Smart Management for Small Water Systems

# Project Economics and Financing for Energy Management Projects

EFCN environmental finance center network

American Water Works Association

UNC ENVIRONMENTAL FINANCE CENTER

This program is made possible under a cooperative agreement with EPA.

# 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

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# Savings vs. 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 | **10.6** |
| Commercial | 7.4 | 7.9 | 9.3 | 10.0 | 10.6 | **9.3** |
| Industrial | 5.5 | 5.8 | 7.3 | 7.9 | 8.5 | **7.1** |
| **All Sector Average** | **7.8** | **7.8** | **9.4** | **10.0** | **10.7** | **9.2** |

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

# Simple Payback Period: Definition

$$\text{Simple payback (years)} = \frac{\text{Total cost of project (\$)}}{\text{Annual savings (\$/year)}}$$

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

# Simple Payback Period: Example

- Project A: Replace inefficient pump motors
- Cost: $200,000
- Savings: $100,000 per year in energy costs
- Life span: 5 years
- What is the simple payback?

$$\text{Simple payback (years)} = \frac{\text{Total cost of project (\$)}}{\text{Annual savings (\$/year)}} = 2 \text{ years}$$

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

# Life-Cycle Cost Analysis: Definition

A type of cost benefit analysis

LCC ($) = Initial cost of project
+ Cost to operate
+ Cost to maintain
– Savings over the life of the project

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

# Life-Cycle Cost Analysis: Example

- Town of Derby, 10 min SE of Wichita, KS, population 23,600
- Project: Installation of VFDs on process mixers at WWTP

**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 |
| **Total Project Cost** | | | **$65,000** |

**Benefit**

| Task | Quantity | Savings Per Unit (per year) | Total Savings (per year) |
|---|---|---|---|
| Mixer Power Reduced to 80% | 2 | $8,935 | $17,870 |
| **Total Project Savings** | | | **$17,870** |

$$\text{Simple payback (years)} = \frac{\text{Total cost of project (\$)}}{\text{Annual savings (\$/year)}} = 3.64 \text{ years}$$

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

# Life-Cycle Cost Analysis: Example

- Assume 15 year lifespan of VFDs and DO meters

**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 |
| **Total Project Cost** | | | **$65,000** |

**Benefit**

| Task | Quantity | Savings Per Unit (per year) | Total Savings (per year) |
|---|---|---|---|
| Mixer Power Reduced to 80% | 2 | $8,935 | $17,870 |
| **Total Project Savings** | | | **$17,870** |

LCC ($) = Cost of project = -$203,050

– Savings over life of project

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

# Time Value of Money: Definition

The **time value of money** (TVM) is the idea that **money** available at the present **time** is worth more than the same amount in the future due to its potential earning capacity.

Time Value of Money - TVM Definition | Investopedia
www.investopedia.com/terms/t/**timevalueofmoney**.asp

# Net Present Value: Definition

- Takes project cash flow in each year and "translates" it into what it's worth today. Then adds all of that, crunching everything into one dollar value for the whole project.

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

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 $t$.

- Useful for project prioritization using decision rules such as:
  - Do any project with positive NPV
  - Choose the project with the greatest positive NPV

# Net Present Value (NPV): Example

- Project A: Business as usual (BAU)
- Project B: Put VFDs on 2 WTP pumps
- For project B, assume the initial investment in the pumps is made in “year 0”, and the project operates for 2 years (years 1 and 2).
- In either case, we sell the WTP in year 3.
- Which project should we do?

- We can use NPV to decide. Remember, NPV “translates” project cash flow in each year into what it’s worth today, and then adds all of those values.

# 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** |
| **CASH IN** | | | | | |
| | *Flows* | | | | |
| | Water System Revenue | | 200,000 | 200,000 | |
| | *Stocks* | | | | |
| | WTP Liquidation Value of Initial Investment | | | | 950,000 |
| | WTP Liquidation Value of Capital Improvements | | | | 0 |
| | CASH IN SUB-TOTALS | 0 | 200,000 | 200,000 | 950,000 |
| **CASH OUT** | | | | | |
| | *Flows* | | | | |
| | Water System Expenses | | 100,000 | 100,000 | |
| | *Stocks* | | | | |
| | WTP Initial Investment (i.e. plant value) | 1,000,000 | | | |
| | WTP Capital Improvements Investment | 0 | | | |
| | CASH OUT SUB-TOTALS | 1,000,000 | 100,000 | 100,000 | 0 |
| | NET CASH FLOWS | (1,000,000) | 100,000 | 100,000 | 950,000 |
| | PRESENT VALUES OF NET CASH FLOWS | (1,000,000) | 95,238 | 90,703 | 820,646 |
| | **NPV OF PROJECT** | **$6,587** | | | |

# 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** |
| **CASH IN** | | | | | |
| | *Flows* | | | | |
| | Water System Revenue | | 200,000 | 200,000 | |
| | *Stocks* | | | | |
| | 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 |
| **CASH OUT** | | | | | |
| | *Flows* | | | | |
| | Water System Expenses | | 82,130 | 82,130 | |
| | *Stocks* | | | | |
| | 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 |
| | **NPV OF PROJECT** | **$9,368** | | | |

# Some Resources

- NYSERDA's Payback Analysis Tool
  http://www.nyserda.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
- 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?


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

# Whiteboard Video: Financial Benchmarking

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

# Whiteboard Video: Financial Benchmarking

**Terms to keep an eye out for:**

- Operating ratio
- Expenses vs. expenditures
- Quick / current ratio
- Days cash on hand
- Infrastructure condition

# Operating Ratio

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

Natural Benchmark: > 1.0

A measure of self sufficiency.

# Expenses vs. Expenditures

- **Operating Expenses** include asset depreciation

- **Operating Expenditures** do not include asset depreciation

# Quick or Current Ratio

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

Accepted Benchmark: > 2

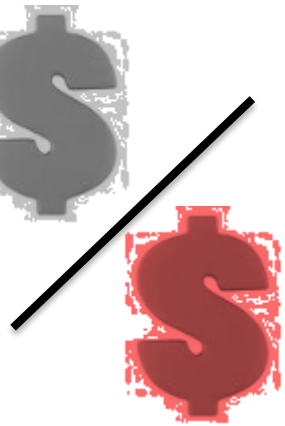
A measure of short-term liquidity: ability to pay your current bills

# Days Cash on Hand

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

Benchmark: At the very least, enough to last a billing cycle (or until you expect a substantial inflow of cash)

A measure of ability to weather a significant temporary reduction in revenue



# Debt Service Coverage Ratio

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

Natural Benchmark: > 1

A measure of the ability to pay debt service with revenue left over after operating expenditures

# 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.

# Quick Recap:

- Operating Ratio
- Quick Ratio
- Days Cash on Hand
- Debt Service Coverage Ratio

# 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)?

Debt Service Coverage Ratio

Asset Depreciation

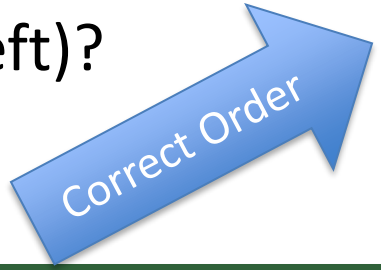
Operating Ratio

Quick Ratio

Days Cash on Hand

# Can You Afford Capital Improvements?

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



# Can your customers afford capital improvements?

Calculating affordability…

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

In other words, "*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*"

# Where Capital Funding Comes From

# Energy Improvements and Capital Planning

- 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

# 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

- Save in advance and pay (fund balance)
- Pay as you go (current receipts)
- Pay later (someone loans you money)
- Let someone else pay (grants)

# How does your organization pay for capital improvements?

# The Debt Market – Pay Later

- 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

# Grants – Let Someone Else Pay

**But, grants aren't completely free money:**

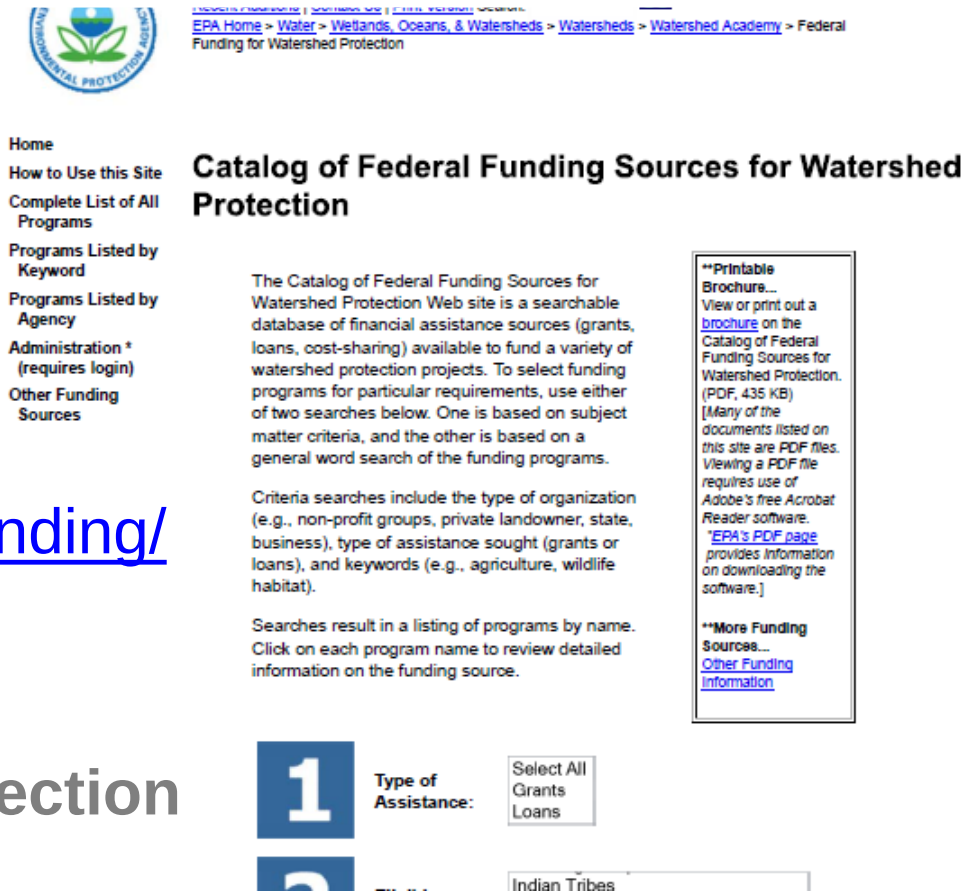
- Application can be expensive – staff time and money
- Applications can take months to process
- Often lots of strings attached
- Often require a percentage match
- Lots of competition
- Difficult to sustain

# Find and Choose Grants

## Catalog of Federal Funding

- *Grants*
- *Local government*
- *Wastewater*
- *Get results in table format*

http://water.epa.gov/grants_funding/




## Catalog of Federal Funding Sources for Watershed Protection

http://cfpub.epa.gov/fedfund

# 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

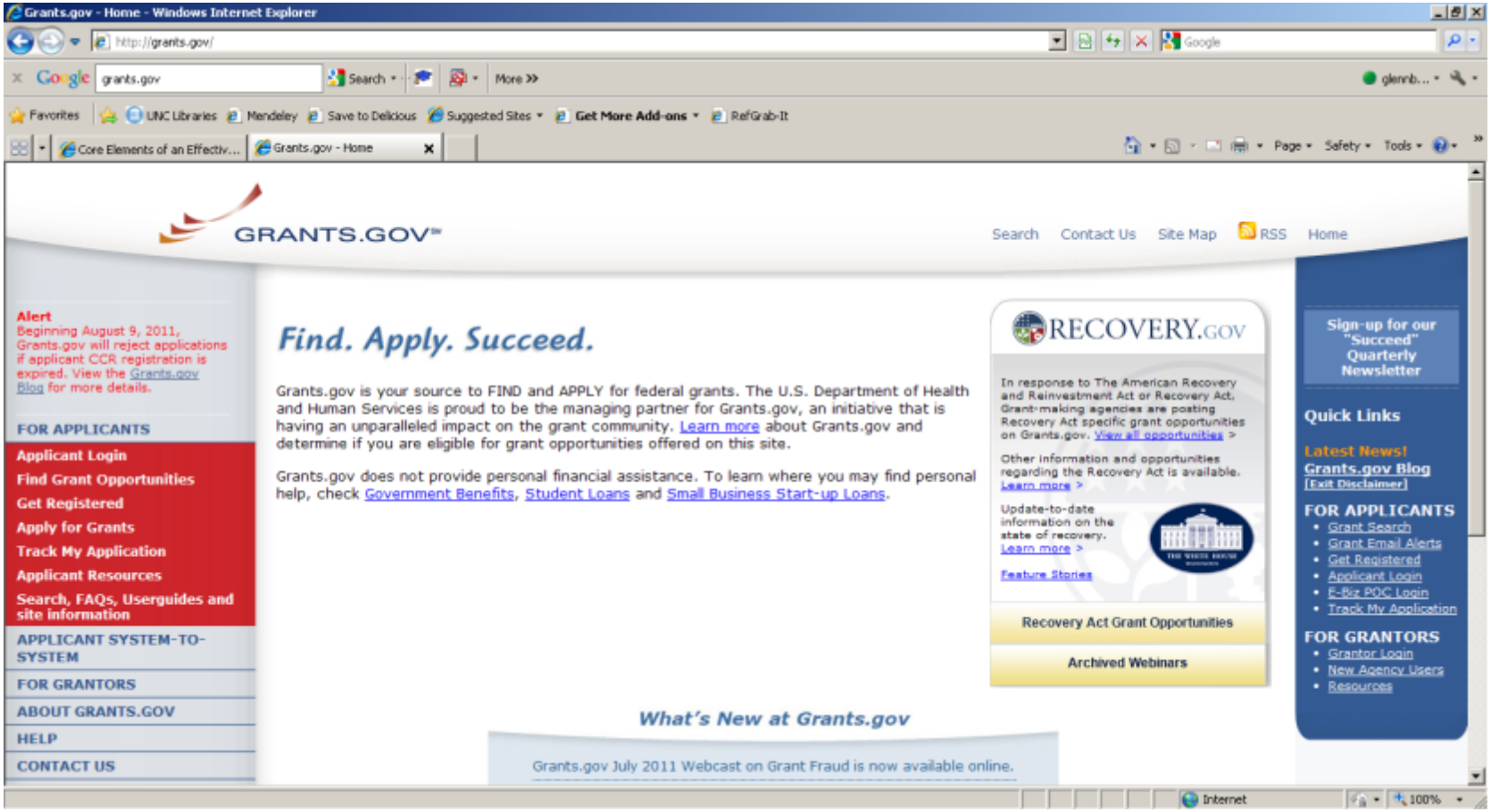
Many organizations nationwide can provide the financial assistance you need to achieve and maintain regulatory compliance. While your state may be a the best option, it is important to contact the organizations directly to make sure they can help meet your system's financial needs.

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

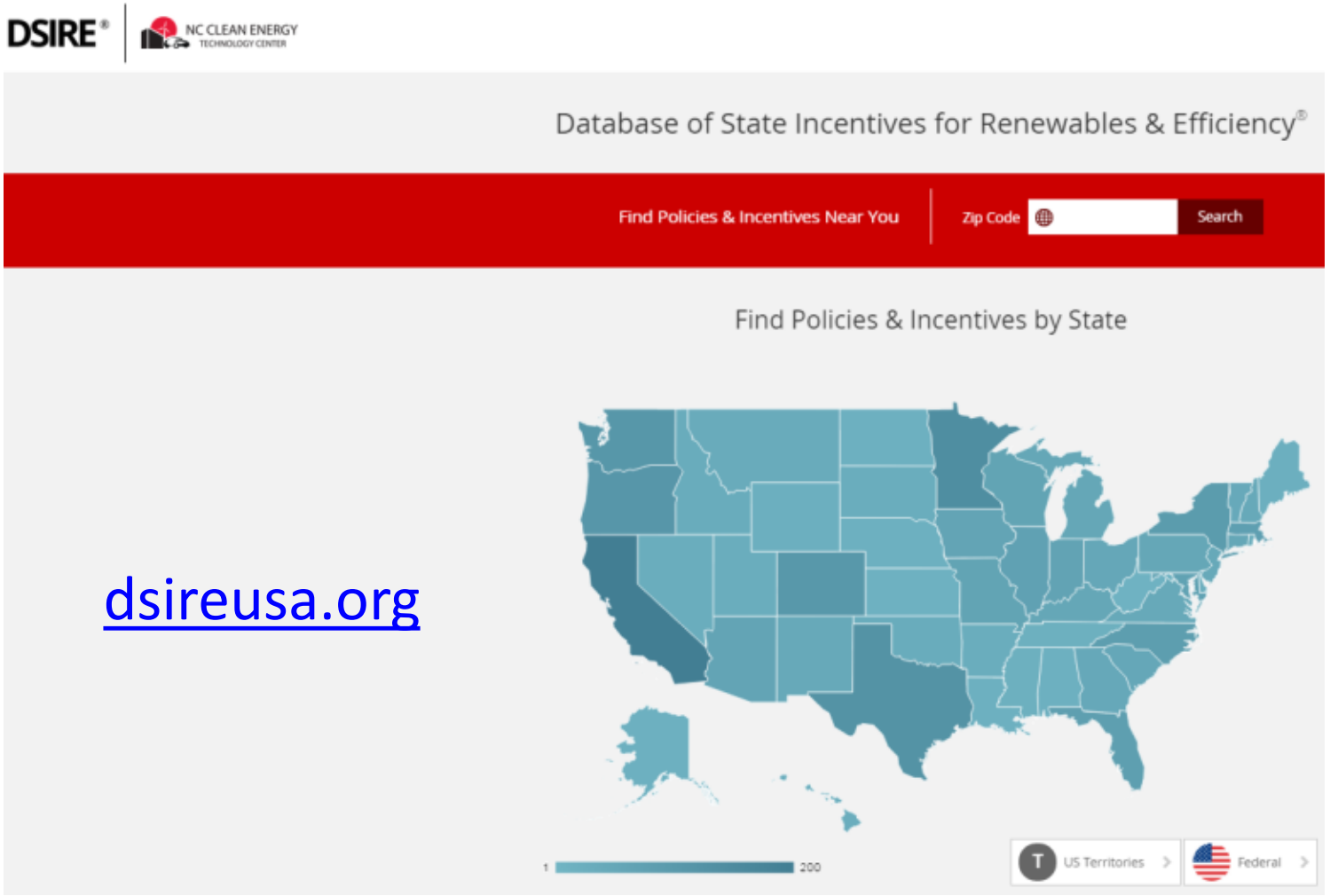
- EPA's Drinking Water State Revolving Fund (DWSRF)
  Low-interest loans and other assistance to cover the costs of infrastructure projects; can also fund activities such as technical assistance and sourc
- USDA's Rural Utilities Service (RUS)
  Loans, grants, and loan guarantees for drinking water facilities 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

# Find and Choose Grants




Grants.gov

# Find and Choose Grants




dsireusa.org

# Grants from Non-Profits or the Private Sector

- Trusts and charitable foundations offer some grants - but local governments usually not main target
- Can partner with a non-profit or community-based group
- Helpful to highlight cultural significance of your community if looking at environmental justice grants

# Grant Writing Tips

- Read RFP thoroughly
- Look over any sample grant applications
- Follow suggested outline
- Include maps and photos as appropriate
- Include letters of support from partner agencies
- Be specific with your work plan and timeline
- Cite measurable goals
- Focus on the results specific to this funding source
- Focus on your community's unique needs and assets
- If applying as a group, choose as the lead the agency with the most work or best relationship with the funder
- Apply on time

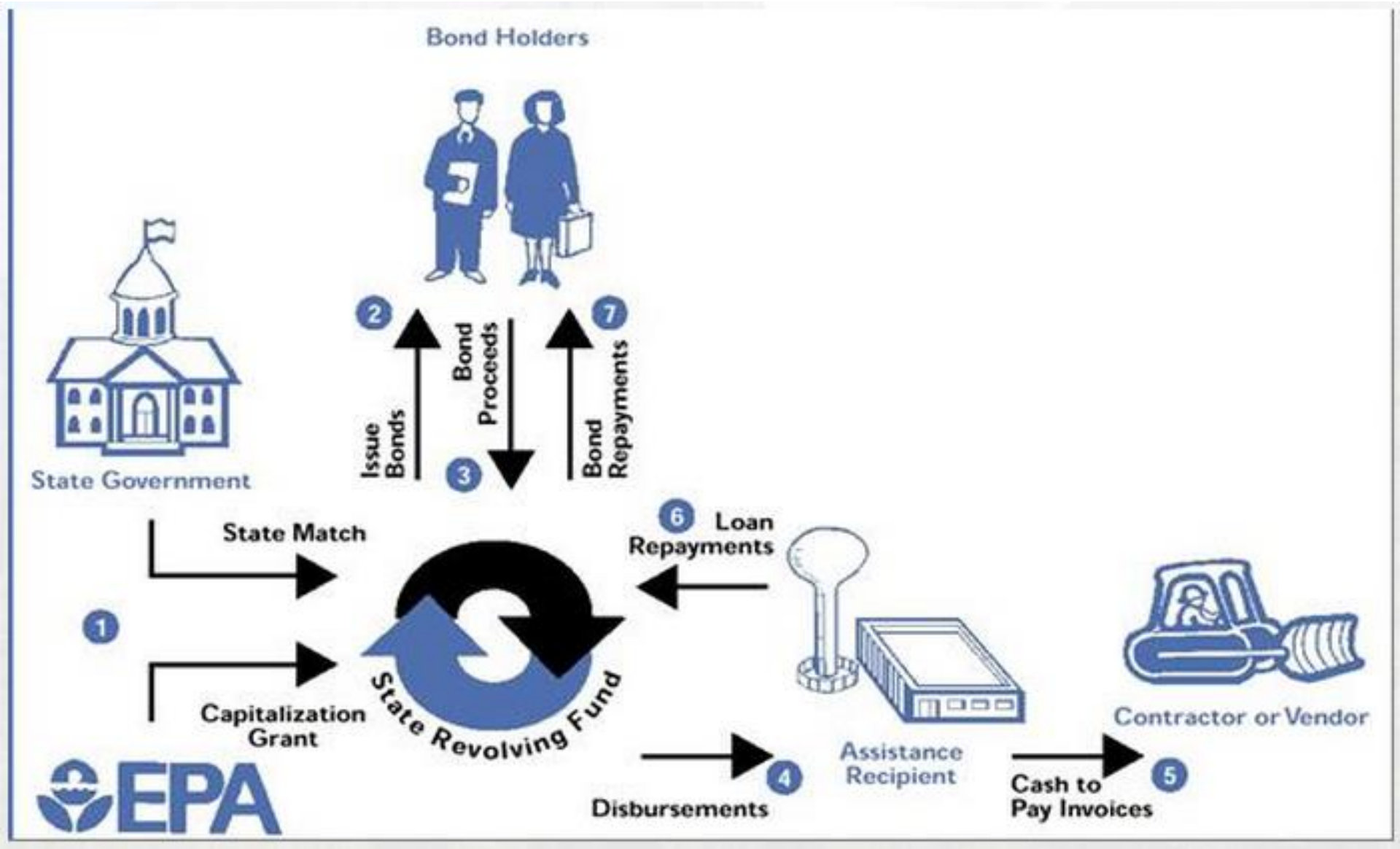
# Grant Writing Tips

- Ask the funder any questions you have during the application process
  - Know that your questions may be published for other applicants to see
- 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 North Carolina

- Drinking Water State Revolving Fund (DWSRF)
- Clean Water State Revolving Fund (CWSRF)
- See our NC 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?

# 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

Loan Term

20

Total Fundin(

$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



Instructions | Fiscal | Economic

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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# North Carolina Water and Wastewater Funding Matrix

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

# Questions?