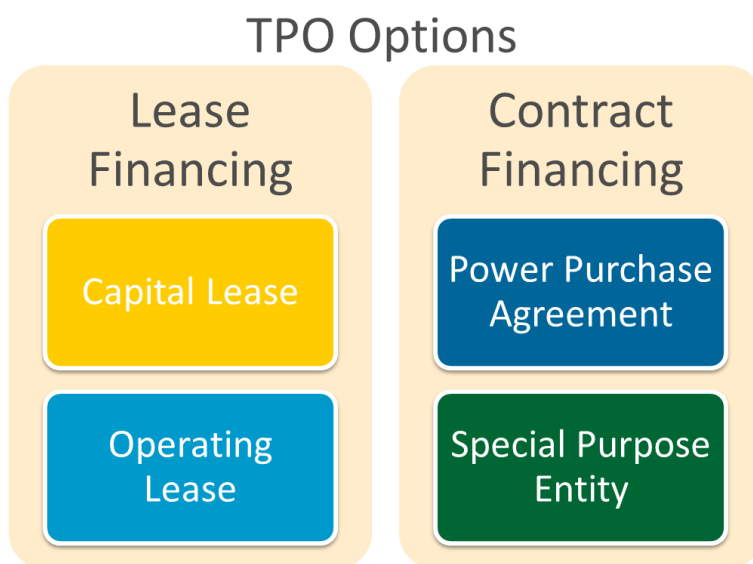
EQUITY FINANCING

Equity financing is the method of raising capital by selling company stock to investors. In return for the investment, the shareholders receive ownership interests in the company. Equity is more expensive than debt since the equity investor gets paid after the debt lender and thus implicitly accepts more risk when providing equity or subordinated debt¹¹ for the project.

Equity financing can apply to most types of CHP projects. CHP developers, equipment vendors and fuel suppliers may be equity investors in a CHP project. In addition, investment banks may also be potential investors, although they tend to mainly invest in larger projects.¹²

2.2 Third-Party Ownership (TPO)

Due to the complexities and costs associated with a new CHP installation, some end-users may not have the expertise or capital to begin such a project. Instead of using their own capital or equity, end-users have the option to work with an outside organization to construct and operate a CHP facility, moving the costs from a capital expense to an operating expense. Third-party ownership allows an end-user to reap the benefits associated with CHP without having to assume all of the risks that come with a project of this type or scale. While this option deflects the risks, it will usually add to the long-term costs of a project, since an end-user must pay for the services of a third-party owner, and/or the third-party owner may be looking for a return on investment. Below are the most common third-party ownership options.



¹¹ Subordinated debt gets repaid after senior debt lenders are paid and before payments go to equity investors. Subordinated debt is sometimes viewed as an equity equivalent by senior lenders.

¹² Ibid.

Lease Financing

A lease is a contractual agreement for one party's use, of property owned by another party. Leasing is often used to finance smaller (<1 MW) CHP projects. With a lease, the operating savings from the CHP system (energy cost savings) are used to offset the monthly lease payments, resulting in a positive cash flow for the lessee organization (see the Ohio example in the call-out box below). Lease arrangements help the project owner capture indirect tax benefits of the project (e.g., accelerated depreciation) that would otherwise go unclaimed. Lease arrangements also typically provide the lessee with the option to purchase the assets after a specific timeframe or extend the lease. Equipment vendors and some financing companies lease CHP equipment. The two main forms of leasing for CHP are capital and operating leases.

CAPITAL LEASE

A capital lease (sometimes referred to as a financial lease) is an extended equipment rental from a vendor or third party that appears as an asset (rather than debt) on the lessee's balance sheet. A host/customer may choose to document the lease as a capital lease for accounting purposes to improve their asset value because it will be counted as an asset on their balance sheet. A capital lease also allows the system owner to acquire tax credits and other incentives. According to the Financial Accounting Standards Board, a lease falls into this category if any of the following requirements are met:

- The life of the lease is 75% or greater of the asset's useful life
- The lease contains a purchase agreement for below market value (known as a bargain purchase option)
- The lessee gains ownership at the end of the lease period
- The present value of lease payments is greater than 90% of the asset's market value.

Lease Agreement

In 2014, the city of Dublin, Ohio established a lease agreement with IGS Energy to install a 248 kW CHP unit at the local recreation center, running 8,232 hours per year and providing 60% of the center's power needs. The lease is for 15 years, and payments are based on the system's actual generation. IGS assumes the performance risk of the CHP project. The first five years will have a payment set at \$12.5215/hour, which equates to \$103,077 per year and roughly \$0.051/kWh at peak output. Each remaining year includes a 3% annual price escalation. The city expects direct energy cost savings of \$19,000 per year due to the agreement's flat electricity costs for the first five years compared with expected increases in electricity rates. The city will also see savings from avoiding replacement of an existing boiler at the recreation center (estimated to cost \$69,000).

Source: City of Dublin, Ohio,
<http://dublinohiousa.gov/dev/dev/wp-content/uploads/2014/06/Res-55-14.pdf>

OPERATING LEASE

An operating lease is similar to a capital lease, except that the equipment rental is instead treated as an operating expense for the lessee. Because renting the asset does not equate to ownership in this case, use of an operating lease is often referred to as off-balance sheet financing.¹³ In addition, the rental period for an operating lease is much shorter relative to the life of the asset. For example, cars, airplanes, and ships are often financed through an operating lease because the duration of the lease is short when compared to the total life of the equipment (examples of states where CHP operating leases are common are identified in the call-out box to the right).

A company may prefer to finance a CHP unit with an operating lease in order to leave the liability off the balance sheet, make use of operating lease tax incentives, and potentially show high returns on asset ratios to shareholders. The IRS stipulates the following conditions for a lease to qualify as an operating lease:

- No transfer of ownership prior to maturity of lease
- No bargain purchase option
- Remaining economic life of asset at end of lease must be at least one year or 20% of the originally estimated life
- Lessor has to maintain at least 20% of asset's value throughout the term of lease.

Contract Financing

POWER PURCHASE AGREEMENT

A power purchase agreement (PPA) is a contract between a power producer (seller) and a power consumer (buyer). A PPA is an off-balance sheet transaction where the buyer agrees to buy all

Operating Leases

Operating leases are commonly used in states where an owner of a CHP system cannot sell energy. The Southwest Energy Efficiency Project (SWEET) points out that in states like AZ, CO, and UT that do not allow electricity to be sold by a company that is not a "public utility," a CHP developer can lease the system thereby avoiding this obstacle. Key considerations for operating leases are:

- An operating lease structure often matches that of a PPA
- IRS regulations are tougher
- Modular equipment is preferred for operating leases

Source: Southwest Energy Efficiency Project (SWEET),
http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Financing_Options_for_CHP_Feb_2014.pdf

¹³ Off-balance sheet financing is discussed in more detail later in this report. Off-balance sheet financing refers to transactions that do not appear on the host/customer's balance sheet.

of the power and thermal energy that the CHP system produces. The seller is usually a third-party owner but could be the owner of the facility in which the CHP unit is located. The buyer could be a facility (if under a third-party ownership (TPO) structure), a specific customer, group of customers, or the utility itself. The contract is based on a specified electricity rate that is generally less than or equal to the market rate of the local utility company. Since there is more risk to the investor, a PPA usually costs more than other financing options.

Upper Chesapeake Medical Center

The UCMC partnered with Clark Financial Services Group (CFS) to install a 2 MW CHP system with 350 tons of absorption chilling capacity, which was completed in 2014. The PPA will extend for a 20 year contract, valued at \$9,000,000 for the entire contract period based on the agreed price of electricity.

UCMC, under Maryland's EmPower CHP incentive program, was provided \$1.5 million in capital from Baltimore Gas and Electric (BG&E).

Source: CFSG,
<http://www.distribugen.org/docs/presentation/Doug-Davis-Clark-Broad-Upper-Chesapeake-Presentation-WADE.pdf>

PPAs are primarily used for financing and implementing on-site renewable energy installations because they provide a stable revenue stream for the owner. A PPA differs from a lease in that its fixed rate is anchored to the amount of electricity produced, as opposed to a fixed cost per month. Typically, the host/customer rents out the portion of their facility where the CHP unit is sited, and the provider owns and operates the CHP unit.

PPAs typically contain a number of milestones to mark progress toward commercial operation. This allows the buyer to track the progress of the project and penalize any failures to meet the development checkpoints. Development milestones

include benchmarks such as permit acquisitions, construction commencement, and construction contract execution.

In the case of TPO, the buyer would likely enter a PPA because they establish certainty for their energy costs over the lifetime of the contract. They also avoid any down payments for the CHP unit, and do not have to pay operations and maintenance expenses for it (see the example of the Upper Chesapeake Medical Center in the call-out box above).

SPECIAL PURPOSE ENTITY

In the context of CHP, a special purpose entity (SPE) is a legal entity used to manage a single asset, and isolate risk for the larger corporation. Under a build-own-operate (BOO) model, the CHP system is built, owned, and operated by an entity other than the host/customer and the host purchases electricity and power at set rates from the third-party owner. Some BOO projects allow for the ownership of the CHP system to be transferred to the host/customer after a specified timeframe. BOO projects are typically implemented by entities such as energy service companies (ESCOs) and occasionally by equipment suppliers.

ESCOs are best described as project developers who work on all aspects of a project, from design, financing, and installation to operational elements. ESCOs can perform services including but not limited to energy analysis, audits, energy management, project design, maintenance, operation, monitoring, financial evaluation, facility management, and financing. Since 1990, ESCOs have guaranteed \$50 billion in energy efficiency savings, and have delivered over \$45 billion in direct project investment. Lawrence Berkeley National Laboratory estimates that ESCOs annually invest \$5 billion in energy efficiency retrofits.¹⁴

A CHP host/customer will typically partner with an ESCO by entering into an energy savings performance contract (ESPC). An ESPC is an agreement between an ESCO and a building owner (in this case the CHP end-user). The ESPC is best described as a “design-build” contract whose financing elements may include operating leases, power purchase agreements (PPAs) or other pieces. An ESPC allows the CHP project to be treated as an off-balance sheet expense, since the ESCO owns and maintains the equipment over the life of the contract. The ESCO also takes on the responsibility of securing funding and providing assurance to project lenders that the energy savings will meet or exceed the debt service payments.

Eight Flags Energy – Rayonier CHP

In 2014, Florida Public Utilities (FPU) and their parent company, Chesapeake Utilities Corporation, formed a subsidiary, Eight Flags Energy, LLC to operate as a special purpose entity for an Amelia Island CHP installation. The CHP plant now provides steam and electricity to the Rayonier Advanced Materials cellulose plant, and additional electricity to 16,000 residents of Amelia Island, Florida.

Eight Flags Energy was created to build, own and operate the CHP plant, isolating the risk from FPU and Chesapeake Utilities Corporation. The CHP plant is 75% efficient, and is expected to provide \$28 million in savings to ratepayers over the 20-year contract term. It will also protect Amelia Island residents and businesses from power outages that stem from the island’s single electricity transmission line.

*Source: Southeast CHP TAP,
http://southeastchptap.rlmartin.com/Data/Sites/4/documents/profiles/eight-flags-chp_project_profile.pdf*

¹⁴ National Association of Energy Service Companies (NAESCO). “What is an ESCO?” <http://www.naesco.org/what-is-an-esco>.

Under an ESPC, the CHP developer sells the power and waste heat from the project to the customer through a long-term PPA for a pre-determined price and guaranteed quantity of produced electricity.

ESPCs like this are usually best for systems larger than a certain size threshold such as 2-3 MW because of the fixed transactional costs of the somewhat complex PPA arrangement. Under the ESPC, the operating lease portion (i.e., the PPA) is usually offered at slightly lower rates (a few percent or less) as compared to a stand-alone lease.¹⁵ The electricity from the CHP system within an ESPC structure is usually sold at 10 to 20 percent less than what the customer was paying for electricity before the project.

Commonly the customer will contract for a 10- to 20-year lease to obtain guarantees on the volume and price of the energy produced from the CHP system.¹⁶ The overall agreement package typically includes the following components:

- 10 year manufacturer's performance guarantee
- 10 year operations and maintenance agreement
- 10 year natural gas contract (flat, floating with collar, escalator)
- 10 year operating lease
- 10 year "wrap-up"¹⁷ backstop insurance policy (optional)

Traditionally, most ESPCs shared the project's cost savings between the host and the ESCO, with the latter guaranteeing the performance of the CHP system. However, most ESPC contracts today use "guaranteed savings" with more stringent and transparent measurement & verification (M&V).¹⁸ This means that the ESCO sells electricity and heat to the host/customer at a fixed rate that is slightly lower than what the host/customer would pay the utility, and bears all the risk of under-performance. ESPCs are often used for public sector projects, partly because they require little to no up-front costs from the customer. About 85% of ESPC projects are from the public and institutional (healthcare, college/university) markets¹⁹.

Third-Party Ownership Challenges

Third-party financing inherently adds complexity and it may not be an option for CHP in certain markets. In some regulated electricity markets, states will not allow the sale of energy from an on-

¹⁵ Thrall, Larry. "Combined Heat and Power Project Finance." The DataCenter Journal. October 2012, <http://www.datacenterjournal.com/combined-heat-and-power-project-finance/>.

¹⁶ Ibid.

¹⁷ "Wrap-Up" Insurance is commonly defined as a liability policy that serves as all-encompassing insurance, which protects all contractors and subcontractors working on a large project. Wrap-up insurance is meant for construction projects over \$10 million in value.

¹⁸ Coleman, Philip, S. Earni, and C. Williams. "Could What That ESCO Sales Rep Said Really be True? Savings Realization Rates in ESPC versus Bid-to-Spec Projects." Lawrence Berkeley National Laboratory. Submitted to the ACEEE Summer Study on Energy Efficiency in Buildings, 2014, <http://aceee.org/files/proceedings/2014/data/papers/5-1278.pdf>.

¹⁹ Ibid.

site generator owned by a third party to an end-use customer.²⁰ For example, Arizona, Colorado, and Utah do not allow electricity to be sold by any company that is not a “public utility,” even within the boundaries of a customer’s site.²¹ In addition, some states do not allow electricity sales from a CHP system at one site that sells to another nearby commercial or industrial facility unless the sites share a common boundary and there are no public rights-of-way in between the CHP plant and the off-taker.

2.3 Financing Mechanisms Comparison

The ideal financing mechanism is unique to each customer and depends heavily upon available capital from the host/owner, the regulatory structure and electric utility in the local and regional electricity market, and the onsite expertise with CHP design and project development. Furthermore, it should be remembered that the premium for risk mitigation will cost the end-user more in the long run.

A host/customer interested in financing a CHP system should assess the main financing options described above in addition to available local incentives, such as state, local and/or utility-sponsored grant and loan programs. Such supplemental financing options typically cover a portion of the CHP system’s costs. A summary of the key financing options discussed in this section is shown in **Table 2-2**, along with the pros and cons of each approach and characterizations of the most common investors/market participants by financing type.

²⁰ Quinn, James, and Fred James, “Combined Heat & Power, 2013: Are We There Yet?” ACEEE, http://aceee.org/files/proceedings/2013/data/papers/4_162.pdf.

²¹ Kowley, Neil, “Financing Options for Combined Heat and Power Systems,” Southwest Energy Efficiency Project (SWEPP), February 2014, http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Financing_Options_for_CHP_Feb_2014.pdf.

Table 2-2. Summary of CHP Financing Options

Source	Description	Ownership	Pros and Cons	Entities/Participants
SELF-FINANCING				
Internal Capital	Use of cash generated from the organization's operations	System is owned by end-user	Pros: Low cost of capital; retain full ownership and control of the project; full tax and incentive benefits Cons: CHP project is competing with other projects and use of internal funds, meaning less money likely available for operating and other capital expenses; technical and financial risk associated with designing and funding project remains with owner	Self-Financed Examples: <ul style="list-style-type: none"> • Gunderson Healthcare • University of New Hampshire
Debt	A loan agreement is signed between the lender and borrower. Lenders provide funds; borrowers pay interest and repay the principal	System is owned by host but in event of a non-payment the lenders have a claim on the organization's assets	Pros: Interest rates are low (at the time of writing, early 2017), so debt cheap compared to historic levels; full ownership retained. Cons: Sometimes difficult to receive traditional bank loans for CHP, especially if banks have limited experience with this type of project; interest costs on borrowed capital; owner retains most technical and financial risks (some risks may lie with suppliers and contractors)	<ul style="list-style-type: none"> • Lender • System owner • End-user
Equity	The company generates stock for investment or any other security representing an ownership interest	System can be partially owned by host but also by the investor	Pros: Applicability to most projects Cons: Higher cost; returns to host/owner are reduced to cover off-loading of risk to investor	<ul style="list-style-type: none"> • End-user • Investor

THIRD PARTY				
Lease Financing	Organization agrees to make a series of payments to the leasing company for use of an asset owned by the lessor	Asset is owned by the leasing firm	<p>Pros: End-user not required to use significant capital; provides financing for a range of CHP project sizes, including smaller systems; transfers tax benefits; operating leases are off-balance sheet; not responsible for maintenance and insurance costs</p> <p>Cons: More expensive than debt financing; capital leases are subject to lender or internal capital budget constraints</p>	<ul style="list-style-type: none"> • Lessor • Lessee • Measurement and verification provider (sometimes)
Contract Financing (PPA)	A contract between a power producer (seller) and a power consumer (buyer) – differs from a lease because the fixed rate is anchored to the amount of electricity produced as opposed to a fixed cost per month	System is often owned by a third party	<p>Pros: Establishes certainty for energy costs over lifetime of contract; customer can avoid down payments and operations and maintenance costs</p> <p>Cons: Expensive compared to other financing options; customers must have very good credit to be eligible for PPA; can be difficult to create interconnection agreement with utility; long-term commitment to purchase power</p>	<ul style="list-style-type: none"> • Customer/end-user • System owner • Management company • Debt lender • Special purpose entity • Measurement and verification provider
Special Purpose Entity	A combined package of financing components – includes an operating lease, power purchase agreement (PPA), and other pieces	Asset is owned by a third party	<p>Pros: Operating lease portion usually offered at lower rates (1-4% less) compared to stand-alone lease; no up-front capital required; operating and maintenance by third-party</p> <p>Cons: Minimal rate relief - electricity usually sold at 10 to 20% less than existing rate</p>	<ul style="list-style-type: none"> • End-user • ESCO • Financial firm

3. Financing Considerations

3.1 End-User Perspective

Prospective CHP end-users are often hindered by a shortage of investment capital. This is especially common for industrial facilities, where CHP projects have to compete for capital against higher priority projects like process improvements, new product lines, or marketing efforts. Furthermore, industrial and commercial facilities in the U.S. face significant competition and typically have little capital available for facility investments (CHP or otherwise). As a result, CHP financing options that require little to no initial capital outlay are often attractive to this sector.²²

Although third-party CHP projects require minimal upfront end-user investment, they also usually incur greater costs over the life of the CHP project for the end-user compared to self-owned and financed projects. For this reason, industrial facilities with plentiful capital may choose to own and operate their own systems.

Harbec Plastics

Despite initial concerns from customers, Harbec's CHP system beat ROI expectations and increased manufacturing efficiency, leading officials to conclude that "company ownership and operation of CHP is for those who want to get the most out of the economic opportunity."

Source: Bob Bechtold, Harbec Plastics

Financing Variability by Sector

The type of business line of the end-user can heavily influence the financing option sought, and changing market conditions for different businesses can significantly influence CHP project financing. For example, surveyed hospitals stated that in previous years they would have self-financed their CHP system but that they would not be able to do so today. Federal and state changes have led to hospitals generating lower revenues and having less capital available for projects that are outside of their core business. While this means that healthcare facilities are less likely to self-finance their own CHP projects, they can still use third-party, off-balance sheet financing options, such as lease agreements and energy savings performance contracts.

Source: Discussions with hospital energy managers

²² SWEEP. "Financing Options for Combined Heat and Power Systems." February 2014, http://swenergy.org/data/sites/1/media/documents/publications/documents/Financing_Options_for_CHP_Feb_2014.pdf.

Accounting

Prospective CHP users in the commercial and institutional sectors can have significantly different financing considerations and preferred options. The financing structure for CHP systems in these sectors is partially determined by whether the owner is a public, for-profit or non-profit entity. Non-profit entities that face capital constraints may prefer energy savings performance contracts (ESPCs), since the ESPC provider (typically an energy service company or ESCO) has the ability to directly take advantage of federal tax credits for CHP systems and pass along the benefits of such credits to the facility. Moreover, little to no up-front capital is required for most ESPCs. Other entities that have access to capital may prefer to avoid the ESPC financing route, since charges for the output from the CHP system can be only slightly less than what the utility would charge for electricity and fuel. These factors leave the end-user with an accounting decision – whether to use an on-balance or off-balance sheet transaction for their CHP project.

ON-BALANCE SHEET

On-balance sheet transactions are captured on the balance sheet statement of the host/customer as either an asset, liability, or stakeholder equity. Common on-balance sheet financing options are either a cash purchase of the CHP system or debt financing (often through a loan). Customers with strong balance sheets (i.e., those with few liabilities) can usually obtain financing quickly and easily at a low interest rate. Based on past performance lenders are confident of the organization's assets, cash flow, and profitability.

Key Attributes of On Balance Sheet Financing

- Facility owner funds the project
 - Financed through a blend of debt and equity
 - Financed through 100% debt for a non-profit entity
- Owner is responsible for all risks
- If the owner is a tax paying entity, then any tax credit incentives will go directly to the owner

Lenders often consider on-balance sheet financing to be similar to investing in a blue-chip company, and off-balance sheet financing as similar to investing in a start-up company.²³ Some financial firms reported that CHP projects recently have been favoring on-balance sheet financing due to low interest rates in the U.S. (in the mid-2010s) and the corresponding availability of cheap debt through loans and bonds.

On-balance sheet financing options include:

- Internal Funding
- Debt Financing
- Capital Lease Financing

²³ Caterpillar. "Managing Risks, Reaping Rewards through CHP and CCHP." September 2013, <http://s7d2.scene7.com/is/content/Caterpillar/LEXE0676-00>.

OFF-BALANCE SHEET

Off-balance sheet financing, by contrast, refers to transactions that do not appear on the host/customer's balance sheet. Common examples include joint ventures, research and development partnerships, operating leases, and third-party ownership (e.g., ESPCs and PPAs). Off-balance sheet financing is most commonly used by CHP projects that are owned by a third-party and repaid by the host/customer through operating leases. In this case, the lessee reports only the required rental expense for the use of the asset.

With an off-balance sheet financing structure, energy costs (including the payment for the CHP output—both electric and thermal) are typically bundled and captured as an ongoing operating expense, which is lower than the previous energy costs. In addition, companies do not commit their own capital, which is attractive to industrial companies who prefer not to commit their capital to power generation and instead invest in their own core business. A company may also prefer off-balance sheet financing in order to keep their debt-to-equity ratios low.

Off-balance sheet financing options include:

- Operating Lease Financing
- Energy Service Company (ESCO) Financing
- Power Purchase Agreement (PPA)
- Equipment Supplier Financing

Regardless of whether a company chooses an on-balance or off-balance strategy, consideration should be given to potential revenue streams and/or avoided costs afforded by CHP. Several companies are exploring alternative revenue streams (such as sale of excess electric or thermal steam) as offsetting revenue streams. Additionally, in some cases some regular costs of business can be reduced or eliminated with the installation of CHP. As an example, catastrophic insurance and/or equipment redundancy costs may be reduced with the reduction in risk created by a more resilient distributed generation energy source created by on-site CHP.

3.2 Lender and Investor Perspective

Lenders and investors typically decide to invest in a CHP project based on the perceived level of risk and expected financial performance. These groups focus solely on the expected monetary benefits, rather than non-energy benefits such as environmental or other co-benefits from the project that may be important to the end-user but will not be considered unless they can be quantified and valued. They tend to place a strong emphasis on the credit history of the facility

Off-Balance Sheet PPA Financing

According to financing firms, many CHP end-users are interested in off-balance sheet financing, with an estimated 60% of CHP prospects seeking an off-balance sheet option. PPA structures are the most popular form of off-balance sheet financing.

owner and the financial metrics discussed below (debt coverage ratio, rate of return, internal rate of return, and payback period²⁴). The expected financial performance of the project is evaluated using a pro forma, typically including an income statement, balance sheet, use of funds, and an analysis of projected cash flows over time. The pro forma estimates revenues from the CHP project and its costs, including escalation over the expected life of the project for project expenses, energy prices, financing costs, and tax considerations.

It should be noted that, as with any long-term capital investment, projections for future costs, especially energy prices, include a level of uncertainty in pro-forma calculations. Fuel and electricity costs are typically estimated with an annual escalation rate. Any variations from the estimates can have an impact on future cash flows and the rate of return on the CHP investment. Due to the unpredictable nature of energy markets, this uncertainty needs to be understood by investors.

Pro Forma Statements

A pro forma statement is important to ensure that a CHP project makes financial sense. To help create pro forma statements for CHP and other energy projects, the Washington State University Extension Energy Program, with assistance from several organizations, developed the RELCOST financial analysis tool.²⁵ This tool evaluates the financial viability of energy projects over a 30-year period, taking into account funding needs and applicable financial incentives for CHP projects, and creates pro forma statements for several application types. The RELCOST tool has been used to analyze a variety of CHP applications including CHP at universities, industrial plants, and commercial buildings. An example pro forma (for a debt-financed project) from RELCOST is shown in **Table 3-1**.

²⁴ Other financial factors considered include net present value (NPV), and benefit-cost ratio.

²⁵ More information on RELCOST is available at <http://northwestchptap.org/ResourcesSoftwareLinks/Software.aspx>.

Table 3-1. Example Pro Forma

Project Year	0	1	2	3
Income Statement (Tax Calculation)				
(+) Revenue	\$ -	\$ 1,713,193	\$ 1,780,205	\$ 1,850,139
(-) Cost of Sales	\$ -	\$ (1,211,113)	\$ (1,261,940)	\$ (1,314,987)
Gross Income (Profit)	\$ -	\$ 502,080	\$ 518,265	\$ 535,151
(-) Operating Expense	\$ -	\$ -	\$ -	\$ -
EBITDA	\$ -	\$ 502,080	\$ 518,265	\$ 535,151
(-) Depreciation (Tax)	\$ -	\$ -	\$ -	\$ -
Operating Income (EBIT)	\$ -	\$ 502,080	\$ 518,265	\$ 535,151
(-) Interest Expense	\$ (99,094)	\$ (136,393)	\$ (121,171)	\$ (105,329)
(+) Interest Income	\$ -	\$ -	\$ -	\$ -
(-) Finance Charges	\$ -	\$ -	\$ -	\$ -
Net Profit Before Taxes	\$ (99,094)	\$ 365,687	\$ 397,094	\$ 429,823
(-) Income Taxes	\$ -	\$ -	\$ -	\$ -
Net Profit After Taxes	\$ (99,094)	\$ 365,687	\$ 397,094	\$ 429,823
(-) Dividends	\$ -	\$ -	\$ -	\$ -
Retained Earnings	\$ (99,094)	\$ 365,687	\$ 397,094	\$ 429,823

Once the pro forma is successfully created, CHP developers should communicate its key points to the prospective lender/investor in a familiar and accessible framework. The choice of reported financial metrics can influence perceptions of a project and even determine whether or not it moves forward. Lenders and investors will commonly evaluate whether a CHP project makes sense based on one or more of the following financial metrics:

DEBT COVERAGE RATIO

The debt coverage ratio measures the host/owner's ability to meet debt payments. Debt coverage is defined as the ratio of operating income to debt service requirements, usually calculated on an annual basis.

RETURN ON INVESTMENT (ROI)

Return on investment (ROI) describes the gain or a loss on an investment over a specified period of time. The ROI for internal funds is often expected to be between 12 to 20 percent for common CHP project types. Equity investors tend to expect a ROI of 15 to 25 percent or more, depending on the risks associated with the project. These ROI estimates are based on investments made early on in the project; investments made during the development or operational stages of the project often have lower ROI expectations since the risks associated with the project have been substantially reduced.

INTERNAL RATE OF RETURN (IRR)

The internal rate of return (IRR) – i.e., the discount rate that would yield a zero NPV for the project – is used in capital budgeting to measure the profitability of investments, enabling the investor to compare projects that require differing initial capital investment and projected future cash flows. Typically, the higher the IRR, the more willing a company will be to undertake the investment.

PAYBACK PERIOD

A payback period is commonly used to assess CHP projects. The payback period is the time required for a project

Assessment of Multiple Financial Metrics for CHP

For CHP projects to receive financing from the Connecticut Green Bank, an assessment of the project's pro forma is required along with the commitment of non-Green Bank financing sources to determine if the costs of the equipment and installation are reasonable. In addition, the Green Bank requires evaluation of the following project economic metrics:

- Ratio of financial support request to total project cost
- Staff financial support calculation
- Net present value (NPV) and internal rate of return (IRR)
- Cash flow consistency
- Simple payback

Under the program, financial support options requiring no or little direct subsidy rank higher in preference than those requiring the most direct subsidy. The order of preference from highest to lowest is as follows:

1. Unsubsidized loan
2. Loan loss reserve
3. Subsidized loan (interest rate buy-down)
4. Power purchase agreement
5. Direct subsidy (grant)

Source: Connecticut Green Bank,
[http://www.energizect.com/sites/default/files/uploads/V2%20S103_11-80%20CHP%20Rolling%20RFP\(final%207-9-13\).pdf](http://www.energizect.com/sites/default/files/uploads/V2%20S103_11-80%20CHP%20Rolling%20RFP(final%207-9-13).pdf)

to repay its initial capital costs – i.e., the time it takes for an investment to pay for itself.²⁶ The payback period is calculated by dividing the initial capital cost by the annual operating savings. Using the payback period to assess a CHP project is sometimes criticized since this method does not present the overall net benefits or savings of a project relative to its costs. For example, payback period method ignores annual net cash flows after the payback period.

3.3 Incentives

Incentives can help to defray the investment cost of a project. A common statement from interviewees was that eligibility for a financial incentive helps to move a proposed CHP project forward. In certain markets, projects will typically not make it to the stage of seeking financing without a high likelihood or guarantee of receiving a financial incentive such as a rebate, grant, loan, performance-based incentive, or other monetary supplement. CHP projects often utilize state and/or utility incentives, such as California's Self-Generation Incentive Program (SGIP) and NYSEERDA's CHP Acceleration program. Utility CHP programs such as Baltimore Gas & Electric's Smart Energy Savers Program have also helped incentivize a number of new CHP projects such as the Upper Chesapeake Hospital CHP project described in an earlier call-out box (see Power Purchase Agreement section).

It is critical to understand what is being incentivized, in terms of applicability for types of equipment and also who can take advantage of the incentive. Some incentives focus on particular end use markets and some on specific technologies. Others are based on the type of investor. As an example, for a project to benefit from an investment tax credit, a financial package would require an entity that can make that tax deduction. For a list of the types of incentives available in your area, please visit the Environmental Protection Agency Combined Heat and Power Partnership's Policies and Incentives Database, located at <https://www.epa.gov/chp/dchpp-chp-policies-and-incentives-database>.

²⁶ Water Environment Research Foundation (WERF). Reframing the Economics of Combined Heat and Power Projects. <http://www.nyserda.ny.gov/-/media/Files/EERP/Commercial/Sector/Municipal-Water-Wastewater-Facilities/CHP-Economics-fs.pdf>.

4. Making the Business Case for CHP

One CHP investor noted that less than 30% of potential CHP projects are actually finalized; another CHP broker estimated that only about 1 in 10 prospective CHP projects secure financing. Clearly, it is important to equip CHP developers with the necessary tools for successfully determining the economic feasibility of CHP project and then presenting a promising CHP project, both internally to a CFO and externally to investors. This section provides an overview of the key points that CHP hosts and developers should consider when preparing a CHP project to present to a financial firm.

Sectors often well suited for CHP

- Hotels
- Hospitals
- College/University Campus
- Military Base
- Industrial Sites
- Cold Storage/Food Storage
- Waste Water/MSW
- Data Centers

4.1 Economic Feasibility

The CHP financing firms contacted for this report highlighted several factors as critical to the feasibility of a CHP project:

SIZE

Energy and cost savings grow disproportionately as the project size grows, particularly for projects 1.5 MW or larger. However, the CHP system should be properly sized according to the facility's energy demand; some investors have noted that CHP developers tend to oversize the system, which can hurt a project's financial viability.

SPARK SPREAD

For the economics of a CHP project to be favorable, the project needs a high "spark spread," which is the relationship between purchased natural gas (or other fuel) and electricity prices^{27 28}. Based on the difference between gas and electricity prices, it represents the difference in cost between buying electricity from the grid and generating it onsite with a CHP unit. At a constant fuel price, the savings due to operating CHP increases as the price of electricity increases; at a constant price of electricity, the savings increase as the fuel price decreases. The best case for a CHP operator is high electricity prices and low fuel prices.

²⁷ The spark spread is calculated by taking the difference between the power price (\$/MWh) and the fuel price (\$/MMBtu) multiplied by the heat rate for the CHP equipment (MMBtu/MWh).

²⁸ Midwest CHP Technical Assistance Partnership, "Combined Heat and Power: Is it Right for your Facility," May 14, 2009, http://energy.gov/sites/prod/files/2013/11/f4/webcast_2009-0514_chp_in_facilities.pdf.

EXISTING INFRASTRUCTURE

CHP projects that can use existing infrastructure, and do not need a new building, extensive piping or significant site improvements, are viewed more favorably. Additionally, infrastructure is a non-revenue generating asset and end-users can avoid the costs and disruption of a new infrastructure project.

THERMAL DEMAND

CHP systems that are sized to meet thermal demand without selling excess electricity back to the grid or other off-takers often receive more favorable financing. Utilities often purchase excess electricity at low rates that can hinder the economic viability of CHP. Systems that are sized smaller to ensure full thermal utilization with little or no excess electricity sales are generally more attractive to CHP financiers.

LOAD FACTOR

A higher utilization of the CHP system typically results in increased energy cost savings since the facility is less reliant on grid-supplied electricity. Investors look to invest in CHP in market sectors with long operating hours and high thermal demand (see those common target markets listed in the call-out box above).²⁹

Ideal Candidate Sites for CHP

- Facilities with large, steady thermal loads.
- Project development can be a lengthy process (often 2-3 years), so must be able to sustain momentum on a project from conception to completion.
- Ideal sites can take advantage of the strong economies of scale associated with CHP
- Ideal sites will have a guaranteed lifetime to ensure payback on the project.
- Examples include facilities in the chemical, food processing, hospital, hotel, and university market sectors.

²⁹ The market sectors highlighted as most attractive to investors are based on feedback from conversations with CHP financiers.

INTERNAL CHP ADVOCATE

Having a strong internal CHP advocate, along with support from both the facilities manager and organization CFO can determine whether a project moves forward or not.

CHP Advocates – CFO vs. Facilities Managers

A number of CHP financiers highlighted the importance of having an internal CHP advocate at the end-user site, and think that many times having such an advocate makes the difference on whether a CHP project moves forward or not.

Another key factor involved in whether a CHP project gets installed depends on agreement between the chief financial officer (CFO) and facilities manager at an end-user site. It is often difficult to get both of these people on the same page, though of vital importance for the project to progress.

4.2 Internal vs. External Financing

The ease of financing a CHP system is largely dependent on the nature of the selected financing. Entities with sufficient internal capital, such as colleges and universities and some petrochemical companies, are able to finance their own CHP systems. As a result, their due diligence process may be shorter and certain items in the process may be accomplished more smoothly. Another advantage of self-financed projects is the low cost of capital compared to external financing options.

Projects that receive external financing usually do so through a third-party financial firm. The financiers that were contacted listed their primary clients as industrial sector facilities, followed by some large commercial clients interested in installing CHP. Typically a CHP developer will propose a project to an attractive existing CHP candidate. Good CHP candidate sites are considered to be those with significant and sustained thermal and electric loads with high operating hours. CHP developers are usually companies that focus solely on working with end-users to develop, promote and implement CHP projects, though they may also be manufacturers or vendors. CHP system manufacturers that also work on project development may provide financing for CHP projects themselves.

The CHP end-user should work with the project developer to navigate the project sizing, design, and due diligence steps prior to submitting the project to the financial firm's credit group for evaluation. PPA structures with the end-user purchasing all heat and power produced from the CHP system are the most popular external financing mechanism.³⁰

³⁰ Based on discussions with CHP financiers.

4.3 Business Case for Internal CFO or Investment Committee

CHP project developers may help end-users secure financing first through seeking funding from third-parties if there is not sufficient internal capital to cover the full project cost. If the project will compete for internal funds, the developer must clearly articulate that the returns on CHP are long-term with relatively high internal rates of return (IRR is a very popular metric by which internal investments in different projects can be compared). Typically, the higher the IRR, the more willing a company will be to undertake the investment.

Many companies have minimum values, known as internal discount rates or “hurdle” rates, that CHP project IRRs must exceed to be considered for funding. IRRs for industrial projects usually exceed those of commercial applications due to economies of scale. However, project economics are very site-specific, depending on local electric and fuel rates.

In the industrial sector, CHP projects may be assessed on 2-year simple payback criterion (the equivalent of a 61% IRR) because this is the metric most often used for non-core business investments. To help CHP projects overcome such prohibitive IRR hurdles, it may be necessary for CHP project proponents to present the project using different financial metrics. For example, prospective CHP sites could show that they will be able to pay for the project using energy dollars that would have been paid to the utilities and/or fuel companies, and that this is why the length of payback period (or the IRR) should be viewed differently than a normal equipment purchase that is impacting limited finances. Other financial metrics may also be used to assess CHP projects, although each has its pros and cons and takes different factors into consideration.

A popular way to finance a CHP project that makes less of an impact on the company/end-user's bottom line is to move the CHP asset off the balance sheet and finance it through a third-party. By using third-party financing, the energy purchase from the CHP system is treated as an expense instead of a capital expenditure. The decision-making criteria for energy purchases are typically assessed differently compared to capital investments, with cost savings being the principal focus. Under third-party financing, the CHP advocate simply has to demonstrate that the CHP project can provide month-to-month cost savings for the facility. The CFO or project approval committee typically finds such cost reductions appealing, provided the risks are well understood and mitigated and that the energy savings are guaranteed.

4.4 Business Case for External Investor

Finding the right capital provider can be challenging for two main reasons: relatively few brokers or investors specialize in CHP projects, and many that do prefer larger projects (i.e., 5 to 50 MW or greater).

The typical external CHP financing path begins with a CHP developer presenting a project to candidate sites. If the candidate site is interested in installing CHP, the developer will start the project development process and guide the end-user through all of the necessary steps, from design to project completion. The CHP developer usually already has well-established relationships with third-party financiers and will connect the end-user to a financier. These

relationships, along with project experience and technology familiarity, generally help the CFO of the host/customer company in communicating with investors and answering detailed questions about project risk mitigation. The CFO is usually the main facilitator or point-person for the project proposal and should be supported by the facilities manager most familiar with the intricacies of the CHP project.³¹

Before approaching a broker or investor, the CHP end-user needs to have a demonstrated financial ability to meet contracted payments. This creditworthiness is the foundation of a strong project and is validated by:

1. Strong credit rating – this is the most important factor, and investors prefer a facility to be part of a larger company and/or system. For example, investors may favor CHP projects at hospitals that are part of a larger hospital or healthcare system.³²
2. Willingness to open up their accounting statements to scrutiny, and having a strong balance sheet.
3. Past three years of tax returns, including showing a profit in at least two of the past three years.
4. Project proposal including financial modeling of the projected cash flows.
5. A debt coverage ratio at or above 1.25.³³

Lenders/investors often want to see income statements, balance sheets, and cash flow statements for the previous two fiscal years. Investors prefer that these documents be prepared by a certified public accountant in accordance with generally accepted accounting principles (GAAP). These statements should also include detailed footnotes and year-to-date (YTD) interim financials less than 90 days old (with income statements, balance sheets, and cash flow) prepared by management. Detailed descriptions of all debts and liability are typically required. This includes the debt amount, how it was secured, terms of repayment, and lender contact information.

Due Diligence and Risk Mitigation

Due diligence is the research and analysis conducted in preparation for a business transaction. Brokers and investors use the due diligence process to gain a more complete understanding of the project's risks prior to signing a contract. This process delves into a number of details including the customer organization's financials, project economics, technical information, certifications and more.

³¹ Based on discussions with investors.

³² Based on discussions with investors.

³³ In corporate finance the term debt coverage ratio is indicative of the amount of cash flow available to meet annual interest and principal payments on debt. To justify any project investment, the ratio should be well over 1, meaning that the property is generating enough income to pay its debt obligations. A ratio less than 1 means a negative cash flow.

Table 4-1 contains a checklist of items that a CHP developer should cover in a presentation to a potential investor. These items were compiled from conversations with actual investors, and should be accompanied in the presentation by explanation of their respective risks, with the intended mitigation strategy for each. The developer should ensure that the items in this list are covered before presenting, although financiers will often work with the developer to implement their own required modifications prior to submitting the project to their firm’s credit team for review.

Table 4-1. CHP Project Finance Due Diligence Checklist

Item No.	Description
1	Letter of Intent from Host/Customer
2	Engineering Feasibility Study and Financial Model
3	Interconnection Agreement, Permits and Easements
4	EPC Contract
5	Technology Warranty and Performance Guarantee
6	O&M Agreement
7	Fuel Supply Contract and Price Hedging

LETTER OF INTENT OR CONTRACT WITH CUSTOMER/HOST

Investors and brokers will only invest their time and money in a project if the developer is fully committed and demonstrates a thorough understanding of the project. For this reason, a letter of intent (LOI) is a standard due diligence requirement. An LOI or similar contract is an agreement that signals a host/customer’s intention to install a CHP system on their site, and is the first step in a transaction. It reflects the project’s specific engineering, contracting and financing characteristics. The LOI should include detailed descriptions of the remaining six due diligence elements contained in **Table 4-1**.

The LOI document can be legally binding or non-binding, but should always be prepared by the legal counsels of both counterparties to ensure their respective legal commitments are understood. While investors tend to prefer the certainty that comes with a legally binding contract, most LOIs are non-binding. Currently, there is no standardized LOI documentation in the CHP industry for developers to review before drawing up their own. In order to safeguard intellectual property that developers and investors have worked hard to develop, LOIs are often confidential and only seen by the counterparties of the CHP deal and their legal counsel.

ENGINEERING FEASIBILITY STUDY AND FINANCIAL MODEL

Strong coordination between the financial professionals and the site developer is paramount for accurately determining the financial viability of the project. The developer or host/customer must therefore employ an engineer to inspect the site, gather data on electrical and thermal loads, and calculate the optimal system size. These engineering studies signal to the investor that the site

owner/developer has “skin in the game” by spending money on key inspections and reports. These internal studies should make use of the most refined data available, taking into consideration each of the following factors:

- Site load profiles
- System operational schedule
- Capital cost
- Heat recovery
- Mechanical system components
- System efficiency
- Sound levels
- Space considerations
- System vibration
- Emissions and permitting
- Utility interconnection
- System availability during utility outage
- Availability of incentives
- Maintenance costs
- Fuel costs
- Financial model of project economics

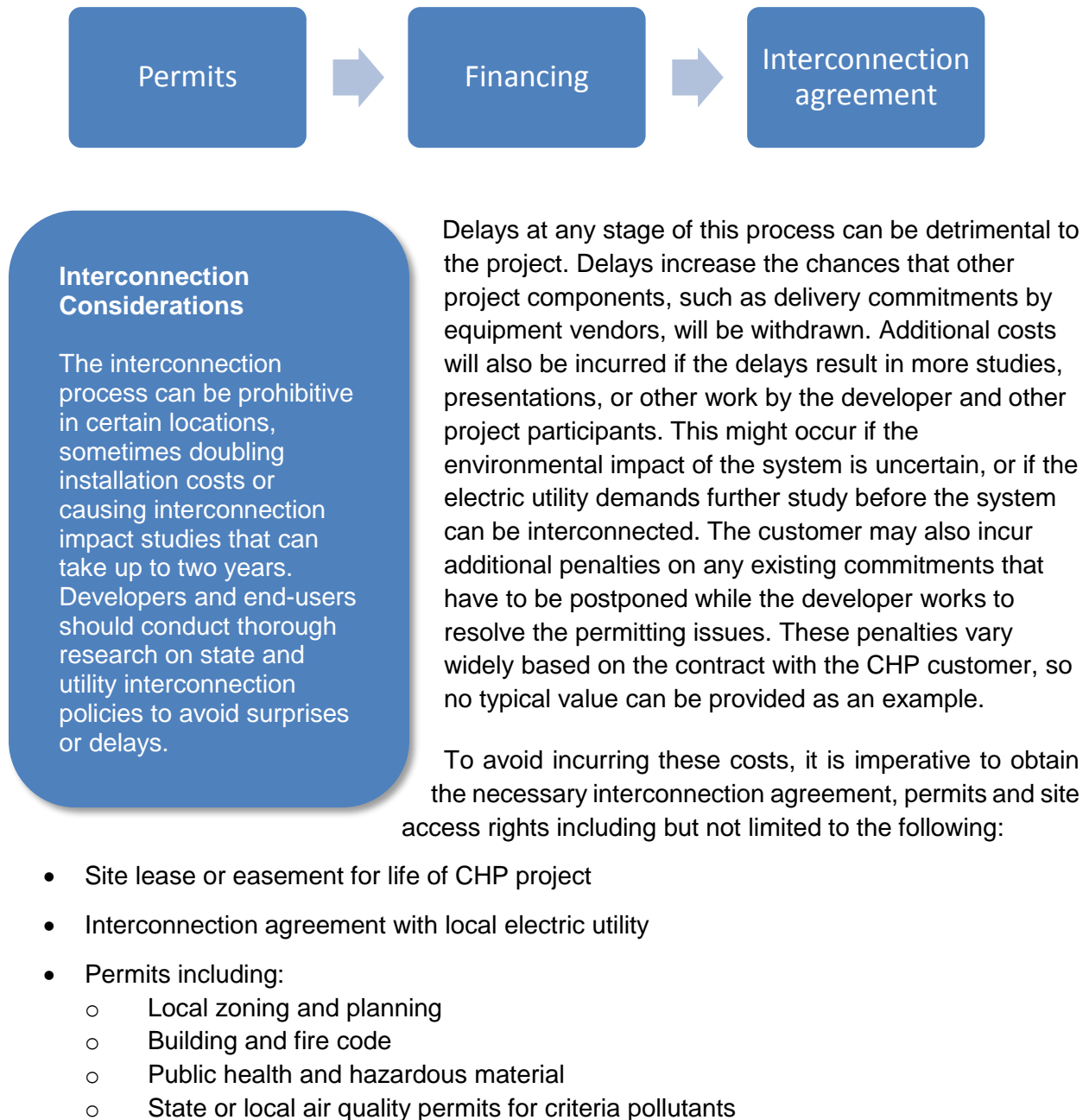
CHP financiers also recommend that a full energy audit be conducted at the end-user site prior to the CHP design phase. This helps ensure that the CHP system is sized properly by accounting for any energy efficiency upgrades (such as HVAC and lighting) that the end-user is considering making prior to installing CHP.

INTERCONNECTION AGREEMENT, PERMITTING AND EASEMENTS

Permitting risk relates to the expected difficulty involved in obtaining the various environmental, site access, grid interconnection, and construction permits that may be required to begin construction. Developers help the CHP end-users with this component of pre-development work.

Financial firms typically expect a CHP project to already have the required air permits in place prior to seeking financing. Similarly, projects often need to have secured financing before paying for interconnection studies and fees, which can be costly. This relationship is illustrated below.

Figure 4-1. CHP Project Permitting Steps



ENGINEERING, PROCUREMENT & CONSTRUCTION (EPC) CONTRACT

Ideally, all construction projects are delivered on time and perform according to design specifications upon completion. However, a project may not be completed even after breaking ground due to construction delays, cost escalation of construction materials or labor, technical problems or environmental concerns. These increased costs may even outweigh the projected energy cost savings from the CHP project.

As a developer begins to contract with many counterparties for major engineering and construction work, creditworthiness again becomes of paramount performance. A key mechanism for mitigating construction risk is a fixed-cost, turnkey engineering, procurement, and construction (EPC) contract with a single counterparty.³⁴ The counterparty may be the developer, equipment vendor or EPC firm, and must demonstrate a strong track record of project budgeting and on-time delivery. To meet these requirements, investors prefer an investment-grade EPC contractor to bear all the risk.

A basic checklist for an EPC contract includes:³⁵

- Commercial operation date - Date by which the facility will achieve commercial operation.
- Milestones - Engineering completion, construction commencement, CHP prime mover delivery, and start-up.
- Cost, rates, and fees - Structures include fixed EPC or turnkey price, hourly labor rates, cost caps, fee amount or percentage, contingency.
- Performance guarantees - Specified output (kW, MMBtu/hr), heat rate, availability, power quality.
- Warranties - Output, performance degradation, heat rate, outage rates, component replacement costs.
- Acceptance criteria - Testing methods and conditions, calculation formulae.
- Bonus amounts and conditions - Bonus for early completion, exceeding specifications.
- Penalties and conditions - Damages for late completion, failure to meet specifications.
- Integration/impact of construction on facility operations - Schedules for power outages, limits to access, etc.

TECHNOLOGY WARRANTY AND PERFORMANCE GUARANTEES

Inferior materials or design increase the risk of equipment failure. Exposure to this technology risk is higher for smaller projects because of a low margin for error. For example, even a small reduction in electric output could render a small project unprofitable. The most important component underlying all warranties, guarantees, and agreements is, again, the counterparty risk and creditworthiness of the issuer. Before the content of the contracts can be assessed, the counterparty will need to demonstrate:

- Creditworthiness of manufacturer or vendor³⁶
- Long and broad track record of equipment performance
- Existing portfolio of long-term warranty commitments

The quality of equipment intended for the project can strongly affect anticipated system performance, which in turn determines how much the CHP project will save in avoided electricity

³⁴ Ibid.

³⁵ Ibid.

³⁶ Based on discussions with financial firms.

(and possibly steam or natural gas) purchases. As such, many investors advise smaller projects and/or newer technology providers to carry additional insurance to cover any default on performance guarantees.

O&M AGREEMENT

Operational risk increases when a plant is poorly operated or maintained. This risk is usually marginal, however, if the selected operator is experienced with the specific equipment deployed in the plant. Investors ensure this with operations and maintenance (O&M) agreements. These contracts should be full service, not for only a portion of the system's O&M or certain components. This helps eliminate down time for the CHP system. O&M contracts can be with the equipment vendor or with a separate specialized O&M company, but should always match the term of the finance offered. Other key components include:

- Creditworthy O&M provider
- Long-term maintenance contract with manufacturer of prime mover
- Vendor certified operators
- Labor and parts cost escalators to be included in contract
- Scheduled and unscheduled maintenance rates

Host-owned CHP projects may rely on in-house facilities management staff for maintenance. Owners may also use third-party contractors, but should always ensure that they have been trained and certified by the vendor (even for smaller projects).

FUEL SUPPLY CONTRACT AND PRICE HEDGING

Fuel risk during the life of the contract tends to be the greatest hurdle to CHP financing from the investor's perspective. Fuel risk encompasses risks associated with price, supply, delivery and quality, but price risk is the chief factor. Hedging of natural gas price risk is essential to mitigating fuel price risk for many CHP projects. Investors seek to secure long-term natural gas contracts that match the term of the finance offered. However, most fixed price natural gas contracts are only 3 to 5 years in length, whereas the financing term for most CHP projects is 7 to 10 years or longer. Some financiers have stated that natural gas price risk and the inability to hedge it for a longer term is one of the biggest (if not the single biggest) deterrent to CHP project development. Some financial firms have begun to work with gas utilities to help figure out a way to offer longer-term price hedges.

Natural gas contracts can be structured to mitigate risks using any of the following:

- Flat rate contract – under this contract structure, the fuel user pays the same price over the life of the contract. This structure benefits the user most towards the end of the contract, by which time natural gas prices have typically risen significantly higher compared to the contracted price.
- Escalating price contract – under this structure, one starts with a base natural gas price which increases over the life of the contract. Customers know the prices they will be paying

under this structure, and derive more benefits at the start of the project. The price is escalated at a pace with which the client is comfortable. Commonly, the escalator is set at or below the expected escalation prices of competing electricity prices.

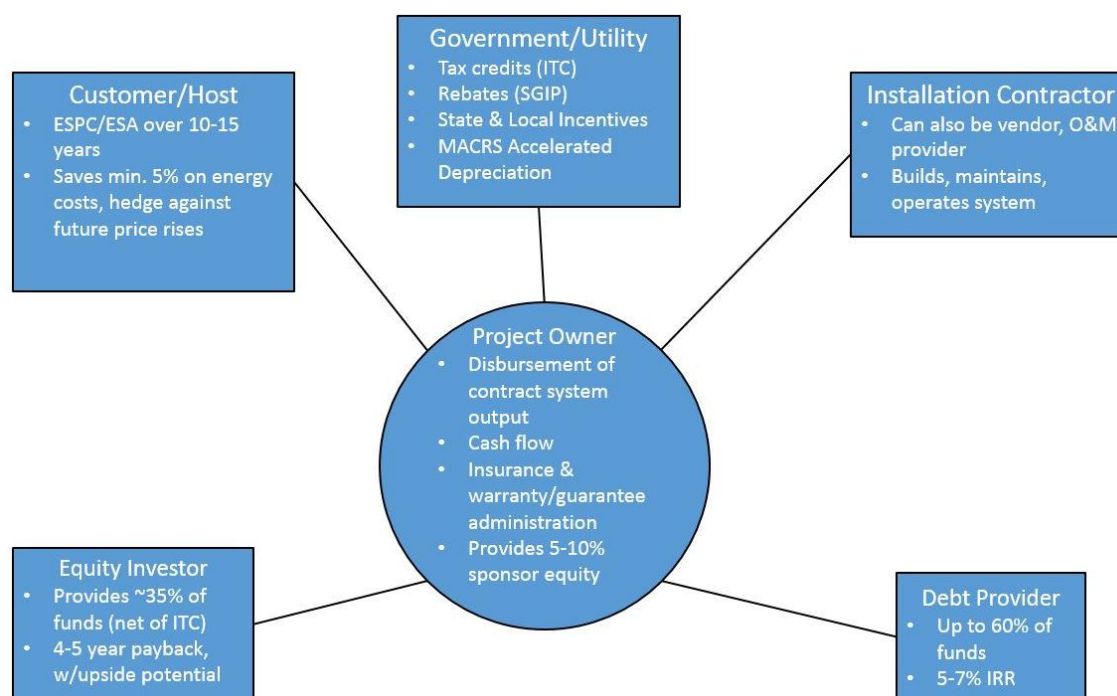
- Floating rate with a price collar – this structure allows the price of natural gas to fluctuate with the market. However, a ceiling on the natural gas price will be set for the life of the contract. This benefits the customer from potentially lower market prices, although customers have to pay a premium to hedge their risk of paying a price above the ceiling.

Some investors assume that fuel price risk is something that is accepted by the host/customer, and do not provide price hedging options.

4.5 Financing Checklist – Final Steps

Once the aforementioned due diligence requirements have been met, the uninterrupted financing process usually takes three to six additional months. Given the unique nature of each CHP project, investors prefer to deal with developers with whom they have established relationships and who can reasonably be expected to meet these due diligence requirements. Some of the investors prefer to be more hands-on and get involved in economic negotiations (such as the terms of a PPA) to ensure strong financials. These matters can also be handled by a broker working with the developer before presenting the project to investors. The investors and brokers will lead the developer and host/customer through the financing process. See **Figure 4-2** for key players involved in the CHP financing process and their roles.

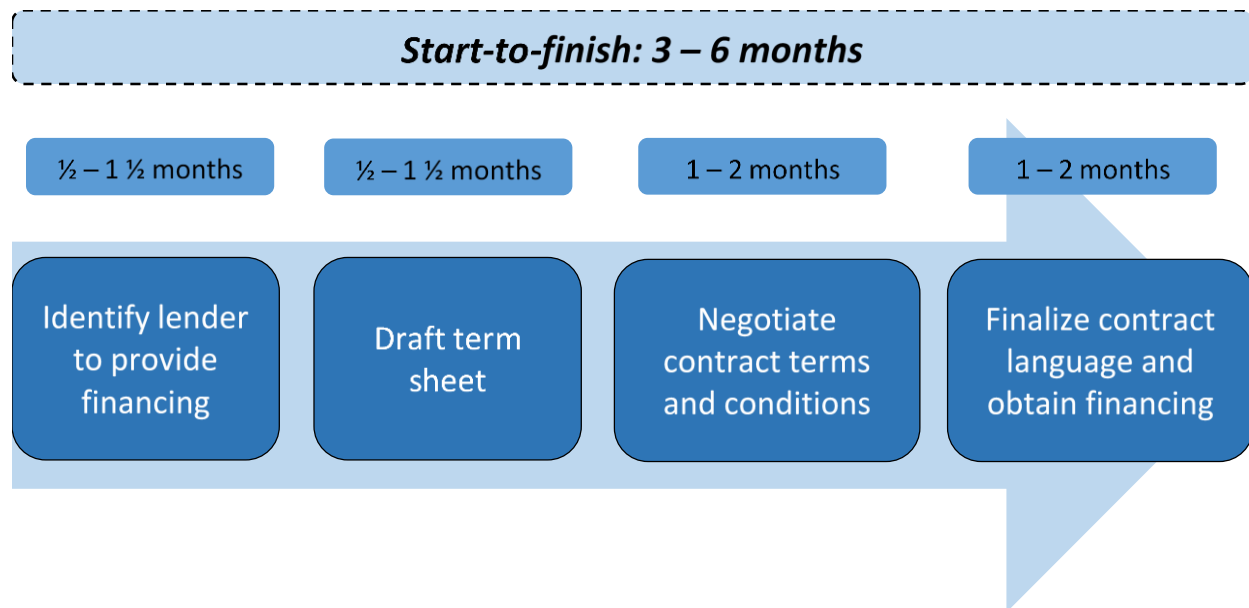
Figure 4-2. Key Players in the CHP Financing Process



Financing Timeline

The due diligence process takes the longest time to complete and varies widely from project to project. Once the due diligence process is complete, however, it typically only takes another three to six months to find a lender and secure capital. A general summary of the six-month timeframe of a well-executed financing plan that meets due diligence is given in **Figure 4-3**.

Figure 4-3. CHP Project Financing Timeline



Some investors can shorten the process to three months if the developer has a “shovel ready” project for which all due diligence has been completed. The investment process can also be considerably accelerated if the investors utilize their own funds for the project. However, surveyed investors noted that only between 10 and 30% of projects that come across their desks actually get financed. A three-month financing activity timeline is shown in **Table 4-2**.

Table 4-2. Three Month Financing Activity Timeline

FINANCING ACTIVITY	Duration (days)
1. Due Diligence Review	30 days
2. Modeling of Criteria	
3. Building the Package of Contracts	60 days
4. Underwriting – Legal and Permitting	
5. Investment Committee Approval	
6. Portfolio Allocation to Balance Sheet	

The smoothness of the financing process depends on the developer’s organizational ability and how well it fields questions from the investor.

5. Project Profiles

This section describes financing aspects of four CHP projects:

- North Carolina State University (11 MW) – third-party ownership
- Gundersen Health System (1.1 MW) – self-ownership
- Shands Hospital (4.3 MW) – third-party ownership
- Harbec Plastics (750 kW) – self-ownership

5.1 North Carolina State University (11 MW CHP, district energy system)³⁷

Overview

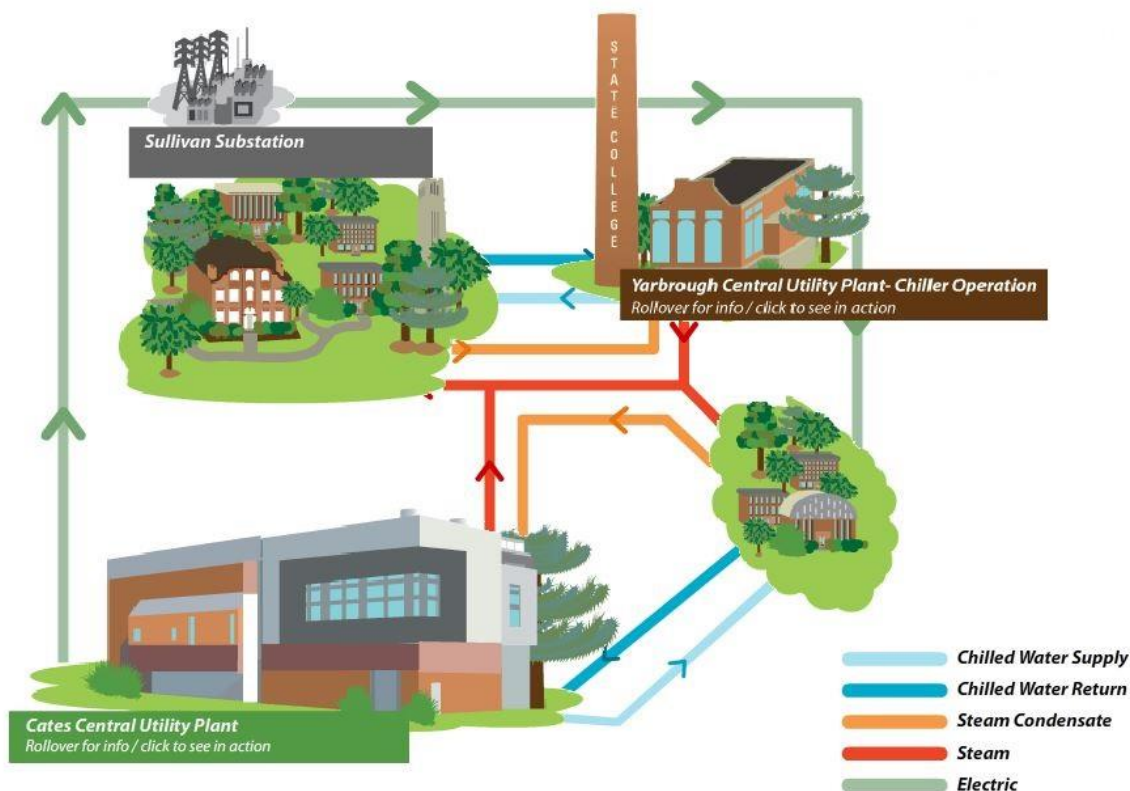
North Carolina State University (NCSU) installed an 11 MW CHP project in the fall of 2012. NCSU entered into a performance contract with Ameresco to install two new CHP units, replace three central plant boilers, install a new 2,000-ton chiller, and make other energy efficiency upgrades around the campus. The CHP portion of the contract included the installation of two 5.5 MW combustion turbines and heat recovery steam generators at the Cates Utility Plant. The system supplies 30% of the North Campus' peak power demand, thereby reducing the need for purchased grid electricity, lowering overall energy costs and advancing the university's goal of being carbon neutral by 2050.

Project Financing

NCSU did not generate power on campus before the current CHP system was installed. The university's district energy system for steam distribution was installed in the 1920's, and in 2000 they added a large chilled water system with a bond that was available under a large new capital construction campaign. While the university was initially only interested in replacing its depreciated steam production boilers, reliability and other issues prompted NCSU's engineering firm, Sebesta, to recommend CHP in lieu of renovations. The engineering firm evaluated different technologies (engines, turbines, simple cycle, and combined cycle) and together with the university ultimately selected and designed a simple cycle gas turbine with heat recovery.

³⁷ U.S. DOE. "North Carolina State University, 11 MW CHP & District Energy System," http://southeastchptap.rlmartin.com/Data/Sites/4/documents/profiles/ncsu-chp_project_profile.pdf.

Figure 5-1. Overview of NCSU's CHP System



Source: <http://sustainability.ncsu.edu/chp/>

In North Carolina, operating savings are generally ineligible for application toward capital construction expenses. Although NCSU was anticipating state legislation that would have allowed entities to convert energy savings to pay debt on capital, legislative uncertainty and potential air quality attainment issues prompted the university to partner with an ESCO instead of counting on this change (that might have permitted self-financing).

After issuing a request for proposals (RFP), NCSU received two response bids. These bids contained estimated cost savings but not estimates of development costs. The proposals outlined how each company would approach the project, including design elements such as the steam structure. NCSU went through a normal evaluation process, considering items such as the project approach, team structure and expertise, and references on similar delivered projects.

In January 2011, NCSU signed a \$61 million ESPC with Ameresco, Inc. for the CHP system and the other measures discussed earlier (boilers, chiller, and other energy efficiency upgrades). Ameresco, an independent energy efficiency and renewable energy solutions company, provided guaranteed savings of \$3.9 million within the first year of the project, and savings of \$10 million per year by the end of the project. The project is financed by Bank of America, with the understanding that the energy cost savings from the project would be applied to service the debt.

Any savings over the guaranteed amount is to be used for other energy conservation projects on campus.

It took nearly four years from the initial work with Sebesta for NCSU to gather all necessary approvals to build the CHP system, while the process of engaging Ameresco and finalizing the project costs took another six months. As the ESPC for this project was the largest in state history, a significant number of approvals from the NCSU System Board of Governors, the state construction agency, the state secretary and others were necessary.

NCSU's CHP Financing Advice

- Project teams need to be focused on the pro forma.
- The cost of electricity and gas makes a big impact on the pro forma.
- Maintaining a large spark spread will produce a project with much better results.
- Energy price assumptions drive the pro forma – NCSU used DOE/Energy Information Administration (EIA) mid-term figures, and levelled off escalation rates.
- A simple two-party financing relationship is preferable to the complexity of a third-party arrangement.
- The cost of service agreement impacts the financing. NCSU chose to go with a long-term service agreement and a full coverage insurance policy. This was also a positive factor for the bank – responsibility for maintenance and repair was with the manufacturer, and not the university.
- Clear understanding of the relationship with the utility, especially the interconnection (standby fees and physical interconnection costs), is critical.
- NCSU's CHP system does not export power, so that made the interconnection process simpler.
- NCSU buys standby service at half the cost of generation capacity. This allows NCSU to sequence maintenance downtimes to low peak periods.
- Everyone's situation is different involving CHP financing. Rules of thumb are elusive.

Source: based on conversation with NCSU

5.2 Gundersen Health System: Onalaska Campus (1.1 MW CHP, landfill gas)³⁸

Overview

In March 2012, Gundersen Health System (Gundersen) invested its own funds in, and began operating, a combined electric power and thermal system fueled by landfill gas (LFG) at its Onalaska Campus, a medical research center located in Onalaska, Wisconsin. The landfill gas, which is piped 1.5 miles from a La Crosse County landfill, is used to fuel a 1,137 kilowatt reciprocating engine generator set with heat recovery. The system is sized to completely offset the electrical energy usage of the Onalaska Campus; however, rather than using the generated electricity directly at the campus, it is sold to Xcel Energy, the local utility. Heat is recovered from the system to provide space heating and domestic hot water to the campus buildings. Gundersen anticipates annual revenue of \$500,000 from selling the generated electricity to Xcel Energy, while the county will collect around \$200,000 per year from selling the landfill gas to Gundersen. Both values should increase over time as the landfill produces more gas. In addition, Gundersen saves \$100,000 annually in space heating and domestic hot water costs thanks to the thermal energy recovered from the system.

Gundersen's LFG System

Gundersen teamed up with La Crosse County to explore potentially using the La Crosse County landfill's existing landfill gas collection system, which at the time collected and subsequently flared an average of 300 cubic feet of landfill gas per minute. Nearly 400 such projects are in operation in the United States today; however, less than 7% of these use the recovered energy to offset a thermal load, since landfills generally have no space or process heating needs on site. While the least expensive option would have been to install an engine generator at the landfill and only generate electricity, Gundersen and the County recognized a greater opportunity and chose to pipe the landfill gas 1.5 miles from the landfill site to Gundersen's Onalaska Campus in order to fuel the gas-to-energy system.

³⁸ U.S. DOE. "Gundersen Health System: Onalaska Campus," December 2012, <http://www.midwestchptap.org/profiles/ProjectProfiles/GundersenLutheranOnalaska%20.pdf>.

Figure 5-2. Gundersen's CHP Unit



Source: <http://i.ytimg.com/vi/vxajy4Q-BcM/maxresdefault.jpg>

Project Financing

In 2007, Gundersen saw its energy costs increasing at an alarming rate of more than \$350,000 per year. Determined to stop this trend, Gundersen developed an environmental program called Envision® which set a goal to reduce energy consumption by 20% by 2009 and achieve total energy independence system-wide by 2014. The Onalaska project offsets 11% of Gundersen Health System's total energy use and renders the Onalaska Campus 100% energy independent. The project uses on-balance sheet financing.

The county provided about \$1.6 million of the total \$4.1 million project cost, while Gundersen funded the remainder (\$2.5 million).³⁹ Gunderson estimates that it will take seven years to pay off its investment, and La Crosse County's solid waste department estimates that it will take eight years to recoup its portion (via the landfill gas payments from Gundersen). The arrangement led to \$176,000 in revenue for La Crosse County in 2012. Gundersen saved around \$400,000 on its electricity costs and \$100,000 on its heating costs in 2012.⁴⁰ This public-private partnership has proved mutually beneficial by helping Gundersen achieve its energy goals, and by helping the county's solid waste department earn Green Tier status from the Wisconsin Department of Natural Resources while simultaneously creating a new revenue stream.

³⁹ Hubbuch, Chris. "Gundersen, County Recognized for Landfill Gas-to-Energy Project," January 31, 2013, http://lacrossetribune.com/news/local/gundersen-county-recognized-for-landfill-gas-to-energy-project/article_5e8b1770-6b4e-11e2-8a68-001a4bcf887a.html.

⁴⁰ Ibid.

5.3 Shands Hospital (4.3 MW CHP)⁴¹

Overview

Shands HealthCare Cancer Hospital is located on the University of Florida campus in Gainesville, FL. Shands selected Gainesville Regional Utilities (GRU) to design and build an on-site energy center for the hospital to ensure power quality and reliability. The facility uses a combustion turbine for the prime mover, producing 4.3 MW of electricity while the heat recovery steam generator provides steam for the building and aids with the production of chilled water. The 4.3 MW natural gas turbine provides 100% of the hospital's electric and thermal needs, which allows the site to operate at a total thermal efficiency of 75%.

Figure 5-3. CHP Installation at Shands HealthCare



Source: <http://www.burnsmcddb.com/2014/03/31/why-on-site-energy-matters/>

Project Financing

Gainesville Regional Utilities financed, owns and operates the South Energy Center as part of a 50-year agreement to provide electricity, steam, and chilled water to the hospital. The hospital saved \$30M in capital by not building its own central plant. Burns & McDonnell provided architecture, engineering, procurement, and construction management for the \$45M project. The project was financed through a tax-exempt municipal bond issued by GRU. Shands agreed to repay all capital costs through a monthly capital cost recovery mechanism, and to accept pass-through costs from GRU for fuel (natural gas, electricity and diesel) and medical gas. It also

⁴¹ U.S. DOE. "Shands Hospital 4.3 MW CHP & District Heating/Cooling System." October 2013, http://southeastchptap.rlmartin.com/Data/Sites/4/documents/profiles/Shands_Hospital-CHP_Project_Profile.pdf.

agreed to pay for O&M, and to pay GRU for its production costs for electricity, chilled water, and steam and O&M. Budgets are developed and reviewed by an operations committee, and any savings are split on a 50-50 basis.⁴²

5.4 Harbec Plastics (750 kW CHP)⁴³

Overview

Harbec Plastics, Inc. is located in Ontario, New York, and produces plastic parts for the medical, automotive, consumer goods and other applications. Harbec decided to install CHP due to rising energy costs and frequent electricity supply problems in the late 1990s. The company was paying about 10.5¢/kWh⁴⁴, and power outages and surges had cost the company over \$15,000 in one month alone due to damaged equipment.⁴⁵

Harbec's CHP system started operating in the summer of 2001 and consists of 25 low emission 30 kW Capstone microturbines with a total capacity of 750 kW. The company also has wind turbine installations. Harbec uses natural gas to run the Capstone microturbine generators, which produce electricity to operate molding operations. The microturbine exhaust is used to produce hot water, which heats the main building. During the summer, the hot water is sent to an absorption chiller, which produces cold water for air conditioning.⁴⁶ The microturbines generate one-sixth of Harbec's power requirements. Today, Harbec typically operates its CHP system to

How should the industrial facility present the project to investors?

Bob Bechtold, president of Harbec, advises anyone who would follow in his footsteps to present sustainability projects solely in economic terms, and don't even mention the environment—"the other e-word," as he calls it.

Industrial facilities "should show that they are able to pay for the project using energy dollars that would have been paid to the utilities and/or fuel companies, and that this is why the length of ROI should be viewed differently than a normal equipment purchase that is impacting limited finances."

⁴² International District Energy Association (IDEA). "Outsourced and On Site: Hospital, Utility Team Up on Innovative Energy Center." Fourth Quarter 2010, <http://www.burnsmcd.com/insightsnews/news/in-trade-publications/2010/10/district-energy-outsourced-and-on-site-hospital->.

⁴³ Northeast CHP Application Center. "Harbec Plastics 750 kW CHP Application," http://www.northeastchptap.org/Data/Sites/5/documents/profiles/Harbec-CHPProjectProfile_final.pdf.

⁴⁴ Plastics Technology. "Eco-Economics': Harbec Plastics Proves it Pays to be 'Green,'" October 2013, <http://www.ptonline.com/articles/eco--econo-mics-harbec-plastics-proves-it-pays-to-be-green>.

⁴⁵ Northeast CHP Application Center. "Harbec Plastics 750 kW CHP Application," [Web linkhttp://www.northeastchptap.org/Data/Sites/5/documents/profiles/Harbec-CHPProjectProfile_final.pdf](http://www.northeastchptap.org/Data/Sites/5/documents/profiles/Harbec-CHPProjectProfile_final.pdf).

⁴⁶ Northern Development LLC. "Cogeneration," <http://www.northerndevelopment.com/index.html>.

follow the thermal load, which means the plant's heating and air conditioning needs determine the number of turbines operating at any time.⁴⁷

Figure 5-4. Harbec's Microturbine Generators



Source: <http://www.ptonline.com/articles/eco--econo-mics-harbec-plastics-proves-it-pays-to-be-green>

Project Financing

Harbec self-financed a portion of their original CHP system in 2000, and also received funding from one bank (HSBC) and four government economic development agencies (New York State Energy Research and Development Authority (NYSERDA), Wayne County Industrial Development Agency (WCIDA), the U.S. Small Business Administration (SBA), and the New York Business Development Corporation (NYBDC)). Harbec found it difficult to secure financing from outside sources because the expected payback for the project was relatively long (7 to 10 years). The company originally sought outside financing for their CHP system and received over 30

⁴⁷ NRDC Issue Paper. "Combined Heat and Power Systems: Improving the Energy Efficiency of Our Manufacturing Plants, Buildings, and Other Facilities." April 2013, <http://www.nrdc.org/energy/files/combined-heat-power-ip.pdf>.

rejections from banks over a two year period. It took over another year to receive the bank loan after Harbec had successfully presented the project to the bank.

Harbec paid \$1.1 million for the microturbines,⁴⁸ with installation costs partially covered by \$225,000 in funding from NYSERDA. The project's payback ended up being a little over 7 years. The CHP system annually saves Harbec over \$100,000, reducing the company's net energy costs by over 30%.⁴⁹ A few years ago, Harbec made plans to replace 16 of the 30 kW microturbines with eight new 65 kW models.⁵⁰ In 2012, the company was awarded \$740,000 from NYSERDA to make these microturbine replacements,⁵¹ which started operating in 2016.⁵²

5.5 Project Takeaways

The four case studies discussed in this section illustrate financing options for CHP projects, characteristics of good candidate sites, and the benefits of CHP systems for the facility. Key takeaways include:

- All four of the facilities had reliability needs, but the main motivation for each installation was the rising cost of energy and the potential to reduce energy costs with CHP.
- Each facility received a financial incentive, even if the facility provided their own capital to build the CHP system. Incentives are helpful because sites often lack access to capital for CHP projects (especially public institutions) due to perceived risks for a CHP project, which may be outside the host sites normal line of business.
- Of the four installations, only one (Gundersen) did not use all of the electricity produced from the CHP system on site. In this case, the facility sold excess power to the local utility. This situation highlights difficulties often encountered with utility interconnection, and potentially poor economics of selling (i.e., exporting) power.

⁴⁸ Plastics Technology. "Eco-Economics": Harbec Plastics Proves it Pays to be 'Green.'" October 2013, <http://www.ptonline.com/articles/eco--econo-mics-harbec-plastics-proves-it-pays-to-be-green>.

⁴⁹ Energy Concepts. "Harbec Plastics," <http://nrg-concepts.com/harbec-plastics/>.

⁵⁰ Plastics Technology. "Eco-Economics": Harbec Plastics Proves it Pays to be 'Green.'" October 2013, <http://www.ptonline.com/articles/eco--econo-mics-harbec-plastics-proves-it-pays-to-be-green>.

⁵¹ NYSERDA. "Harbec Inc. and NYSERDA Investment in New Ontario Wind Turbine Brings Clean Energy Power to Three Companies." May 2013, <http://www.nyserda.ny.gov/About/Newsroom/2013-Announcements/2013-05-02-Harbec-Inc-and-NYSERDA-Invest-in-New-Ontario-Wind-Turbine>.

⁵² Alliance for Industrial Efficiency. "Case Study: Energy Efficiency is Good for Business." 2016, <http://alliance4industrialefficiency.org/wp-content/uploads/2016/08/HARBEC-Case-Study.pdf>

6. Conclusions and Recommendations

There are a number of emerging trends that are driving CHP project development and financing. Financing firms have seen more focus on power reliability and resiliency in recent years. Many customers are also responding positively to financing options like PPAs that shift the capital risk to developers and financiers. These factors, along with improved project economics from lower natural gas prices, have been driving the demand for CHP financing.

There are several potential hurdles in a CHP financing process that, if properly addressed, can make the CHP financing process go much more smoothly. Strategies to address some of the key financing barriers include:

1. Full energy audit and other energy efficiency upgrades undertaken prior to CHP project initiation – To achieve greater overall energy savings at a facility, and to size and design a CHP system correctly, it is important for an end-user to undertake less involved energy efficiency measures such as installing more efficient HVAC and lighting, prior to initiating CHP.
2. Design and scaling of projects – Some CHP financiers cite over-sizing (relative to site demand) as a problem that they often see when a CHP project developer first approaches them for financing. Improper sizing of a system can negatively impact the payback and other financials of a CHP system.
3. Agreement between CFO and facilities manager – Many CHP financial firms stress the importance of strong support of the CHP project from both the CFO and facilities manager as being vital to the project's success. Another issue raised by financial firms is the absence of approval from the company's board prior to seeking financing (even if the project has support from the CFO and facilities manager). This too is a major issue that can derail CHP projects.
4. Legal fees – Legal fees associated with the financing process are often an issue, especially for smaller projects. These fees are usually the same cost regardless of project size and can often damage the economics of a small project. CHP investors noted that CHP end-users often are unaware of the legal fees associated with the financing process.
5. Longer duration natural gas contracts – one of the biggest hurdles to CHP financing from the investor's perspective is not being able to hedge natural gas price risks over the long term. Most natural gas hedges are only for three to five years, whereas the financing term for most CHP projects is seven to ten years. This mismatch in terms and the prospect of end-users being subject to potentially significant natural gas price risk over the life of the CHP project is a barrier to projects moving forward.

6.1 Additional Resources

The Department of Energy provides several resources for CHP end-users and developers to assist in the CHP project development process. For technical assistance related to CHP

project development, the seven regional CHP Technical Assistance Partnerships (CHP TAPs)⁵³ provide neutral third-party technical assistance to help end-users explore the feasibility of CHP.

The DOE Better Buildings Financial Navigator⁵⁴ is an online tool that helps public and private sector organizations find financing solutions for energy efficiency projects, such as CHP. Through the Navigator, users can also connect to the larger Better Buildings Challenge Financial Ally community, which includes banks and lenders that are committed to making bold financial investments in energy efficiency and are actively pursuing new opportunities to finance projects. The Navigator is designed for anyone who wants to access financing for energy efficiency projects or learn more about the marketplace in general, including building owners, facility and energy managers, sustainability directors, executives, contractors, consultants, brokers, researchers, and other decision-makers.

⁵³ DOE CHP TAPs. <https://energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps>

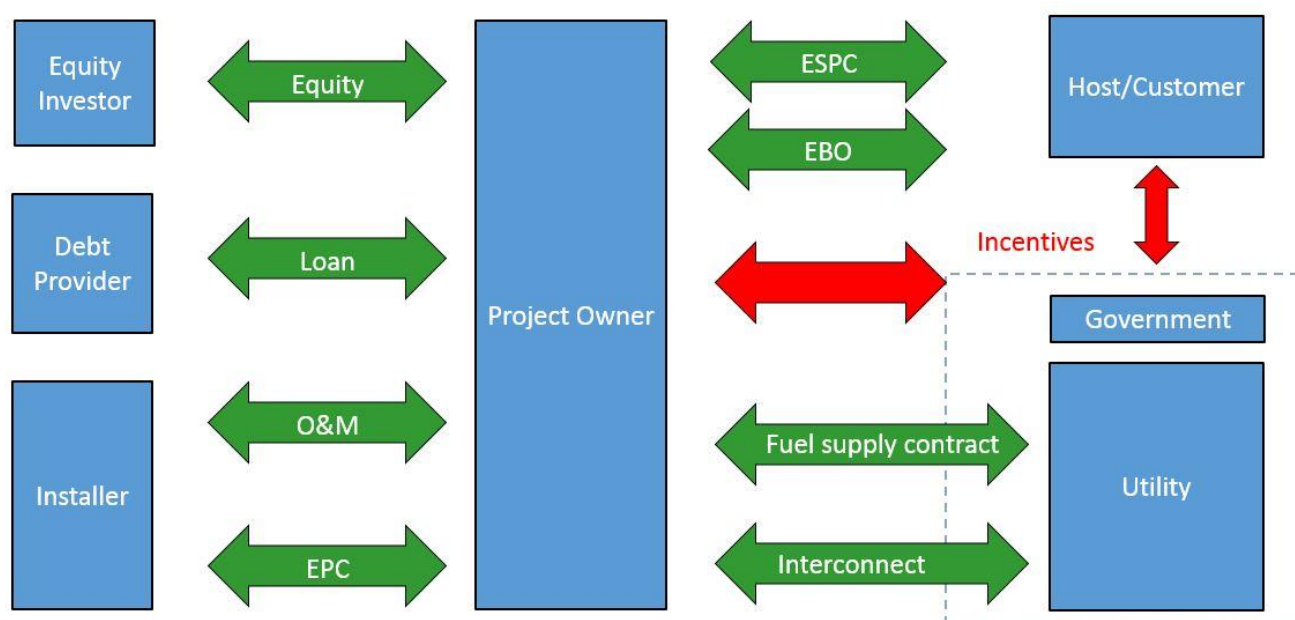
⁵⁴ DOE Better Buildings Financial Navigator. <https://betterbuildingssolutioncenter.energy.gov/financing-navigator>

Appendix A. CHP Project Development Stakeholders

This appendix describes the various stakeholders involved in the development and implementation of a CHP project besides the customer/end-user and the investor.

In addition to the various financing sources that are the subject of this paper, the interaction of many of the key stakeholders is outlined in **Figure A-0-1**. The role played by each stakeholder in the project development process is outlined in the remainder of this appendix.

Figure A-0-1. CHP Project Development Stakeholders



Host/Customer

The host or customer is the site/facility where a CHP system is going to be installed. Not only are the host's electric and thermal loads critical to a project, but its financial position can determine how a project is financed as well as how the project ownership is structured. If the customer proposes to own the system, its balance sheet will be critical to the ability to purchase the equipment. Even if the customer prefers to buy electricity and thermal energy from a third party owner, the customer's creditworthiness will critically determine if and how the project can be financed in this way. As the physical host of the facility, the customer can sometimes earn a stream of revenue in the form of a lease payment for the land, if a developer or another third party owns the CHP plant.

Vendor

The equipment vendor supplies individual units like engines, turbines, heat recovery systems and controls. With the exception of fuel cells and microturbines, equipment is typically sold by large

organizations that have multiple product lines with proven track records and substantial resources.

Turnkey engineering, procurement & construction (EPC) contractor

In larger projects, the EPC or prime contractor assumes responsibility for building the plant to specifications. It sources equipment, selects various subcontractors and manages and coordinates the entire construction process. The EPC contract is also the interface between plant construction and the developer/owner. Typically, the EPC contractor is expected to provide a guarantee for the completion of the project and the performance of the plant over a certain period. Usually, the prime contractor is a construction company that manages the project and only performs a portion of the actual construction work with a substantial portion subcontracted. In return for its project management services, construction work and guarantees, the EPC typically charges a fee that is a percentage of the plant cost.

Engineer

The engineering task spans a number of functions that may be carried out by different engineering entities. In the case of a large project, an architectural and engineering (A&E) firm is typically retained to conduct a feasibility study and prepare the preliminary plant design and equipment specifications. Then, in conjunction with the selected contractors, the firm prepares detailed designs. During construction, engineers participate in a supervisory and problem-solving role.

To protect its interests from both a cost and performance perspective, the owner customarily employs an engineering consultant to review and approve the engineering work done by outside entities. When the investor is a third party, it is conceivable that the investor and the host could each retain their own engineer.

Since these services add to the cost of an installation, smaller projects need to prioritize necessary engineering services in order to minimize costs. Presumably, the smaller the project, the less time needed for feasibility studies and designs. The nature of CHP projects, however, means that the cost reduction is not always proportionate, and that even small projects require customized engineering.

Developer

The developer is the entity responsible for putting together the project. In the case where the facilities manager of the host site acts to develop the project, then the host/customer is also the developer. Developers identify project opportunities, oversee the design and specifications for the plant, negotiate the contracts, arrange the financing, and potentially oversee construction of the facility through to completion. Given the scope and complexity of most of these undertakings, a developer can make substantial commitments of time and money, all of which could be lost if the project stalls at any point prior to completion.

Fuel Supplier

Given the importance of managing fuel risk to the success of any distributed generation project, the fuel supplier necessarily plays a key role. The fuel supplier ensures that sufficient quantities of fuel that meets plant specifications will be available and delivered to the plant in a timely fashion. While it may be possible to get a supplier to enter a fixed price contract for the useful life of the project, this is unlikely and usually very expensive. Since fuel price volatility is a risk that most financial sources and many customers are unwilling to take, some hedging mechanisms can be implemented to manage this risk.

Utility

Both gas and electric utilities play a key role in CHP project development. Gas utilities can use their customer and support service network to help identify potential opportunities, but look to another entity to develop the project. An electric utility can impose interconnection standards and various fees on any distributed generation project, CHP included. Lack of certainty increases the risk and cost of the project, making it less attractive to financial sources. Utilities are often the source for project incentives, generally in the form of rebates.

Regulatory Authorities

At both the state and federal levels, there are a number of requirements imposed on a project. The bulk of these requirements pertain to construction and environmental permitting. The approval process for any given item can be complicated and resource-intensive. Many times the requirements are subject to negotiation. All of these circumstances lead to higher, often unexpected costs. Regulations may change during the life of a project, leading to costly redesigns or extra engineering. Changes in the way a regulation is enforced can also impact a project. However, these regulations often contain grandfathering provisions, where facilities already built are not subject to the same strict standards as new facilities.

O&M Operator

The O&M operator is the entity that actually operates and maintains the CHP facility. There are firms independent of either the developer or customer that can provide this service. Sometimes equipment vendors themselves will subcontract to run a facility or, more often, engage in a service contract to perform regular maintenance on the facility.

Many developers of large-scale projects maintain in-house O&M groups to operate their portfolio of plants. Concerns for a third-party operator, apart from having the requisite experience and expertise, include having a large enough balance sheet to back up guarantees and either maintain or have ready access to an inventory of critical parts.

Investors and Lenders

Investors and lenders provide funds to support the development of CHP projects. Investors who provide funding in the form of equity to the project with the expectation of a financial return are commonly called “equity investors.” Lenders provide funding in the form of debt to the project with the expectation of repayment of the funds (principal) plus interest and/or fees, and are commonly called “debt lenders.” Financial firms are the financial intermediaries that introduce owners to investors and lenders. This report refers to all financing parties as investors.

Brokers

Brokers act as agents to match counterparties of a transaction and are usually paid by commission. For CHP projects there are a variety of different transactions including but not limited to natural gas supply, power purchase agreements (PPAs), and financing of the CHP project. Brokers have established relationships with suppliers, PPA off-takers, and investors, and will screen projects to ensure they meet the requirements of their clients. The filtering process enables only proven projects to reach their clients, improving the deal flow and speeding up the financing timeframes.

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