



Smart Management for  
Small Water Systems

# Project Economics and Financing for Energy Management Projects



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# My level of familiarity with project economics is:

- A. Just call me Alan Greenspan!
- B. I know my costs from my benefits.
- C. I'm glad my life doesn't depend on it.
- D. What the heck is an NPV?
- E. It's "payback" time for you asking me this!



# Project Economics: Comparing Costs & Benefits



Resolution: 1280x1024 px - Free Photoshop PSD file download - [www.psdgraphics.com](http://www.psdgraphics.com)





# Simple Payback Period: Definition

- Also known as Payback Period or Simple Payback.
- Does not account for the time value of money.
- The SPB method calculates the length of time over which cumulative energy savings and other project benefits will be equal to (or “payback”) the initial project investment. To calculate the SPB, divide the total project cost by the total expected benefit.

$$SPB(yr) = \frac{\text{Cost of project}(\$)}{\text{Annual savings}(\$ / yr)}$$

Source: NYSERDA, “Water & Wastewater Energy Management: Best Practices Handbook,” 2010.



# Simple Payback Period: Example

- You are evaluating Project A, whether to replace pump motors with more efficient models.
- The new motors cost \$200,000 total.
- They are expected to reduce energy costs by \$100,000 per year and last for 5 years before another \$200,000 motor replacement is needed.
- The Simple Payback Period for Project A is 2 years.

Source: NYSERDA, “Water & Wastewater Energy Management: Best Practices Handbook,” 2010.



# Savings v. Avoided Costs

**Table 2.1. Retail Electricity Price Forecast Scenario in Reference Case  
(cents per kWh in 2007\$)**

	2007	2010	2015	2020	2025	Average
Residential	9.4	9.0	10.6	11.4	12.1	<b>10.6</b>
Commercial	7.4	7.9	9.3	10.0	10.6	<b>9.3</b>
Industrial	5.5	5.8	7.3	7.9	8.5	<b>7.1</b>
<b>All Sector Average</b>	<b>7.8</b>	<b>7.8</b>	<b>9.4</b>	<b>10.0</b>	<b>10.7</b>	<b>9.2</b>

Note: These figures are in real, 2007-year dollars and therefore do not take into account inflation. 2007-year prices are actual.

Source: Energy Information Administration, 2009, Annual Energy Outlook, cited in ACEEE's report on NC's energy future:

[http://www.energync.net/Portals/14/Documents/EnergyPolicyCouncil/ACEEE\\_03182010\\_final\\_report\\_text.pdf](http://www.energync.net/Portals/14/Documents/EnergyPolicyCouncil/ACEEE_03182010_final_report_text.pdf)



# Life-Cycle Cost (LCC) Analysis

- LCC analysis considers the initial cost of the project as well as all of the costs and benefits over the lifetime of the project. The LCC approach incorporates the time value of money, the volatility of utility costs and other factors, such as operation & maintenance or other costs.

$$LCCSavings = LCC(Current\_process) - LCC(New\_process)$$

where:

$$LCC(Current\_process) = \sum AnnualCosts - \sum AnnualSavings$$

$$LCC(New\_process) = CapitalCost + \sum AnnualCosts - \sum AnnualSavings$$



# LCC: Derby and KANWE

- Town of Derby has population 23,600
- 10 minutes SE of Wichita, Kansas
- Has Water and Wastewater utilities
- Participates in KANWE, the Kansas Water and Energy Partnership, with the U.S. EPA, the EFC at Wichita St. University, and other groups.
- Looking at energy savings projects for WWTP.

Source: "The Quest for Energy Savings! City of Derby, KS. By Eddie Sheppard, Assistant Director of Public Works, December 2012.

# LCC: Derby and KANWE

## Cost/Benefit Analysis

### Cost Benefit Analysis for Installation of VFD's on Process Mixers

Cost				
Item	Quantity	Cost Per Unit	Total Cost	
VFD's	2	\$15,000	\$30,000	
DO Meters	2	\$5,000	\$10,000	
Start Up/ Installation Cost		\$25,000	\$25,000	
<b>Total Project Cost</b>			<b>\$65,000</b>	

Benefit				
Task	Quantity	Savings Per Unit (per year)	Total Savings (per year)	
Mixer Power Reduced to 80%	2	\$8,935	\$17,870	
<b>Total Project Savings</b>			<b>\$17,870</b>	

**Number of years until savings pays for project cost** 3.64

Total energy savings over lifetime **\$200,000\***

\*estimate based on 15 years lifespan of VFD and DO meters



# Net Present Value (NPV)

- NPV can be one of the most useful ways of assessing to “go” or “no go,” and rank, projects. Calculating an NPV crunches all the numbers into one positive or negative dollar number for the value of the project as a whole.
- NPV takes into account the time value of money by summing up all the individual (e.g. annual) cash flows at all the different points in time for the project, and discounting them by the discount rate (interest rate) to “compare apples to apples.”

$$NPV(i, N) = \sum_{t=0}^N \frac{R_t}{(1+i)^t}$$

Where  $i$  = discount rate,  $N$  = total number of periods,  $t$  = the time of any given cash flow, and  $R_t$  = the net cash flow at time  $t$ .



# NPV: Simple Example

- Project A is to proceed with business-as-usual (BAU) with our water treatment plant. No new capital investment. (Always look at the BAU!)
- Project B (which we will contrast with Project A as the baseline) is to implement a WTP capital improvement project: putting variable frequency drives (VFDs) on 2 pumps.
- Let's assume Project B operates for only 2 years (years 1 and 2), and then we sell the WTP Jan. 1, year 3. Initial investment is made Dec. 31, year 0. We will start cash flow discounting in year 1 (not 0), and will omit taxes, depreciation, inflation, distributional analysis, etc.

# Project A: NPV Equals \$6,587

PROJECT A - BUSINESS-AS-USUAL - NET PRESENT VALUE ANALYSIS					
		0.05	Discount Rate (i.e. the interest rate or CoC)		
YEAR		0	1	2	3
	<i>Operations in this year?</i>	NO	YES	YES	NO
	<i>Discount the Present Value for this year?</i>	NO	YES	YES	YES (t=2)
	<i>Assume all transactions happen on what date?</i>	31-Dec	31-Dec	31-Dec	1-Jan
<b>CASH IN</b>					
	<i>Flows</i>				
	Water System Revenue		200,000	200,000	
	<i>Stocks</i>				
	WTP Liquidation Value of Initial Investment				950,000
	WTP Liquidation Value of Capital Improvements				0
	<b>CASH IN SUB-TOTALS</b>	0	200,000	200,000	950,000
<b>CASH OUT</b>					
	<i>Flows</i>				
	Water System Expenses		100,000	100,000	
	<i>Stocks</i>				
	WTP Initial Investment (i.e. plant value)	1,000,000			
	WTP Capital Improvements Investment	0			
	<b>CASH OUT SUB-TOTALS</b>	1,000,000	100,000	100,000	0
	<b>NET CASH FLOWS</b>	(1,000,000)	100,000	100,000	950,000
	<b>PRESENT VALUES OF NET CASH FLOWS</b>	(1,000,000)	95,238	90,703	820,646
	<b>NPV OF PROJECT (First Excel Method)</b>		<b>\$6,587</b>		
	<b>NPV OF PROJECT (Second Excel Method)</b>		<b>\$6,587</b>		

# Project B: NPV Equals \$9,368

PROJECT B - INSTALL VFD UNITS ON TWO PUMPS - NET PRESENT VALUE ANALYSIS					
		0.05			Discount Rate (i.e. the interest rate or CoC)
YEAR		0	1	2	3
	<i>Operations in this year?</i>	NO	YES	YES	NO
	<i>Discount the Present Value for this year?</i>	NO	YES	YES	YES (t=2)
	<i>Assume all transactions happen on what date?</i>	31-Dec	31-Dec	31-Dec	1-Jan
<b>CASH IN</b>					
	<i>Flows</i>				
	Water System Revenue		200,000	200,000	
	<i>Stocks</i>				
	WTP Liquidation Value of Initial Investment				950,000
	WTP Liquidation Value of Capital Improvements				40,000
	CASH IN SUB-TOTALS	0	200,000	200,000	990,000
<b>CASH OUT</b>					
	<i>Flows</i>				
	Water System Expenses		82,130	82,130	
	<i>Stocks</i>				
	WTP Initial Investment (i.e. plant value)	1,000,000			
	WTP Capital Improvements Investment	65,000			
	CASH OUT SUB-TOTALS	1,065,000	82,130	82,130	0
	NET CASH FLOWS	(1,065,000)	117,870	117,870	990,000
	PRESENT VALUES OF NET CASH FLOWS	(1,065,000)	112,257	106,912	855,199
	<b>NPV OF PROJECT (First Excel Method)</b>				<b>\$9,368</b>
	<b>NPV OF PROJECT (Second Excel Method)</b>				<b>\$9,368</b>



# Some Resources

- NYSERDA's Payback Analysis Tool  
<http://www.nyserdera.ny.gov/Energy-Efficiency-and-Renewable-Programs/Commercial-and-Industrial/Sectors/Municipal-Water-and-Wastewater-Facilities/MWWT-Tools-and-Materials.aspx>
- Department of Energy's MotorMaster+  
[http://www1.eere.energy.gov/manufacturing/tech\\_assistance/software/motormaster.html](http://www1.eere.energy.gov/manufacturing/tech_assistance/software/motormaster.html)
- Department of Energy's Life Cycle Cost Analysis for Sustainable Buildings  
<http://www1.eere.energy.gov/femp/program/lifecycle.html>



# Financing Energy Projects



# How Do We Pay For Our Great Ideas?

© 2004 Ted Goff



“This part of the plan will be funded with all the unused money we must have laying around someplace.”



# What is an Energy Upgrade?

- An energy upgrade to water or wastewater facility is really just a **capital improvement**
- You can treat energy upgrades just like any other capital improvement



# Capital Finance in the Old Days...

- Local governments took advantage of the federal government's ambitious construction grants program of the 1970s and 1980s
- Everybody loved their “free” money

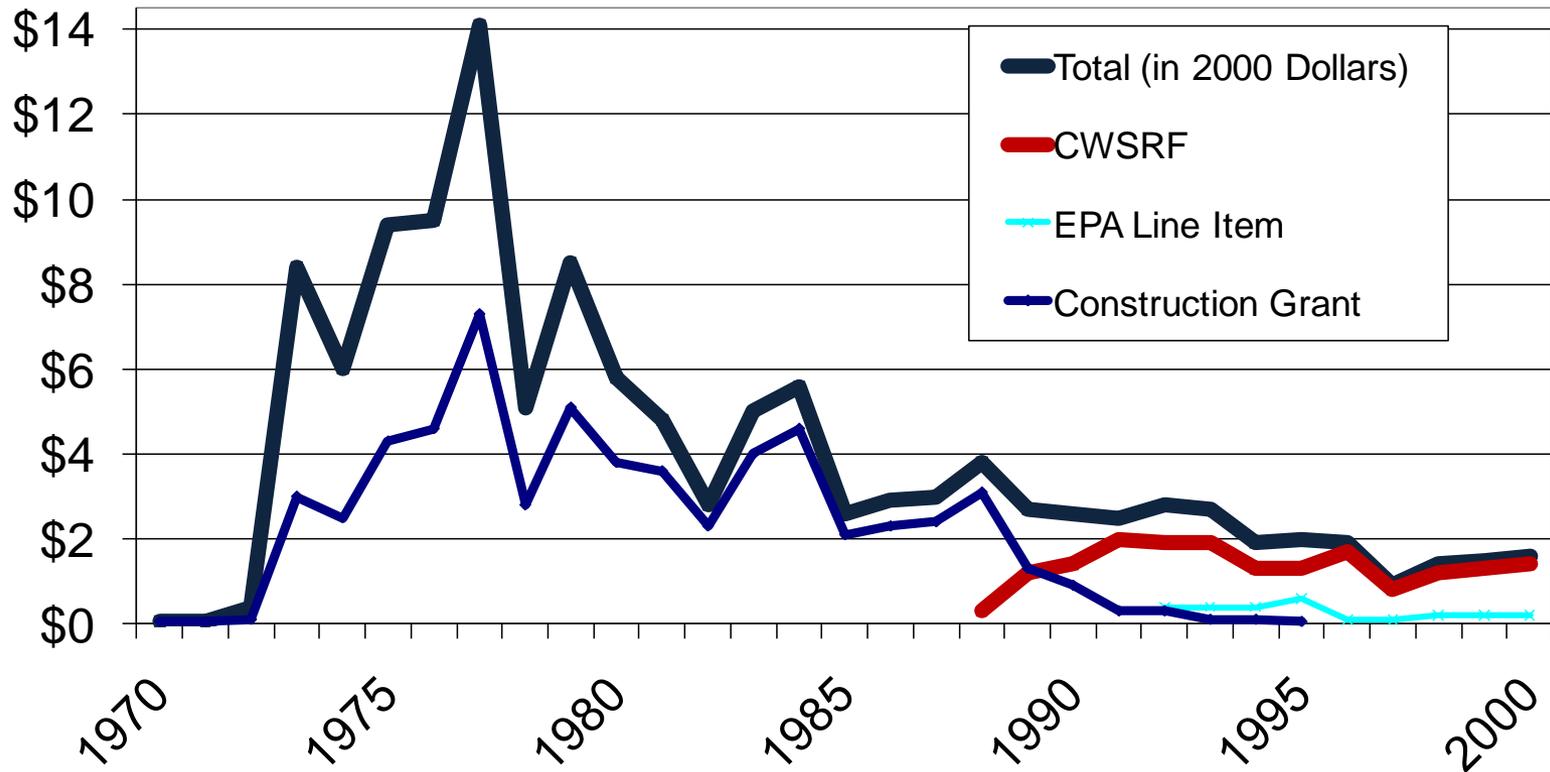


# Capital Finance Today

- The money never really was “free”—it came from tax dollars
- Today, the financial burden has been shifted away from federal and state tax dollars to funds raised by the local government or utility. For example...

# EPA Wastewater Spending (1970-2000)

In Billions of Dollars Per Year





# Financial Indicators: Are You Ready?





# Play the Whiteboard Video: Financial Benchmarking

<https://www.youtube.com/user/efcunc>





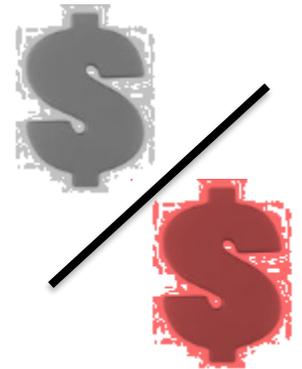
# Operating Ratio

$$= \frac{\textit{Operating Revenues}}{\textit{Operating Expenses}}$$

Natural Benchmark: > 1.0

A measure of self sufficiency.

The revenue you get from daily operations, divided by the expenditures or expenses you make to keep operations running (see next slides) - *some entities may ask you to switch the numerator and denominator-*





# Expenses vs. Expenditures

- **Operating Expenses** includes asset depreciation in the calculation
- **Operating Expenditures** do not include asset depreciation in the calculation

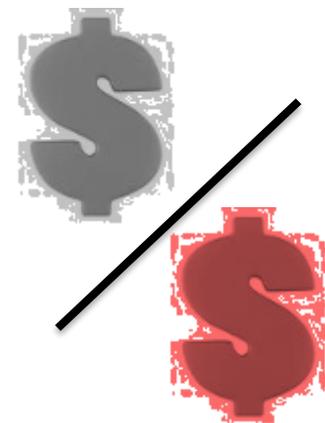


# Quick (or Current) Ratio

$$\frac{\text{Quick Assets (unrestricted, excluding Inventories and Prepaid Items)}}{\text{Current Liabilities}}$$

Accepted Benchmark: > 2

A measure of short-term liquidity: ability to pay your current bills



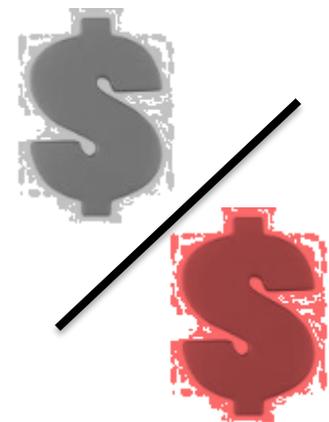


# Days Cash on Hand

$$= \frac{\text{Unrestricted cash and cash equivalents} \times 365}{\text{Operating Expenses} - \text{Depreciation}}$$

Benchmark? At the very least, enough to last a billing cycle or when you expect a substantial inflow of cash

A measure of the ability of the utility to weather a significant temporary reduction in revenue to continue paying for daily operations

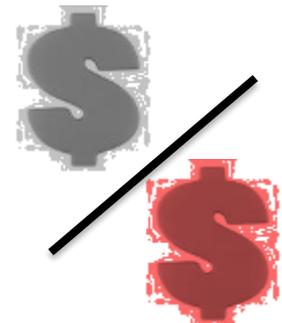




# Debt Service Coverage Ratio

$$\frac{\text{Operating Revenues} - \text{Operating Expenditures (excludes depreciation)}}{\text{Principal} + \text{Interest Payments on Long Term Debt}}$$

Natural Benchmark: > 1



A measure of the ability to pay debt service with operating revenue: Operating revenue left over after daily operation expenditures, divided by debt service. This is a conservative estimate. Non-operating revenues can be added into the numerator to measure annual revenues available for debt service coverage.



# Infrastructure Condition\*

\*Caveat – This indicator is only as good as your depreciation schedule and even then historic pricing is likely to distort the results.

$$= \frac{\text{Total Accumulated Depreciation}}{\text{Total Assets Being Depreciated}}$$

**Benchmark? Don't get close to 100%**

A measure of how much of your total assets have already depreciated. As you approach 100%, your system is near the end of its expected life.



# Can You Afford Capital Improvements?

- Is your utility (public enterprise) self sufficient?
- Can your utility meet its short term obligations?
- If your customers stop paying their bills, how long can you maintain operations?
- Are you able to cover your debt service after paying for your day to day operations?
- How much of your utility's expected life has already run out (and how much is left)?

Operating  
Ratio

Quick Ratio

Days Cash on  
Hand

Debt Service  
Coverage Ratio

Asset  
Depreciation



# Can your customers afford capital improvements?

Calculating affordability...

$$= \frac{\text{Average Annual Household Water Bill}}{\text{Median Household Income}}$$

**Natural Benchmark: utility specific**

*the household that is half-way in the spectrum of all households in terms of income is spending X% of their annual income on water and wastewater*



# Energy Improvements and Capital Planning

- Energy improvements are a type of **capital improvement** not all that dissimilar from pipe replacements, tank painting, etc.
- How you choose to pay for energy improvements ties into your utility's philosophy of how to set rates and pay for capital.



# Where Capital Funding Comes From



# Where Capital Funding Comes From

- Cash
- Grants (including State Revolving Funds)
- Debt market (including State Revolving Funds)
- Private partnerships
- Rates / Monthly bills
- System development charges (new customers)
- Special assessments (current customers)
- Transfers from the general fund (tax revenue)



# Ways to Pay

- Fund balance (save in advance and pay)
- Pay as you go (current receipts)
- Pay later (someone loans you money)
- Grants (let someone else pay)



# How does your organization pay for capital improvements?

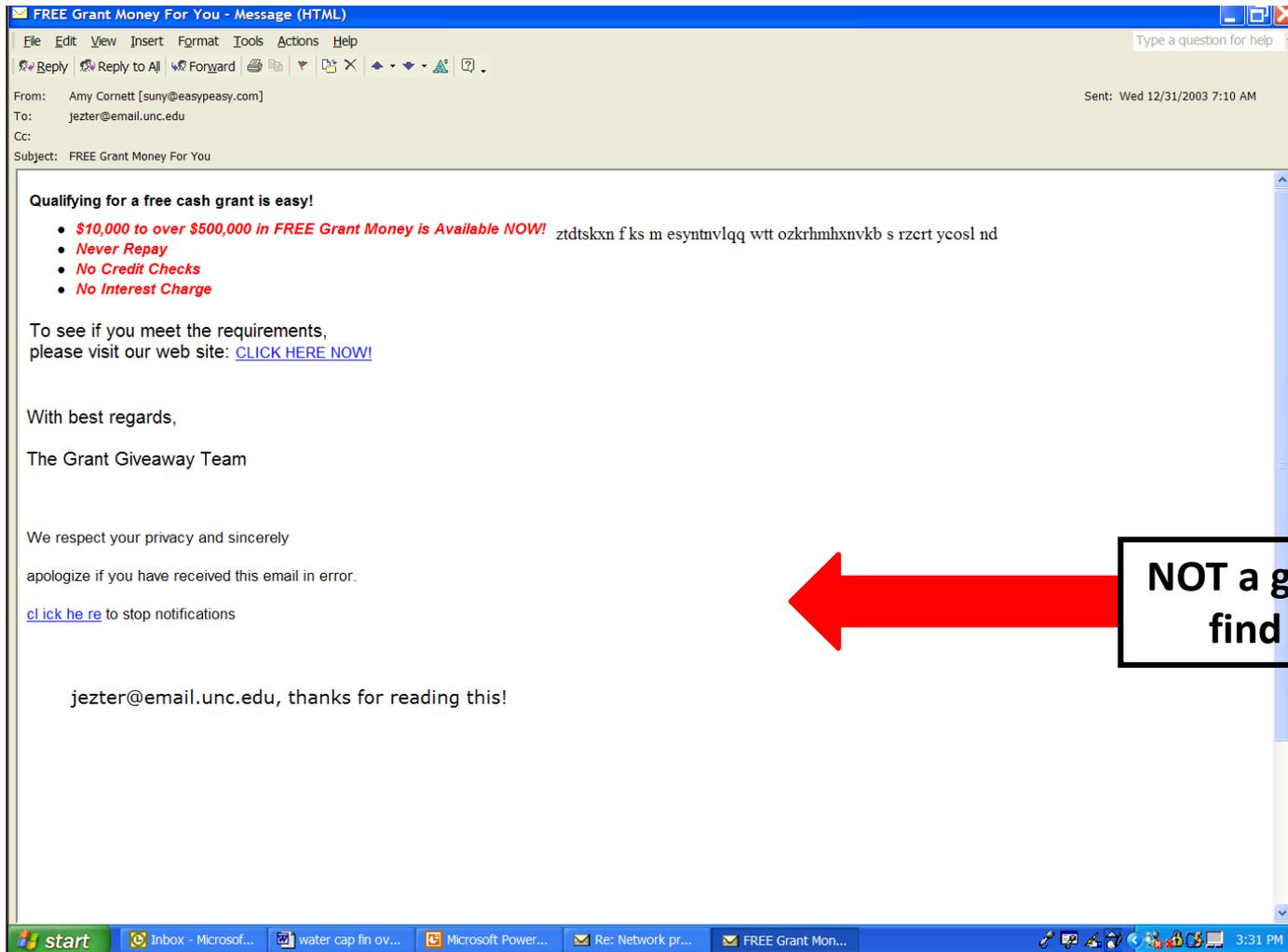


# Grants

- Some limited Federal, State and Private grants available for water and wastewater work and for energy improvements
- Catalog of Federal Funding Sources for Watershed Protection

<http://cfpub.epa.gov/fedfund>

# About Grants





# Grants Aren't Completely Free Money

- Application for the grant can be expensive – staff time and money
- Applications can take months to process
- Often lots of strings attached
- Often require a percentage match
- Lots of competition
- Difficult to sustain

# Find and Choose Grants

<http://water.epa.gov/grants>

[funding/](#) →

## Catalog of Federal Funding

### Input:

- *Grants*
- *Local Government*
- *Wastewater*
- *Get results in Table Format*



## Watershed Academy

[Recent Additions](#) | [Contact Us](#) | [Print Version](#) Search:    
[EPA Home](#) > [Water](#) > [Wetlands, Oceans, & Watersheds](#) > [Watersheds](#) > [Watershed Academy](#) > Federal Funding for Watershed Protection

- Home
- How to Use this Site
- Complete List of All Programs
- Programs Listed by Keyword
- Programs Listed by Agency
- Administration \* (requires login)
- Other Funding Sources

## Catalog of Federal Funding Sources for Watershed Protection

The Catalog of Federal Funding Sources for Watershed Protection Web site is a searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund a variety of watershed protection projects. To select funding programs for particular requirements, use either of two searches below. One is based on subject matter criteria, and the other is based on a general word search of the funding programs.

Criteria searches include the type of organization (e.g., non-profit groups, private landowner, state, business), type of assistance sought (grants or loans), and keywords (e.g., agriculture, wildlife habitat).

Searches result in a listing of programs by name. Click on each program name to review detailed information on the funding source.

**\*\*Printable Brochure...**  
View or print out a [brochure](#) on the Catalog of Federal Funding Sources for Watershed Protection. (PDF, 435 KB)  
[Many of the documents listed on this site are PDF files. Viewing a PDF file requires use of Adobe's free Acrobat Reader software. [EPA's PDF page](#) provides information on downloading the software.]

**\*\*More Funding Sources...**  
[Other Funding Information](#)



Type of Assistance:

Select All  
Grants  
Loans



Indian Tribes



# Find and Choose Grants

## Another way to find EPA Grants



<http://water.epa.gov/type/drink/pws/smallsystems/financialhelp.cfm>

### Water: Small Systems and

You are here: [Water](#) » [Our Waters](#) » [D](#)

### Financial Help

Many organizations nationwide can provide the financial assistance you need to achieve and maintain regulatory compliance. While your state may be a the best option, it is important to contact the organizations directly to make sure they can help meet your system's financial needs.

You will need Adobe Reader to view some of the files on this page. See [EPA's PDF page](#) to learn more.

### Loan and Grant Assistance

- [EPA's Drinking Water State Revolving Fund \(DWSRF\)](#)  
Low-interest loans and other assistance to cover the costs of infrastructure projects; can also fund activities such as technical assistance and source
- [USDA's Rural Utilities Service \(RUS\)](#)  
Loans, grants, and loan guarantees for drinking water facilities in rural areas and in cities and towns with populations of 10,000 or less.
- [The U.S. Department of Housing and Urban Development's Community Development Block Grants \(CDBG\) Program](#)  
States can provide CDBG funding to small towns and rural communities. Water systems have used CDBG assistance to develop new sources and treatment and distribution systems.
- [The U.S. Department of Commerce's-  
Economic Development Administration \(EDA\) Public Works and Economic Development Program](#)

# Grants.gov

The screenshot shows the Grants.gov website in a Windows Internet Explorer browser window. The address bar displays "http://grants.gov/". The search bar contains "grants.gov". The browser's toolbar includes "Favorites", "UNC Libraries", "Mendeley", "Save to Delicious", "Suggested Sites", "Get More Add-ons", and "RefGrab-It". The website header features the "GRANTS.GOV" logo and navigation links for "Search", "Contact Us", "Site Map", "RSS", and "Home".

**Alert**  
Beginning August 9, 2011, Grants.gov will reject applications if applicant CCR registration is expired. View the [Grants.gov Blog](#) for more details.

**FOR APPLICANTS**

- Applicant Login
- Find Grant Opportunities
- Get Registered
- Apply for Grants
- Track My Application
- Applicant Resources
- Search, FAQs, Userguides and site information

**APPLICANT SYSTEM-TO-SYSTEM**

**FOR GRANTORS**

**ABOUT GRANTS.GOV**

**HELP**

**CONTACT US**

**Find. Apply. Succeed.**

Grants.gov is your source to FIND and APPLY for federal grants. The U.S. Department of Health and Human Services is proud to be the managing partner for Grants.gov, an initiative that is having an unparalleled impact on the grant community. [Learn more](#) about Grants.gov and determine if you are eligible for grant opportunities offered on this site.

Grants.gov does not provide personal financial assistance. To learn where you may find personal help, check [Government Benefits](#), [Student Loans](#) and [Small Business Start-up Loans](#).

**RECOVERY.GOV**

In response to The American Recovery and Reinvestment Act of Recovery Act, Grant-making agencies are posting Recovery Act specific grant opportunities on Grants.gov. [View all opportunities](#) >

Other information and opportunities regarding the Recovery Act is available. [Learn more](#) >

Update-to-date information on the state of recovery. [Learn more](#) >

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Recovery Act Grant Opportunities

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**FOR APPLICANTS**

- Grant Search
- Grant Email Alerts
- Get Registered
- Applicant Login
- F-Res POC Login
- Track My Application

**FOR GRANTORS**

- Grantor Login
- New Agency Users
- Resources

**What's New at Grants.gov**

[Grants.gov July 2011 Webcast on Grant Fraud is now available online.](#)



# Grants from Private/Non-Profits

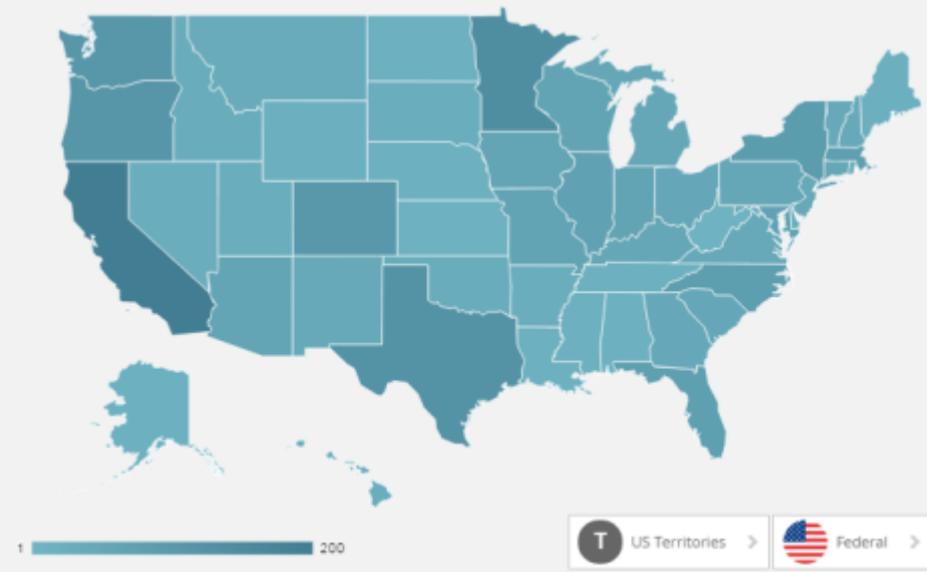
- Trusts and charitable foundations offer some grants, but local governments are not the main target in most cases
- Partnering with a non-profit or community-based group may be an option
- Making the case for cultural significance of your community would be important here (e.g. “environmental justice” issue)



# Database of State Incentives for Renewables & Efficiency®

Find Policies & Incentives Near You | Zip Code  Search

## Find Policies & Incentives by State



<http://programs.dsireusa.org/system/program?state=NH>

<http://www.dsireusa.org/>



# Grant Writing Tips

- Read the RFP thoroughly to make sure your project is appropriate for the funding
- Follow the suggested RFP outline, if there is one
- Include maps and photos as appropriate
- Include letters of support from partner agencies



# Grant Writing Tips

- Be specific with your work plan and timeline
- Cite measurable goals
- Focus on the results from this funding source and not the work of your program as a whole
- Don't mention “unfunded mandates”



# Grant Writing Tips

- If you are applying as a group, choose one agency as the lead agency. Pick either the agency with the most work or the agency with the best relationship with the funder.
- Apply on time



# Grant Writing Tips

- Ask the funder any questions you have during the application process. (But, beware: your questions may be published for other applicants to see)
- Look over any sample grant applications
- Focus on your community's unique needs and assets
- If you are not funded, ask the funders why

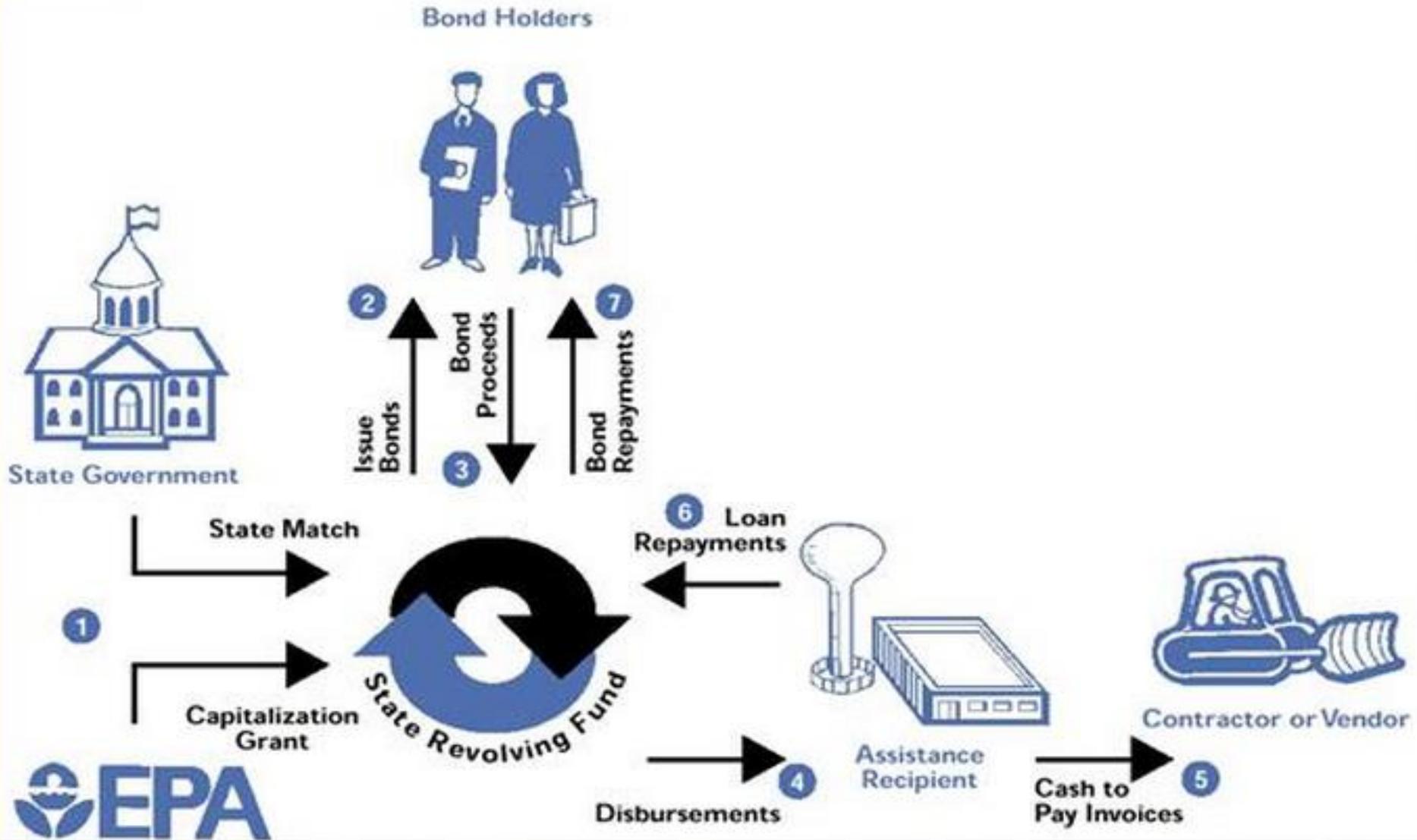


# Credit for proposing green projects to the Drinking Water State Revolving Fund



- The SRF might award an “extra point” for a “green project” when scoring applications to the program.
- Sometimes referred to as a “Green Project Reserve.”

# The SRF Program: How It Works





# DWSRF Program: Background

- Under the Safe Drinking Water Act, states operate Drinking Water State Revolving Funds (DWSRF)
- There is also a similar fund for wastewater, the Clean Water State Revolving Fund (CWSRF)
- In general, DWSRF and CWSRF funds may address:
  - Water and Sewer capital needs
  - Stormwater, green stormwater infrastructure
  - Source water protection
  - Land conservation
  - Failing decentralized wastewater systems



# The SRF's in New Hampshire

- Drinking Water State Revolving Fund (DWSRF)
- Clean Water State Revolving Fund (CWSRF)
- See our N.H. Water and Wastewater Funding Matrix for more details.



# Discussion

- Have any of you already applied for a loan or grant under one of the SRF programs?
- If so, was your project funded as part of the Intended Use Program (IUP)?
- If so, what was that process like for you?
- If not, are you interested in applying for such a loan or grant?



# The Debt Market

- Two types—Loans and Bonds
  - Loans are universally available (from banks, etc.)
  - Bonds are typically only available to large systems with significant revenues and managerial capacity



# UNC Environmental Finance Center: Subsidized Funding Benefit Calculator

- <http://www.efc.sog.unc.edu/reslib/item/subsidized-funding-benefits-calculator>
- Helps demonstrate the financial value to your system of low-interest or zero-interest loans, versus market rates.

# EFC Subsidized Funding Benefit Calculator

Instructions

Fiscal

Economic

Loan Term

20

Total Funding

\$2,500,000

Principal Forgiven

Absolute Amount

\$1,250,000

Percent of Funding

50.0%

Subsidized  
Rate

2.40%

Likely Market  
Rate

3.50%

0%

8%

Flat Principal

Flat Payment

Save/Load Scenario

Print

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Welcome to the Subsidized Loan Benefit Calculator developed by the UNC Environmental Finance Center. This tool provides you with the ability to calculate and perform sensitivity tests around the cash flows and economic benefits of subsidized loans and grant funding.

To the left are the selectors. These allow you to specify and perform sensitivity tests of the funding details.

- 1) Use the drop down menu to specify the term, or years over which the debt will be repaid.
- 2) Input the total amount of funding desired to generate. You may either enter the value directly into the cell or use the arrows to the right of the cell to scroll through values.
- 3) Enter the amount of the loan for which principal will be forgiven, or which will be given in a grant. This can be done either by entering a specific absolute dollar amount of grant funding, or by holding constant the portion of grant funding to total funding. Depending on which radio button is selected, either absolute amount or percentage may be typed directly into the cells below, or may be manipulated using the sliding bar to the right.



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# New Hampshire Water and Wastewater Funding Matrix

- Will pass this out at the end of the day.



# Questions?